Report

Energy Statement for Planning

Partridge Way, Haringey, London, N22 6DT

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1 Introduction

Sweco UK Ltd have been commissioned by Martin Arnold Limited to undertake an Energy Statement to accompany the Planning Application for the development known as Site at Partridge Way, Haringey.

The proposed site lies on the Partridge Way Street having access from Trinity Road and Partridge Way.

The corner plot site currently holds a workshop with a loading bay. The planning application proposes a new 9 storey residential development. The individual building floors shall have the following arrangement:

- Ground Floor: Residential Bike Storage Space, Post, Entrance lobby spaces and bin stores
- 1st Floor: Residential Apartments Unit 1 (2b3p), Unit 2 (2b4p)
- 2ndFloor: Residential Apartments Unit 3 (1b2p), Unit 4 (2b4p), Unit 5 (1b2p)
- 3rd Floor: Residential Apartments Unit 6 (1b2p), Unit 7 (2b4p), Unit 8 (1b2p)
- 4th Floor: Residential Apartments Unit 9 (1b2p), Unit 10 (2b4p), Unit 11 (1b2p)
- 5th Floor: Residential Apartments Unit 12 (1b2p), Unit 13 (2b4p), Unit 14 (1b2p)
- 6th Floor: Residential Apartments Unit 15 (1b2p), Unit 16 (2b4p), Unit 17 (1b2p)
- 7th Floor: Residential Apartments Unit 18 (1b2p), Unit 19 (2b4p), Unit 20 (1b2p)
- 8th Floor: Residential Apartments Unit 21 (1b2p), Unit 22 (2b4p), Unit 23 (1b2p)

The following planning policy and construction guidance documentation has been considered in detail in the preparation of the Energy Statement:

- Haringey Local Plan: Strategic Policies 2013-2026 – consolidated with alteration since 2017 (Haringey Council
- adopted March 2013);
- Development Management Development Plan Document (Haringey Council adopted July 2017);
- Sustainable Design and Construction Supplementary Planning Document (Haringey Council adopted March 2013).

This report demonstrates how the design has followed Haringey's energy policies by reducing the energy demand of the development. Measures proposed include energy efficiency measures, generating heat in a clean and efficient system and by using on-site Low and zero carbon systems to further reduce the overall carbon emissions of the development.

The energy consumption figures of the scheme are based on sample SAP modelling in line with Building Regulations Part L1A 2013 Compliant Software. The proposed Sustainability Principles

and Engineering Concepts incorporate the requirements and guidelines of the relevant British Standards and CIBSE Guides.

Figure 1: Partridge Way, Proposed Block layout

2 Executive Summary

The residential scheme proposes the erection of a nine-storey building, comprising of post/bike store on the ground floor and additionally, 23No. apartments on the first to eighth floor.

The scheme is due to complete post 2021, as such it is envisaged that future Building Regulations will be applicable. This report has undertaken SAP modelling in compliance with Building Regulations Part L1A 2013 Software. The regulated CO2 emissions results have been generated using SAP2012 and then converted using the GLA's Carbon Emission Reporting Spreadsheet (v1.1 2018) to estimate emissions under SAP10.0.

Please be aware that once the new Building Regulations are adopted and if applicable to the scheme, remodelling under the compliant SAP10 software should be undertaken. This is to ensure all new Building Regulations criteria has been reviewed and achieved.

The development will implement significant energy efficiency measures, to achieve the required carbon emission reductions by the Local Authority. The strategy detailed within this report follows London Borough of Haringey's policies. The scheme achieves a 64% improvement in CO_2 emissions over the baseline requirements within Building Regulations Approved Document Part L1A.

The following strategy will be implemented for the proposed development:

'Be Lean': Energy efficiency measures to improve the building fabric and services includes: High performance U-Values (0.18 for external walls, 0.12 for roof, 0.13 for the exposed floor, 1.0 for flat entrance doors and 0.90 for the glazing and a good air tightness (maximum of $3m^3/m^2/hr$ at 50Pa)) and bespoke Psi-values for thermal bridging.

'Be Clean': A CHP or a Heat Network has not currently been deemed feasible for the scheme.

'Be Green': Air Source Heat Pump and Photovoltaic panels have been deemed the most feasible technology.

The energy efficiency measures included within this report represent current best practice and the use of a low and zero carbon technology.

The conclusions of the assessment are summarised in the following table:

TABLE 1 - REGULATED CARBON EMISSION REDUCTION FOR THE SCHEME

Residential	Carbon Dioxide Emissions (Tonnes/Annum)	CO_2 Savings (Tonnes CO_2/ year)	CO_2 Emissions Reduction at each stage (%)
Step 1 –Baseline	23	-	-
Step 2 – 'Be Lean'	20	3	13%

Step 3 – 'Be Clean'	20	-	-
Step 4 – 'Be Green'	8.3	11.7	51%
Total Cumulative Savings	**-**	14.7	**64%**

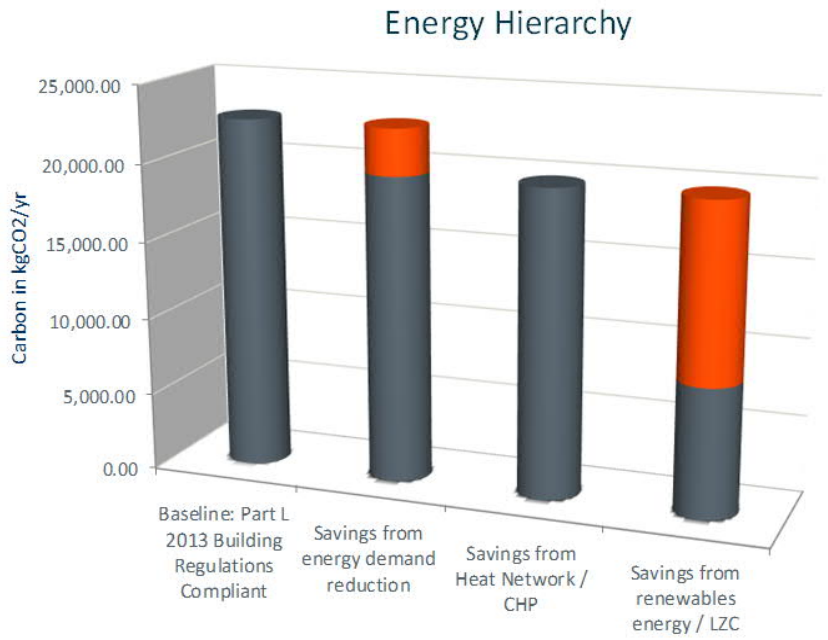


Figure 2 – Regulated Carbon Emission Reduction against Each Stage of the Energy Hierarchy

Note: The orange part in the figure illustrates the CO_2 reduction against the previous step of the energy hierarchy. The dark grey part demonstrates the CO_2 emissions of the building at each energy hierarchy step.

This statement follows the London Borough of Haringey's Energy policy and demonstrates how the development could achieve a 64% energy reduction via all measures are set out in sections 4 to 6 of this report.

Using the measures identified below the site could achieve an 13% carbon reduction via the lean stage and a 51% energy reduction by the use of onsite low and zero carbon technologies. The carbon emissions (DER) of the proposed development can also be reduced by 64%. This enables the buildings to comply with Building Regulation Part L1A.

Details of the method for achieving the above measures are set out in sections 4 to 6 of this report.

3 Planning Policy Requirement

3.1 National Planning Policy Framework (MHCLG, 2019)

The Government's National Planning Policy Framework (NPPF) was first published in March 2012 with the aim of simplifying the planning system in England to facilitate sustainable development. A revised version of the NPPF was published in February 2019. The National Planning Policy Framework sets out the Government's planning policies for England and how these are expected to be applied. It must be taken into account in the preparation of local and neighbourhood plans and is a material consideration in planning decisions.

The document presents a series of policies that constitute the Government's view of what sustainable development in England means in practice for the planning system. At the heart of the National Planning Policy Framework is a presumption in favour of best use of energy resources through landform, layout, building orientation, massing and landscaping in order to minimise energy consumption. In addition, it considers the use of renewable and low carbon energy to mitigate climate change. Policies in Local Plans should follow the approach of the presumption in favour of sustainable development so that it is clear that development which is sustainable can be approved without delay.

3.2 Regional Policy

3.2.1 The London Plan (GLA, 2016)

The latest London Plan was published in March 2016 and consolidates all the alterations to the London Plan since 2011. The plan sets out various issues that European and national legislation requires to be considered along with other requirements of planning law and Government planning policy and guidance. The plan also considers Integrated Impact and Habitats Regulations Assessments and comments received during the consultation and engagement process the recommendations of the Panel that conducted the Examination in Public.

In terms of Climate Change Mitigation, the London Plan includes a strategic target to achieve an overall reduction in London's CO_2 emissions of 60% by 2025 (Policy 5.1). In the planning context, the Mayor expects that all new development will fully contribute towards the reduction of CO_2 emissions and this will be achieved through the application of Policy 5.2: Minimising CO_2 emissions.

Specifically, Policy 5.2 (A) requires developments to make the fullest contribution to minimising emissions of CO_2 in accordance with the energy hierarchy:

- Be lean: using less energy (Policy 5.3);
- Be clean: Supplying energy efficiently, in particular by prioritising decentralised energy generation (Policy 5.5 and 5.6);
- Be green: Using renewable energy (Policy 5.7).

The following are targets for CO_2 emissions reduction, which all major developments are expected to meet (Policy 5.2 (B)):

Year	Improvement on 2010 Building Regulations	
	Residential Buildings:	Non-Domestic Buildings:
2010-2013	25% (CSH Level 4)	25%
2013-2016	40%	40%
2016-2019	Zero Carbon	As per building regulations requirements
2019-2031		Zero Carbon

CO_2 emissions targets should be met on-site and where this is not fully feasible, any shortfall may be provided off-site or through a cash-in-lieu contribution to the relevant borough (Policy 5.2 (E)).

Policy 5.3: Sustainable Design and Construction, seeks to ensure future developments meet the highest standards of sustainable design and construction including construction and operation, and ensure that they are considered at the beginning of the design process. Major development proposals should meet the minimum standards outlined in the Mayor's SPG and this should be clearly demonstrated within a Design and Access statement.

Policy 5.4: Retrofitting applies the principles in Policy 5.3 to existing building stock where retrofit opportunities arise. This policy seeks to reduce carbon dioxide emissions, improve the efficiency of resource use (such as water) and minimise the generation of pollution and waste from existing building stock.

Policy 5.5 Decentralised Energy Networks, prioritises the development of decentralised heating and cooling networks at the development and area wide levels, while Policy 5.6: Decentralised Energy in Development Proposals (A) requires development proposals to evaluate the feasibility of CHP systems, and where a new CHP system is appropriate, also examine opportunities to extend the system beyond the site boundary to adjacent sites.

Policy 5.7: Renewable Energy expects that within the framework of the Energy Hierarchy, major development proposals will provide a reduction in CO_2 emissions through the use of on-site renewable energy generation. The London Plan also includes a presumption that all major development proposals will seek to reduce CO_2 emissions by at least 20% through the use of on-site renewable energy generation.

Policy 5.9: Overheating and Cooling expects major development proposals to reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the recommended cooling hierarchy.

3.2.2 Sustainable Design and Construction, Supplementary Planning Guidance (GLA, 2014)

The SPG provides guidance on to how to achieve the London Plan objectives effectively, supporting the Mayor's aims for growth, including the delivery of housing and infrastructure. It relates to the implementation of London Plan Policy 5.3, but also a range of policies on sustainability as well as those that aim to create a pleasant environment to live in. It also builds on the policies set out in the National Planning Policy Framework, providing specific advice for London.

Notably, the SPG responds to the introduction of the new Building Regulations Approved Document L (ADL) 2013, which requires an overall 6% reduction in CO_2 emissions from new residential buildings and an overall 9% reduction in CO_2 emissions from new non-residential buildings compared to ADL of the Building Regulations 2010. To avoid complexity and extra costs for developers, the Mayor adopted a flat CO_2 improvement target beyond ADL 2013 of 35% for both residential and non-residential developments. This target replaces the previous targets set out under the London Plan Policy 5.2 (B) against ADL 2010.

3.2.3 Draft New London Plan Intend to Publish Version (2019)

The current 2016 Plan is still the adopted Development Plan, but the Draft London Plan is a material consideration in planning decisions. The significance given to it is a matter for the decision maker, but it gains more weight as it moves through the process to adoption.

Following the examination of the draft London Plan in 2019, the Mayor has published his 'Intend to Publish London Plan' (December 2019).

According to the Policy S12 under Draft New London Plan, a major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

- Be Lean: Use less energy and manage demand during construction and operation
- Be Clean: Exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy S13 Energy Infrastructure.
- Be Green: generate, store and use renewable energy on-site.

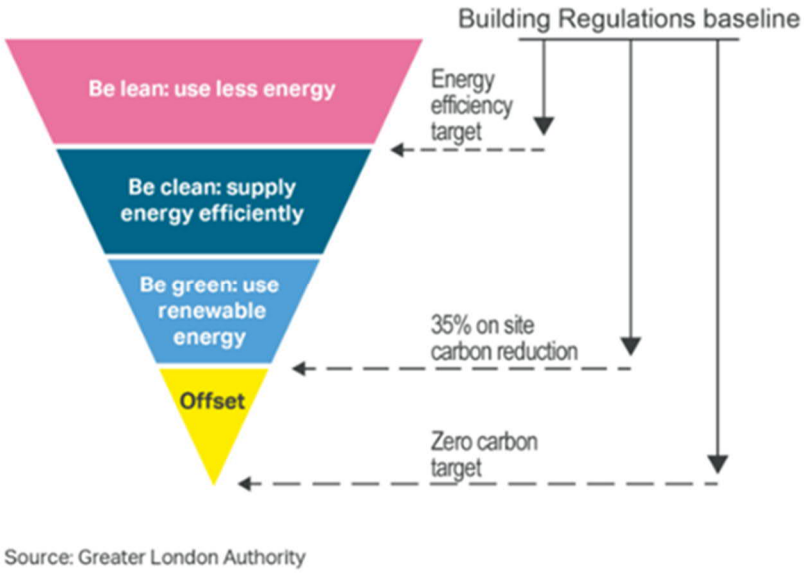


Figure 3- Illustrates Energy hierarchy and associated targets - extracted from the Draft New London Plan (https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/draft-new-london-plan/chapter-9-sustainable-infrastructure/policy-si2-minimising)

3.2.4 Energy Assessment Guidance Greater London Authority Guidance on Preparing Energy Assessments as Part of Planning Applications (October 2018)

The above document provides guidance on preparing energy assessments to accompany strategic planning applications. Each assessment is required to demonstrate how the targets for regulated CO_2 emission reduction over and above 2013 Building Regulations will be met using the Mayor's energy hierarchy.

The latest version of the guidance contains a number of updates, including:

- From January 2019, planning applicants are encouraged to use updated (SAP 10) carbon emission factors to assess the expected carbon performance of a new development. Applicants should continue to use the current Building Regulations methodology for estimating energy performance against Part L 2013 requirements (as outlined in Section 6) but with the outputs manually converted for the SAP 10 emission factors. A spreadsheet (version 1.1) has been developed for this purpose which should be submitted alongside an energy assessment. It should be noted that the use of the SAP 10 emission factors in this context is for demonstrating performance against planning policy targets and, as such, is separate to Building Regulation compliance. Applications should therefore ensure that compliance with Building Regulations is maintained.
- Reference is made to the latest CIBSE TM59 overheating guidance which should be used for all residential planning applications.
- Updated information requirements for applicants proposing to install heat pumps and CHP, including clarification on when CHP is appropriate.

- An appendix containing the existing emission limits for heating and energy plant has been added.

3.3 Local Planning Policy

This energy statement has been produced to adhere to the National, Regional and Local Policies. The proposed development is located within London Borough of Haringey and applicable policies are:

3.3.1 Haringey's Local Plan Strategic Policies 2013-2026 (adopted March 2013):

Haringey's Local Plan: Strategic Policies was adopted by the council in 2013, to replace the Unitary Development Plan (UDP) - with subsequent alterations adopted on the 24 July 2017. The purpose of the document is to set out the long-term vision of how Haringey should develop by 2026 and sets out the council's strategy for achieving that vision including high-level strategic policies used in determining planning applications.

Applicable policies are as follows:

Policy SP4 – Working towards a low carbon Haringey

Over the lifetime of the Local Plan, reducing energy use in buildings and working towards a low carbon borough will be one of the key challenges facing Haringey. The Council will promote the measures outlined below to reduce carbon emissions from new and existing buildings.

1. In line with London Plan policy, the Council will promote and require all new developments to take measures to reduce energy use and carbon emissions during design, construction and occupation, by incorporating the following measures:

- From 2011 onwards, all new residential development will achieve a minimum 25% reduction in total (regulated) CO_2 emissions in line with Code for Sustainable Homes Level 4 energy standards and should aim to achieve Level 6. All new residential development shall be zero carbon from 2016 onwards; and
- From 2011 onwards all new non-residential development shall be built to at least BREEAM "very good" standard and should aim to achieve BREEAM "excellent" or the current nationally agreed standard. All new non-residential development shall be zero carbon from 2019.
- The Council will promote low- and zero-carbon energy generation through the following measures:
- Requiring all developments to assess, identify and implement, where viable, site-wide and area-wide decentralised energy facilities including the potential to link into a wider network;
- Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible;
- Working with neighbouring boroughs and other partners to explore ways of implementing sub-regional decentralised energy networks including the potential in the Upper Lee Valley Opportunity Area; and

- All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from onsite renewable energy regeneration, which can include connections to local sources of decentralised renewable energy.

3.3.2 Haringey Development Management DPD (adopted Jul 2017)

The Development Management Development Plan Document (DPD) gives effect to Haringey's spatial strategy and the key objectives of the Strategic Policies Local Plan by supporting proposals that contribute to the delivery of sustainable development in accordance with the strategy and providing a clear framework for resisting development that would be at odds with the Local Plan.

Applicable policies are as follows:

Policy DM21: Sustainable Design, Layout and Construction

a. All new development, including building and landscape works, will be expected to consider and implement sustainable design, layout and construction techniques. Proposals should:
b. Apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements;
c. Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems;
d. Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls
e. Wherever possible, use building materials with high environmental performance ratings; and
f. Seek opportunities for locally sourced labour.

a. The Council will support appropriate measures to sustainably retrofit existing homes and non-residential buildings.
b. Proposals that fail to demonstrate adequate consideration for sustainable design, layout and construction techniques will be resisted.
c. Consideration will be given to the use of carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals are unable to meet carbon dioxide emission reduction targets on-site.

Policy DM22: Decentralised Energy

a. Subject to other policy requirements, proposals that contribute to the provision and use of Decentralised Energy network infrastructure will be supported.

Communal Energy Systems

b. All development that incorporates site-wide communal energy systems should examine opportunities for extending such systems, irrespective of whether it is connected to a DE network.
c. All development that incorporates site-wide communal energy systems should optimise opportunities for extending such systems beyond the site boundary to supply energy to neighbouring existing and planned future developments.

Existing and Planned Future DE Networks

d. All development proposals should prioritise connection to existing or planned future DE networks.
e. All major development located within 500 metres of an existing DE Network, and minor new-build development located within 25 metres, will be expected to secure connection to that network subject to demonstration of technical feasibility and financial viability.
f. All major development located within 500 metres of a planned future DE Network, which is considered by the Council likely to be operational within 3 years of a grant of planning permission, will be expected to secure connection to that network subject to demonstration of technical feasibility and financial viability.

DE Network 'Connection Zones'

g. All major development located within 500 metres of a DE network 'connection zone' should be designed for connection to a DE network. H All minor new-build development located within 25 metres of a DE network 'connection zone' should be designed for connection to a DE network.

Customer Charters

h. Where site-wide communal and district heating systems are operational, the Council will strongly encourage heat and energy service providers to enter into customer charters with domestic and micro-business customers.

3.3.3 Sustainable Design and Construction Supplementary Planning Document (Adopted March 2013)

This document expands on the council's adopted policies to provide more detailed information than can be contained in the policies themselves. They give guidance to the public, applicants and developers when making planning applications. Section 3 of the SPD provided further guidance on energy and carbon.

This report assumes Site at Partridge Way is subject to Zero carbon with a minimum of 35% CO_2 reduction on site. In addition, the scheme must achieve 20% reduction through the use of onsite Low and Zero Carbon Technologies.

It is understood that the scheme is not referred to the GLA. The report follows Energy Assessment Guidance Greater London Authority guidance on preparing energy assessments as part of planning applications (October 2018), and has used SAP10.0 carbon factors.

4 ‘Be Lean’ Stage – Reduction by Energy Efficiency Measures

4.1 Proposed Lean Measures

The regulated CO2 emissions results have been generated using SAP2012 and then converted using the GLA’s Carbon Emission Reporting Spreadsheet (v1.1 2018) to estimate emissions under SAP10.0. Note that once a compliant SAP10 software is released for Building Regulations 2020, all modelled units should be reassessed to ensure compliance is achieved. The following Lean measures are applicable to the scheme and allow the proposed development to comply with Building Regulation Part L1A for the residential units. The energy efficiency measures include:

4.2 Enhanced Building Fabric U-Values

Enhancements of the building fabric have been assessed; a summary of these values can be found in the tables below. The table below demonstrates the limiting U-Values set by Approved Document Part L and the proposed U-Values to be utilised for the development.

TABLE 2 – SUMMARY OF BUILDING U VALUES PART L1A

Elements	Building Regulations Part L 1A 2013 minimum U-Value (W/m^{2}K)	Proposed U-Value (W/m^{2}K) Indicative Build-Up	% Improvement of the Proposed U-Value Against Building Regulation
Exposed Floor	0.25	0.13	48%
External Walls	0.30	0.18	40%
All other Heat Loss Walls (e.g. Corridor and stairwell walls)	0.30	0.18	50%
Party Walls	0.30	0.00 (fully filled and sealed)	100%
Roof	0.20	0.12	40%
Windows (inc spandel panels)	2.00	0.90 (double glazed, g value 0.46)	55%
Entrance Doors	2.00	1	50%

4.3 Thermal Bridging (Y-Value)

The proposed residential units on the development will be designed to a high performance and go above the default Y-value. As the scheme will be assessed under future Building Regulations, Accredited Construction Details (ACDs) cannot be used. Bespoke Psi modelling will be undertaken for the top heat loss junctions. Example Psi values proposed for the scheme can be found in table 3 below. At present we have assumed all junctions will be designed to the relevant targets.

TABLE 3 – SUMMARY OF BUILDING PSI VALUES

Elements	Table K1 Reference	Psi-Value Targeted
lintels (including other steel lintels)	E2	0.30
Sill	E3	0.04
Jamb	E4	0.05
Exposed floor (normal)	E20	0.32
Intermediate floor between dwelling	E7	0.07
Balcony within a dwelling, wall insulation continuous	E8	0.00
Balcony between a dwelling, wall insulation continuous	E9	0.02
Flat roof	E14	0.08
Corner (normal)	E16	0.09
Corner (inverted internal area greater than external area)	E17	-0.09
Party wall between dwellings	E18	0.06
Exposed Floor	P7	0.16
Intermediate floor between a dwelling	P3	0.00

Elements	Table K1 Reference	Psi-Value Targeted
Roof (insulation at ceiling level)	P4	0.24

4.4 Fabric Energy Efficiency Improvement

TABLE 4 - AVERAGE % IMPROVEMENT IN THE FABRIC ENERGY EFFICIENCY (FEE)

Apartments	DFEE	TFEE	Improvement
Apartment 1	51.3	64.5	20.5%
Apartment 2	46.8	58.3	19.7%
Apartment 3	41.1	50.8	19.1%
Apartment 4	28.2	37.1	24.0%
Apartment 5	39.2	49.4	20.6%
Apartment 6	39.6	49.0	19.2%
Apartment 7	28.2	37.1	24.0%
Apartment 8	39.2	49.4	20.6%
Apartment 9	39.6	49.0	19.2%
Apartment 10	28.2	37.1	24.0%
Apartment 11	39.2	49.4	20.6%
Apartment 12	39.6	49.0	19.2%
Apartment 13	28.2	37.1	24.0%
Apartment 14	39.2	49.4	20.6%
Apartment 15	39.6	49	19.2%
Apartment 16	28.2	37.1	24.0%
Apartment 17	39.2	49.4	20.6%
Apartment 18	39.6	49.0	19.2%
Apartment 19	28.2	37.1	24.0%
Apartment 20	39.2	49.4	20.6%
Apartment 21	47.2	58.3	19.0%
Apartment 22	36.6	46.4	21.1%
Apartment 23	47.8	59.2	19.3%
Average Improvement			**21.0%**

4.5 Enhanced Air Tightness

The proposed development will be designed to a high performance with good air tightness. It is proposed that the scheme does not exceed an air permeability level of $3m^3/hr/m^2$ at 50Pa during testing.

This target will be achieved by ensuring that sensitive areas are accounted for in the design and construction phases to make certain that a tightly sealed building is constructed. The Design Team must ensure that all openings, both major and minor are to be accounted for and assessed to reduce air leakage.

4.6 Ventilation

Each dwelling will be provided with mechanical ventilation with heat recovery. Each unit will be provided with an integral heat pump for additional heat recovery and cooling. These units propose a maximum Specific Fan Power (SFP) of 0.50 for 1-wet room. Please note the wet room SFP noted above excludes kitchens.

4.7 Heating

Space heating is to be supplied from a communal Air Source Heat Pump with a minimum efficiency of 250%. Heating emitters will be underfloor, and controls will be via charging system linked to use of community heating, programmer and at least two room thermostats.

TABLE – 5 AVERAGE SPACE HEATING REQUIREMENT

Apartments	Space Heating Requirement (kWh/m2/year)
Apartment 1	31.26
Apartment 2	27.70
Apartment 3	19.04
Apartment 4	9.22
Apartment 5	17.27
Apartment 6	17.61
Apartment 7	9.22
Apartment 8	17.27
Apartment 9	17.61
Apartment 10	9.22
Apartment 11	17.27
Apartment 12	17.61
Apartment 13	9.22
Apartment 14	17.27
Apartment 15	17.61
Apartment 16	9.22
Apartment 17	17.27

Apartment 18	17.61
Apartment 19	9.22
Apartment 20	17.27
Apartment 21	24.86
Apartment 22	16.67
Apartment 23	25.58
Average	**17.05**

4.8 Cooling

A small amount of cooling is provided from the MVHR ventilation unit. The unit is provided an integral heat pump, which provides additional heat recovery in the winter and a small amount of cooling in summer.

4.9 Domestic Hot Water

The domestic hot water will be provided by the main system. There are communal thermal stores located in the plant room, which serve the flats via individual HIUs.

4.10 Lighting

As the scheme is proposed to be accessed under Building Regulations 2020, all lighting will ensure an average level of efficiency of 75 lamp lumens per circuit-Watt is achieved. Corridors and communal areas will have PIRs or daylight sensor controls.

4.11 Energy Demand

TABLE 6 – ENERGY DEMAND SUMMARY

Apartments	Energy Demand kWh/Year
Apartment 1	5192.05
Apartment 2	5394.54
Apartment 3	3135.91
Apartment 4	3039.27
Apartment 5	3092.28
Apartment 6	3056.52
Apartment 7	3039.27
Apartment 8	3092.28
Apartment 9	3056.52
Apartment 10	3039.27
Apartment 11	3092.28
Apartment 12	3056.52
Apartment 13	3039.27

Apartment 14	3092.28
Apartment 15	3056.52
Apartment 16	3039.27
Apartment 17	3092.28
Apartment 18	3056.52
Apartment 19	3039.27
Apartment 20	3092.28
Apartment 21	3459.03
Apartment 22	3617.44
Apartment 23	3567.27
Total	**76438.14**

5 ‘Be Clean’ – Selection of Efficient Energy Supply

5.1 London Heat Networks – Connection to Existing Low Carbon Heating Infrastructure

The London Plan Policy 5.6B - Decentralised Energy in Development Proposals outlines the following strategies:

A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.
B. 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

C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

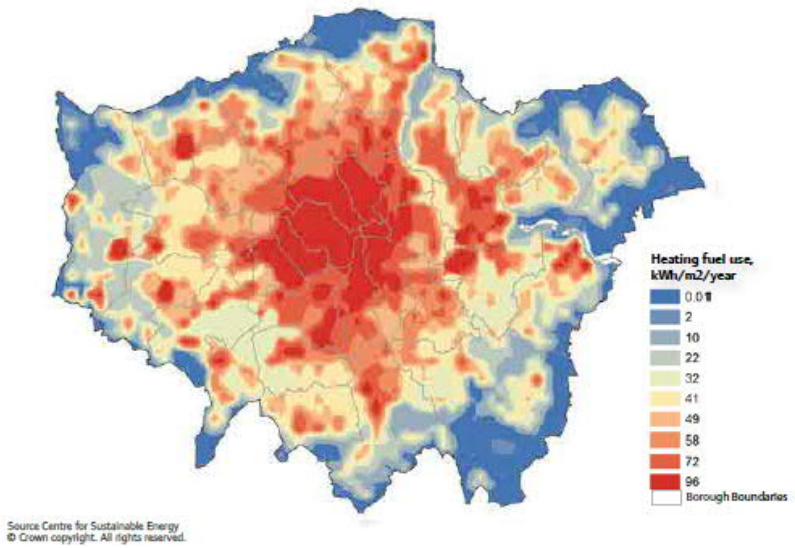


Figure 4 – Heat Density in London (relative heat demand based on fuel use kWh/m^2/year) Extracted from the London Plan March 2016

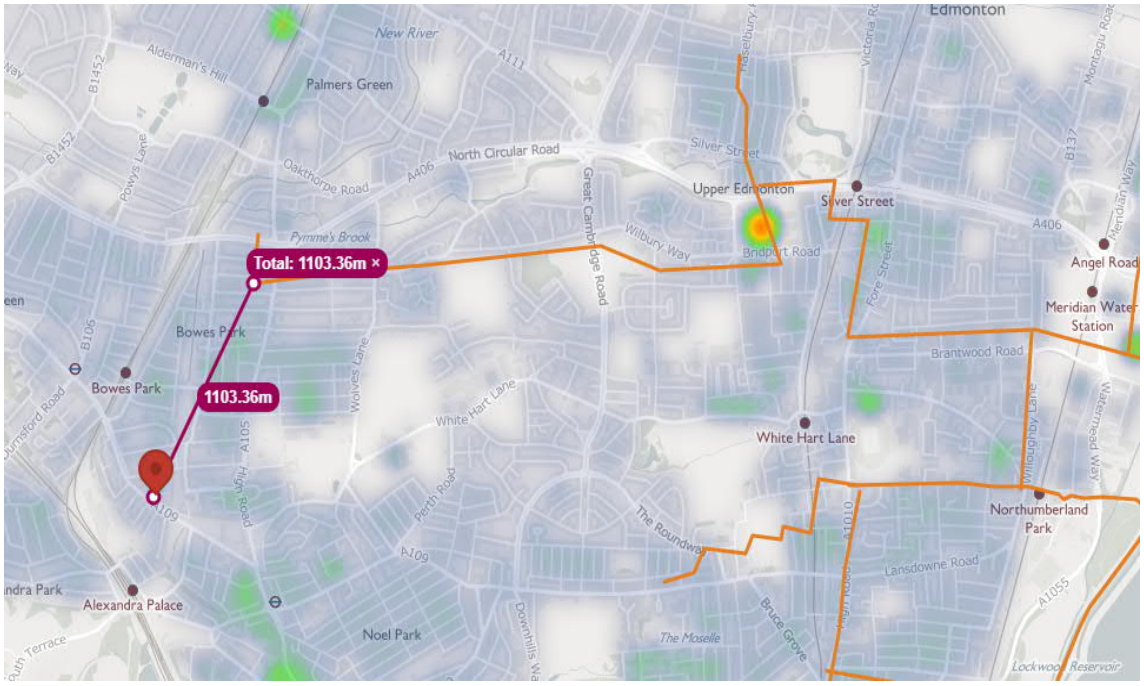


Figure 5 – Illustration of Planned District Heating Route. Proposed Site Plan

The site is located 1103.36m from an existing/proposed heating network according to the London heat map network. Further investigation will need to be undertaken to establish if the scheme can connect to any of these networks.

Discussions with Suzanne Kimman (Climate Change Officer) of Haringey Council, confirmed the scheme is not close enough to any planned or forthcoming District Energy Networks (DENs). Wood Green would be the nearest DEN but it would not be feasible to connect this site to Wood Green.

In the event that a DHN heat supply connection can be obtained initial predictions are that a considerable reduction in carbon emissions will be achieved. In the event that an ESCO or the London Borough of Haringey are able to provide a heat connection from new/existing routes the site proposes capped off services to allow for future connect to the network.

5.2 Feasibility of CHP Scheme

CHP has been deemed not feasible for the scheme, due to the scale of the building. As per the London Plan policies CHP should not be considered on developments of less than 500+ units. Additionally, according to the London Plan's hierarchy, a district heating connection is preferable to a CHP system. The proposed development is future proofed by being designed to connect to a DHN.

"Energy Assessment Guidance" published by the Greater London Authority in October 2018, considers that CHP should be avoided for developments in areas where there are established plans for district heating: Paragraph 10.16, page 35:

“Where a development is to be located in an area where a heat network is being delivered or there are firm plans for a heat network that are proceeding to implementation, the development should incorporate a site wide heat network and install a compatible temporary heat source until the development connects to the area wide heat network. The installation of permanent low carbon heating plant (such as CHP engines or heat pumps) should be avoided in this scenario as it could impact the financial viability of connection.”

6 Cooling Hierarchy

6.1 Policy

Haringey's planning policy DM21 states, all new developments will apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems.

It further explains that development proposals should seek to integrate the cooling hierarchy in accordance with sustainable design, layout and construction principles. This will help to ensure that buildings are better equipped to manage their cooling needs in energy efficient ways over their lifetime. This policy applies the cooling hierarchy set out in the London Plan:

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 lowest carbon options)

Measures at the highest priority level of the cooling hierarchy should be applied to the fullest extent possible before relevant measures at the next level are considered

6.2 External Noise Survey

A Noise Impact Assessment has been undertaken for the site and confirms, there are facades that have a medium to high risk noise level. As such any overheating strategy should not use openable windows as a solution. Openable windows are acceptable on negligible and low risk facades. Figure 6 below illustrates the at-risk facades.

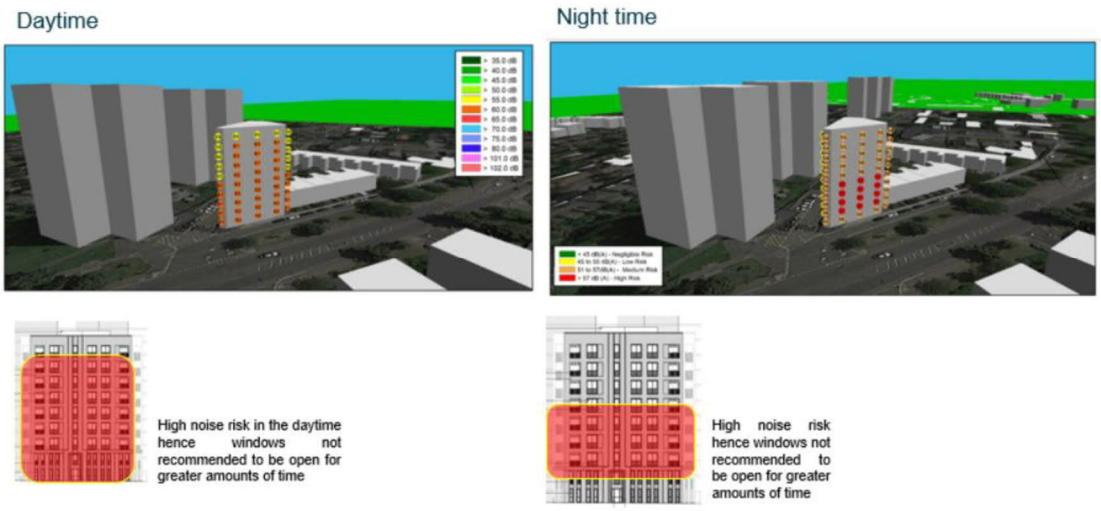


Figure 6 Acoustic Noise Risk Analysis

For further details please refer to the Noise Impact Assessment (document reference 103464-MLM-ZZ-RP-YA-0001), prepared by MLM group as part of the planning process.

6.3 Overheating Assessment Methodology

Environmental Design Solutions Limited EDSL – TAS v 9.5 was used to carry out the computer simulation for the overheating risk analysis. This software is approved by the Government for dynamic modelling simulation according to CIBSE AM 11. Initial discussion with design team has been carried out in order to make changes to optimise the design with regards to air quality and noise assessment under the weather file for London Weather Central 2020 LWC DSY1/2/3. Subsequent simulations under LWC DSY 2, 3 2020 high 50% as well as for future weather scenarios (2050 and 2080) have been carried out. Each set of simulation contains the total of 9 results for each 2020 (DSY 1, 2 and 3), 2050 (DSY 1, 2 and 3) and 2080 (DSY 1, 2 and 3) weather scenarios.

In addition to thermal comfort under CIBSE TM59, daylighting levels and distributions have been taken into account during the analysis to make sure that internal spaces enjoy good daylighting levels and distribution. The daylighting levels have been reviewed against BRE Guide (Site Layout Planning for Daylight and Sunlight – A guide to good practice, second edition) for internally occupied areas

Please refer to the Summer Overheating Assessment in Dwellings – CIBSE TM59 Compliance (document reference 7135068-MLM-ZZ-XX-RP-SU-0002), prepared by MLM group as part of the planning process.

6.4 Window Design and Ventilation strategy for Thermal Comfort

Based on the Noise Impact Assessment (document reference 103464-MLM-ZZ-RP-YA-0001), it was noted that the development lies in a high-risk area of noise which would be a nuisance to residents. If windows were open for longer periods of time.

For the purposes of the overheating analysis, windows are assumed to be closed in order to mitigate nuisance caused by external noise.

For the purpose of the analysis the windows are assumed to be closed in order to avoid negative acoustic influence from the outside (Refer to figure 6). Overheating is mitigated by using enhanced ventilation from the MVHR units, which has the ability to provide cooled air into the apartment spaces from its own integrated heat pump during periods of high temperatures coinciding for periods of high external noise levels which the residents considers to be a nascence.

The following assumptions have been made to for the assessment as follows:

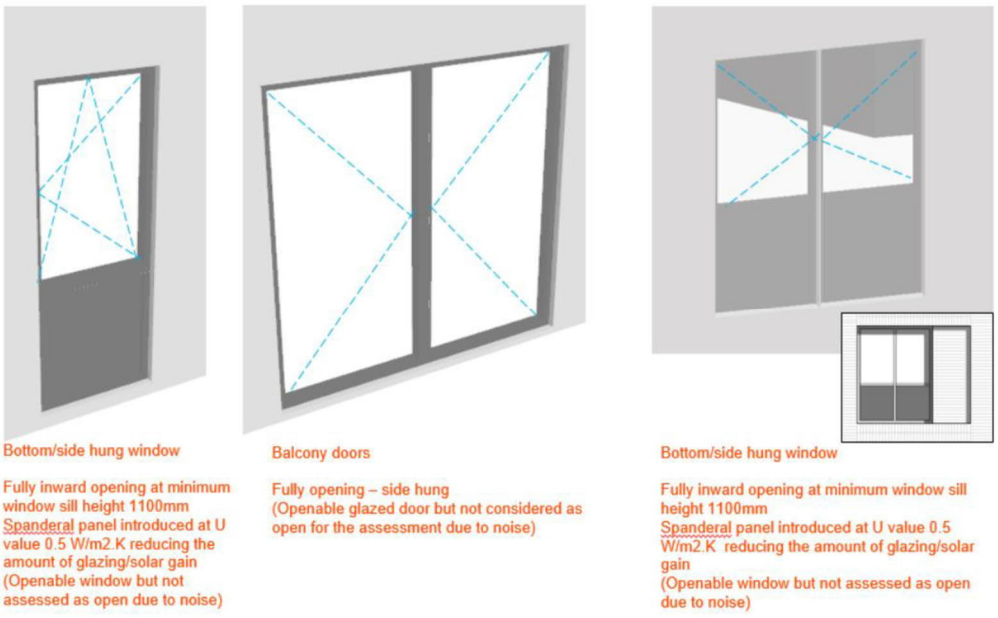


Figure 7 - Window types and opening free areas for all simulations

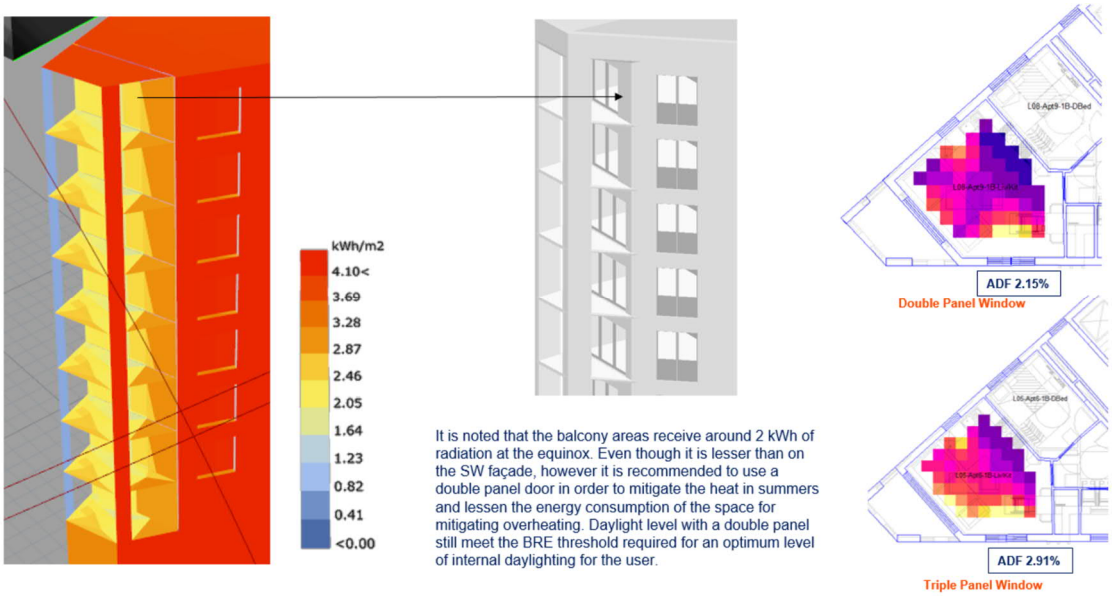


Figure 8 Optimisation study - Double Panel vs Triple Panel

Based on the acoustic assessment the spaces are assessed on the basis that window openings are not the only way to mitigate overheating. Windows are still specified to be openable with user operability.

In addition to windows, internal doors play an important role to allow air flow. The following opening configurations have been implemented for all simulations:

- Internal bedroom doors open during day time;
- Doors to kitchen/living (if any) open at all times.

The ventilation is based on enhanced ventilation from the MVHR units, which has the ability to provide cooled air into the apartment spaces from its own integrated heat pump. An air change rate of 1.5 via any packaged unit system has been assumed.

6.5 Cooling Hierarchy Stages

6.5.1 Step 1 - Minimising internal heat generation through energy efficient design

The Proposed Development aims to respond to the cooling hierarchy through the use of the following hierarchy strategies.

Orientation & Shading

The proposed development known as Partridge Way is within the London Borough of Haringey. The site is located in an urban location and it is surrounded by high-rise residential buildings to

the north and low-rise houses towards south. Figure 9 illustrates site location and sun path overlay.

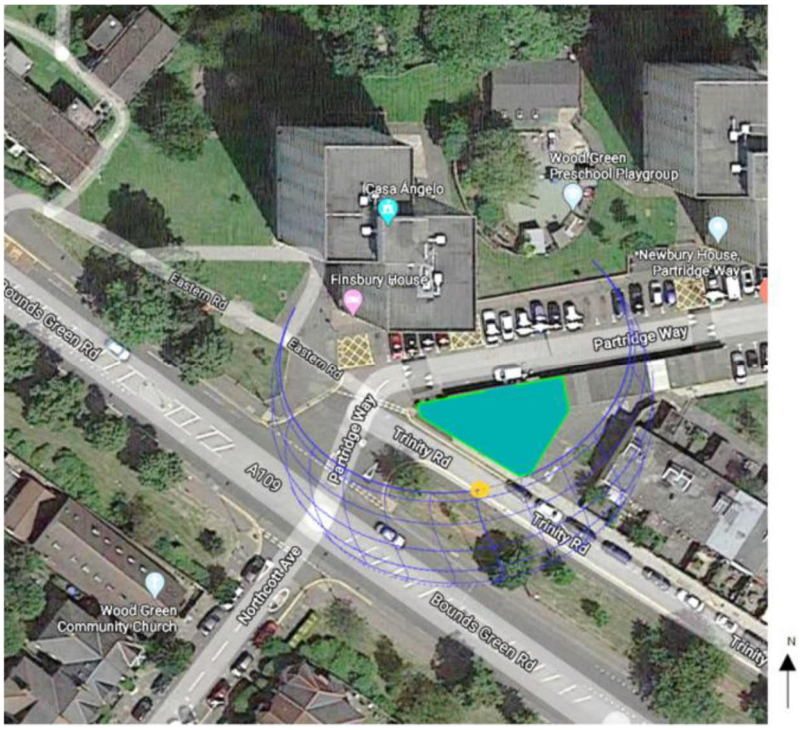


Figure 9 - Google map overlaid with sun path

The initial analysis depicted higher radiation towards the South-West façade at 4.10 kWh/m2. Whereas the South East façade and North façade depicted lesser radiation with 2.05 kWh/m2 and 0.82 kWh/m2 respectively.

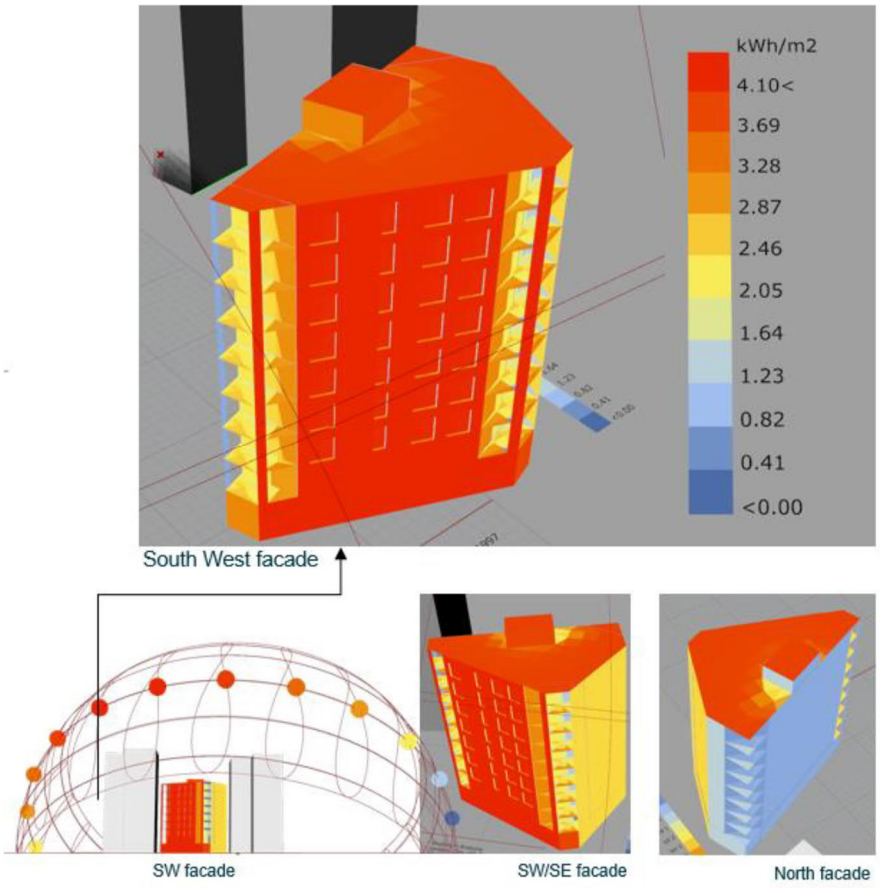


Figure 10 Facade solar studies for enhanced window and fabric optimisation

Due to the constraints of building on a previously developed site, the scheme is limited with regards to orientation and existing shading.

Fabric efficiency

The scheme is proposing high performance U-Values as illustrated in the table below. The proposed U-values are considerably better than Building Regulations.

TABLE 7 – SUMMARY OF BUILDING U VALUES PART L1A

Elements	Building Regulations Part L 1A 2013 minimum U-Value (W/m^{2}K)	Proposed U-Value (W/m^{2}K) Indicative Build-Up	% Improvement of the Proposed U-Value Against Building Regulation
Exposed Floor	0.25	0.13	48%

External Walls	0.30	0.18	40%
Party Walls	0.30	0.00 (fully filled and sealed)	100%
Roof	0.20	0.12	40%
Windows	2.00	0.90 (double glazed, g value 0.46)	55%

Furthermore, the scheme proposes an air tightness of $3m^3/m^2/hr$ at 50Pa and bespoke Psi-values for thermal bridging. These are enhancements which go over and above the minimum Building Regulation requirements. We have worked closely with the architectural and client team to ensure that the fabric performance enhancements have been optimised for the project. Refer to section 4 of this report for full details of the fabric strategy.

Energy Efficient Lighting

LED lighting is proposed throughout, to reduce internal heat gains and energy consumption.

Pipe lengths

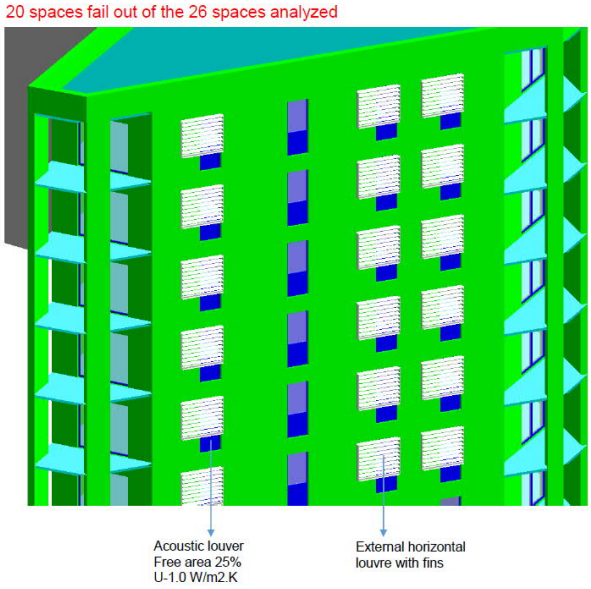
The landlords internal heat network distribution pipework will be operating at a low temperature. Additionally, it will be provided with enhanced thermal insulation to minimise heat gain to internal spaces and reduce heat losses and improve system efficiency.

Based on the above measures the project has minimised internal heat generation through energy efficient design.

6.5.2 Step 2 - Reducing the amount of heat entering the building in summer

Based on the recommendation a test model was simulated for the scenario with external louvre fins (horizontal) to avoid solar gains. Secondly, based on the architect's recommendation the bottom panel was converted to an acoustic louvre, to assess the impact of the thermal comfort in internal spaces.

Louvers were found to provide inadequate ventilation to the rooms. Only 6 rooms were seen to pass out of a total of 26 spaces. This is due to closed windows as noted previously. Even with measures to mitigate the solar gains, there is still a lot of internal gains by the occupants, equipment loads both sensible and latent which must be ventilated out.



Domestic Overheating (CIBSE TM59)

Natural Ventilation Overheating Results

Zone Name	Room Use	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Annual Night Occupied Hours for Bedroom	Max Exceedable Night Hours	Criterion 2: Number of Night Hours Exceeding 26 °C for Bedrooms	Result
L01-Apt1-2B-DBed	Bedroom	3672	110	6	3285	32	27	Pass
L01-Apt1-2B-Kit/Liv	Living Room / Kitchen	1989	59	37	N/A	N/A	N/A	Pass
L01-Apt1-2B-SBed	Bedroom	3672	110	27	3285	32	40	Fail
L01-Apt2-2B-DBed1	Bedroom	3672	110	20	3285	32	54	Fail
L01-Apt2-2B-DBed2	Bedroom	3672	110	17	3285	32	18	Pass
L01-Apt2-2B-Kit/Liv	Living Room / Kitchen	1989	59	59	N/A	N/A	N/A	Pass
L02-Apt3-1B-DBed1	Bedroom	3672	110	28	3285	32	33	Fail
L02-Apt3-1B-Kit/Liv	Living Room / Kitchen	1989	59	35	N/A	N/A	N/A	Pass
L02-Apt4-2B-DBed1	Bedroom	3672	110	83	3285	32	45	Fail
L02-Apt4-2B-DBed2	Bedroom	3672	110	80	3285	32	41	Fail
L02-Apt4-2B-Kit/Liv	Living Room / Kitchen	1989	59	126	N/A	N/A	N/A	Fail
L02-Apt5-1B-DBed	Bedroom	3672	110	37	3285	32	42	Fail
L02-Apt5-1B-Liv/Kit	Living Room / Kitchen	1989	59	123	N/A	N/A	N/A	Fail
L05-Apt6-1B-DBed	Bedroom	3672	110	41	3285	32	45	Fail
L05-Apt6-1B-Liv/Kit	Living Room / Kitchen	1989	59	107	N/A	N/A	N/A	Fail
L05-Apt7-2B-DBed1	Bedroom	3672	110	34	3285	32	38	Fail
L05-Apt7-2B-DBed2	Bedroom	3672	110	31	3285	32	38	Fail
L05-Apt7-2B-Kit/Liv	Living Room / Kitchen	1989	59	109	N/A	N/A	N/A	Fail
L05-Apt8-1B-DBed	Bedroom	3672	110	41	3285	32	49	Fail
L05-Apt8-1B-Kit/Liv	Living Room / Kitchen	1989	59	150	N/A	N/A	N/A	Fail
L08-Apt9-1B-DBed	Bedroom	3672	110	40	3285	32	45	Fail
L08-Apt9-1B-Liv/Kit	Living Room / Kitchen	1989	59	107	N/A	N/A	N/A	Fail
L08-Apt10-2B-DBed1	Bedroom	3672	110	31	3285	32	36	Fail
L08-Apt10-2B-DBed2	Bedroom	3672	110	30	3285	32	36	Fail
L08-Apt11-1B-DBed	Bedroom	3672	110	30	3285	32	43	Fail
L08-Apt11-1B-Kit/Liv	Living Room / Kitchen	1989	59	36	N/A	N/A	N/A	Pass

*Zone name's that have an orange coloured font are bedrooms which do not have 24/7 365 days a year occupancy, as per the TM59 guidance.

Figure 11 Louvers anaylsis results

It was found that smaller spaces such as bedrooms heated up quickly due to the small volume of these spaces. As the volume of spaces increases, it is slightly easier to maintain the thermal comfort.

The potential to introduce significantly larger panels with a greater free area, had the potential to resolve the overheating issue. However, it proved difficult to source larger louvers/free areas, as seen in the technical data sheet below.

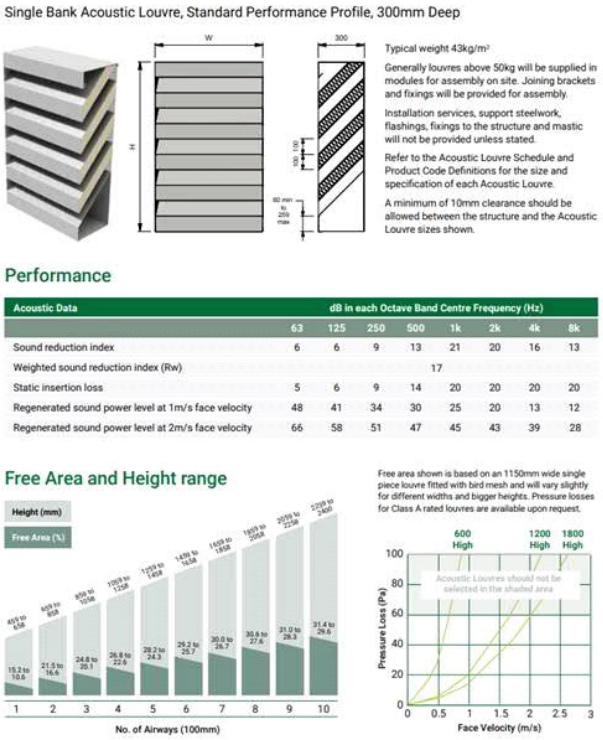


Figure 12 louvers technical data sheet

As illustrated in the analysis above it was found that shading devices (Louvres) would not assist with reducing the amount of heat entering the building in summer. Thus, these shading measures have not been progressed further.

6.5.3 Step 3 - Use of thermal mass and high ceilings to manage the heat within the building

Buff colour bricks and light-coloured materials are proposed for most of the facades. This will help in reducing the urban heat island impact.

The scheme is proposing a concrete frame building, with a brick work external wall and a light weight insulated metal section internal lining. This form of construction provides the highest possible thermal mass for this type of project.

The project is proposing an Internal floor to ceiling height of 2.5 metres, and this is as per the minimum requirements of the London plan and the London Borough of Haringey. The ceiling height has been optimised to accommodate for building services and act as a heat preventing measure.

Due to further planning policy the general building height has been designed to be no greater than 30 meters, thus the ceiling heights cannot be increased.

6.5.4 Step 4 - Passive ventilation

Natural ventilation is possible through openable windows. Cross ventilation is facilitated by dual aspect apartments, wherever possible. However, due to high external noise levels the potential for natural ventilation is limited, therefore, cooling has been proposed for the residences.

The floor plates have been designed as per the London plan sizing to allow for suitability sized units. Although sallower floorplates may assist with the overheating issues, this change would mean the space requirements would fall below the planning requirements. Furthermore, due to the irregular site space the building has been designed around this and is limited in possible design options.

6.5.5 Step 5 - Mechanical ventilation

Each apartment will be provided with mechanical ventilation with heat recovery. The MVHR is used to maximise the free cooling affect, where the outside air temperature is below that of the internal room temperature during summer months. This will require enhanced ventilation flow rates and a heat exchanger bypass for use in the summer months.

Furthermore, the MVHR unit is provided with an integral air to air heat pump which will provide additional heating in the winter months to improve efficiency and in summer month operate in reverse to provide some cooling to mitigate overheating within rooms, in the event that external noise is a nuisance to residents.

6.5.6 Step 6 - Active cooling systems (ensuring they are lowest carbon options)

We have reviewed the active cooling solutions applicable to this project and discounted active solutions which provided the residents with the ability to provide cooling on demand to their dwelling. The mechanical ventilation units are designed to only provide cooling to the outside air when it is above the desired temperature. The unit are sized and only able to provide a small amount of cooling to the incoming outside air such that on hot days the risk of overheating is greatly reduced.

6.6 Conclusions and Recommendations

This scheme has demonstrated how the relevant stages of the cooling hierarchy have been assessed. It was found that with a combination of enhanced mechanical ventilation flow rates, with a heat pump integrated into the MVHR which provides energy efficient heating in the winter months and cooling during summer months is the optimum solution to migrate for overheating. The enhanced MVHR units do not require regular maintenance over and above a normal MVHR unit. The energy costs for summer cooling will be offset by the energy savings for winter heating by the same units.

TABLE 8 – SUMMARY OF PROPOSED SITE COOLING HIERARCHY STRATEGY

Cooling Hierarchy	Proposed Development Strategy
1. Minimise internal heat generation through energy efficient design	Enhanced fabric performance. Bespoke Psi values to improve thermal bridging. LED lighting is proposed to reduce internal heat gains and energy consumption. Enhanced thermal insulation on primary pipework to minimise heat gain to internal spaces and reduce heat losses and improve system efficiency.
2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls	Internal blinds will be utilized to minimise the solar gains. Window glazing areas reduced on at risk façade, bottom panels converted to spandrel panel to reduce heat gains.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings	Use of buff and light-coloured materials on facades, to reduce the urban heat island impact. The building design accounts for highest possible thermal mass for this type of project. The floor to ceiling height has been optimised to accommodate for building services and act as a heat preventing measure.
4. Passive ventilation	Natural ventilation is possible through openable windows. Cross ventilation is facilitated by dual aspect flats, wherever possible.
5. Mechanical ventilation	Each apartment to be provided with an MVHR unit with an integral air to air heat pump which will provide additional heating in the winter months to improve efficiency and in summer month operate in reverse to provide some cooling to mitigate overheating within rooms, in the event that external noise is a nuisance to residents.

6. Active cooling systems (ensuring they are lowest carbon options	Discounted active cooling solutions that allow the residents, the ability to provide on demand cooling to their dwelling. Provide mechanical ventilation units that only provide cooling to the outside air when it is above the desired temperature. Provide units that are only able to provide a small amount of cooling to the incoming outside air, on hot days and reduce the risk of overheating is greatly.

7 ‘Be Green’

The following section reviews Low and Zero Carbon (LZC) technologies applicable to the proposed development. The reports analysis considered the following technology as suitable for the proposed development:

- Air Source Heat Pump;
- Photovoltaic.

Other renewable technology options were investigated and discounted. The justification for discounting these technologies can be found in the Appendix These alternative technologies included:

- Solar Thermal;
- Wind Turbines;
- Biomass Boiler;
- Ground Source Heat Pump;

7.1 Proposed Low and Zero Carbon Technologies

Subject to the consideration of the technologies previously discussed, the following green measures will be incorporated into the proposed building to reduce fossil fuel consumption and mitigate carbon emissions:

7.1.1 Air Source Heat Pumps

A heat pump extracts heat from the ground, air or water and transfers it to a heating system. Often coupled to underfloor heating, as the temperatures involved are usually lower (around 40º where a boiler will be 80º), an electric pump circulates the water in the system. Ground source heat pumps (GSHP) and air source heat pumps (ASHP) are currently the most common type of heat pump used in the UK and use technology which is essentially the same as a fridge. A typical GSHP system will include a ground heat exchanger (for extracting heat from the ground), the heat pump itself and a heating system.

The overall efficiency of a heat pump is determined by the difference in temperature between the heat source itself (the ground, air or water) and the temperature of the area or environment to be heated. The smaller the temperature difference the higher the coefficient of performance (COP) will be. Typical COPs will be in the range two - four depending upon operating conditions. Heat pumps can supply 100% of heat demand, but it will usually only pre-heat domestic hot water, so an additional method of heating the hot water (e.g. an immersion heater) may be needed. Units range in size but the smaller ones only require equipment approximately the size of a small air conditioning unit on the outside of the property. Air source heat pumps can be connected in series and thus provide a heating/cooling system, modules only work as and when demand requires thus providing excellent efficiencies.

The proposed VRF system will have a minimum SCoP of 2.5.

7.1.2 Photovoltaic Panels (PV)

PV systems convert energy from the sun into electricity through semi-conductor cells. A cell consists of two thin layers of different semi-conducting materials, usually based on silicon. When light shines on the cell, a difference in energy is created – otherwise known as voltage. This voltage is used to produce a direct current (DC), which can be used directly or converted into alternating current (AC). AC can be exported to the local electricity network/national grid. The brighter the sunlight, the more power is produced. Shading from other objects (such as nearby buildings and trees) will affect performance and PV cells are more likely to show a drop in output than solar thermal panels. As with solar hot water, the panels should face as close to due south as possible and be unshaded for most of the day. An individual PV cell only produces a small amount of power; therefore, they are usually connected together to form a module. Modules can then be linked to form an array and sized to meet the required demand.

The size of a Photovoltaic (PV) installation is expressed by its kilowatt peak (kWp) potential, which is an indication of how much electricity the system could generate at peak/optimum conditions. The electricity generated on-site by Photovoltaic cells would be a direct saving on electricity otherwise sourced from the national grid. The electricity generated would be a direct saving on electricity required for power, lighting, heating and hot water (depending on systems installed). Whilst expensive it should be noted that PV technology off-sets three times the carbon dioxide from grid supplied electricity compared to technology which reduces natural gas consumption therefore as a single simplistic solution it compares favourably.

The apartments will be provided with approximately 8.4kWp of photovoltaics and the amounts to each unit will be proportion by floor area, refer to table 4 below. The panels will be located on the roof and are assumed to be south facing at a 30-degree tilt.

TABLE 9 – SUMMARY OF PHOTOVOLTAIC AMOUNTS

Floor Level	Dwellings	PV - kWp	Electricity generated by PV - kWh/Year
First Floor	Flat 1	0.49	423.17
	Flat 2	0.58	500.90
Second Floor	Flat 3	0.31	267.72
	Flat 4	0.43	371.36
	Flat 5	0.31	267.72

Floor Level	Dwellings	PV - kWp	Electricity generated by PV - kWh/Year
Third Floor	Flat 6	0.31	267.72
	Flat 7	0.43	371.36
	Flat 8	0.31	267.72
Fourth Floor	Flat 9	0.31	267.72
	Flat 10	0.43	371.36
	Flat 11	0.31	267.72
Fifth Floor	Flat 12	0.31	267.72
	Flat 13	0.43	371.36
	Flat 14	0.31	267.72
Sixth Floor	Flat 15	0.31	267.72
	Flat 16	0.43	371.36
	Flat 17	0.31	267.72
Seventh Floor	Flat 18	0.31	267.72
	Flat 19	0.43	371.36
	Flat 20	0.31	267.72
Eighth Floor	Flat 21	0.31	267.72
	Flat 22	0.43	371.36
	Flat 23	0.31	267.72

The Design Team has identified sufficient roof space to accommodate the PV systems has shown in the roof plans below.

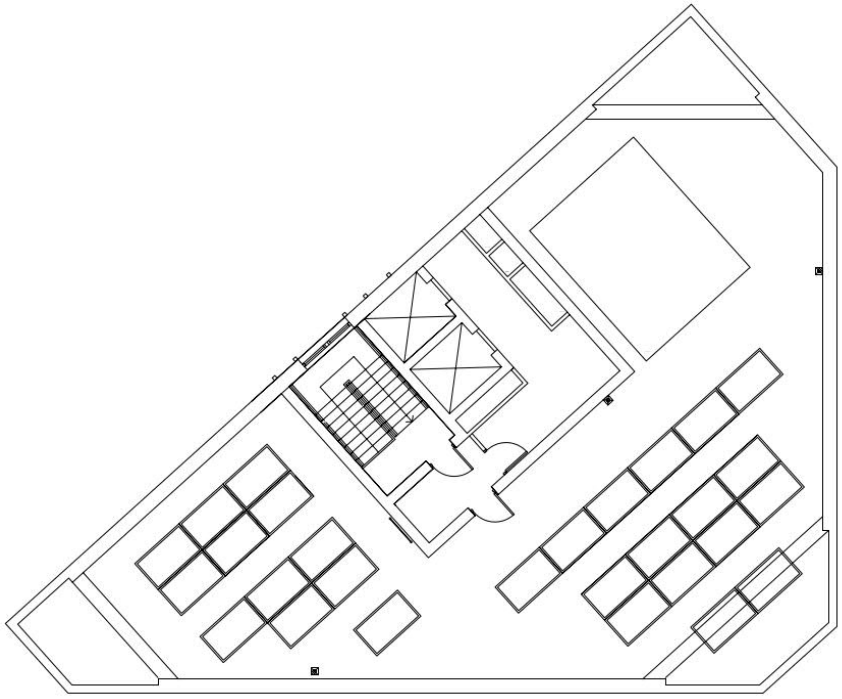


Figure 13 – Proposed location plan of Photovoltaics

8 Carbon Offset Calculation

This report has demonstrated that the carbon savings have been maximised and additional savings cannot feasibly or viably be met onsite. In order to meet the zero-carbon target imposed by the London Borough of Haringey a financial carbon offset is proposed.

The cost per tonne of carbon is set at the nationally recognised price for Carbon Dioxide, as set by the Zero Carbon Hub, of £95.00 per tonne. Following London Plan guidance, the overall contribution is calculated over a 30-year period.

Carbon Offset Calculation

The shortfall of carbon identified within the report after the implementation of a highly efficient building fabric and implementation of ASHP and photovoltaic panels is 8.31 tonnes.

TABLE 10 – CARBON OFFSET PAYMENT FOR THE SCHEME

	Annual Shortfall ελλειμα (Tonnes CO_2)	Cumulative Shortfall (Tonnes CO_2)
Total Target Savings to achieve zero carbon	22.68	-
Carbon saved in the scheme	14.38	-
Carbon Shortfall	8.31	249.3
Cash in-Lieu Contribution (£)	£23,683.5	-

Cumulative Shortfall = Shortfall of carbon * over 30 years (assumed lifetime of the development's services). Tonnes of Carbon *£95.00 per tonne of carbon as per the London Plan Zero Carbon Homes and the Carbon Offsetting Fund.

Therefore, the projects carbon offset payment would equate to £23.683.5. We understand any carbon offset payment will be secured through a S106.

9 Conclusion

This report has followed the London Plan and Haringey's Energy Policies, and in doing so has identified measures to improve energy efficiency and to reduce energy and carbon from the proposed development.

This report demonstrates how the proposed development by using the measures identified in section 4 to 6 to this report achieves a 61% carbon reduction against carbon emission. The following table summarises the improvements recognised by each step of the energy hierarchy approach:

TABLE 11 – SUMMARY OF REGULATED CARBON EMISSION REDUCTION FOR THE SCHEME

	Carbon Dioxide Emissions (Tonnes/Annum)	CO_2 Savings (Tonnes CO_2/ year)	CO_2 Emissions Reduction at each stage (%)
Step 1 –Baseline	23	-	-
Step 2 – 'Be Lean'	20	1	13%
Step 3 – 'Be Clean'	20	-	-
Step 4 – 'Be Green'	8.3	11.7	51%
Total Cumulative Savings	**-**	**14.7**	**64%**

The following strategy will be implemented for the proposed development:

- Be Lean': Energy efficiency measures to improve the building fabric and services includes: High performance U-Values (0.18 for external walls, 0.12 for roof, 0.13 for the exposed floor, 1.0 for flat entrance doors and 0.90 for the glazing and a good air tightness (maximum of $3m^3/m^2/hr$ at 50Pa)) and bespoke Psi-values for thermal bridging.
- 'Be Clean': A CHP or a Heat Network has not currently been deemed feasible for the scheme.
- 'Be Green': Air Source Heat Pump and Photovoltaic panels have been deemed as the most feasible technology.

Using the measures identified above the site could achieve an 13% carbon reduction via the lean stage and a 51% energy reduction by the use of onsite renewable technologies. The carbon emissions (DER) of the proposed development can also be reduced by 60%. This enables the building to comply with Building Regulation Part L1A.

This report has demonstrated that the carbon savings have been maximised through the use of enhanced U-value, the incorporation of bespoke Y-values and low and zero carbon technologies. Additional savings cannot feasibly or viably be met onsite. In order to meet the zero-carbon target on site imposed by LBH a financial carbon offset is proposed.

Appendix A – Baseline SAP Output Documents

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Level 1 - Apt 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.71	(1a) x	2.7	(2a) =	217.92	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.92	(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	0.41	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			1.89	x	1	=	1.89			(26)
Windows Type 1			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Windows Type 2			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Windows Type 3			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Windows Type 4			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Windows Type 5			2	x1/[1/(1.4)+ 0.04]		=	2.65			(27)
Windows Type 6			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Windows Type 7			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Windows Type 8			6.02	x1/[1/(1.4)+ 0.04]		=	7.98			(27)
Windows Type 9			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Windows Type 10			1.28	x1/[1/(1.4)+ 0.04]		=	1.7			(27)
Floor Type 1			14.57	x	0.13	=	1.8941			(28)
Floor Type 2			33.19	x	0.13	=	4.3147			(28)
Floor Type 3			32.95	x	0.13	=	4.2835			(28)
Walls Type1	80.38	18.26	62.12	x	0.18	=	11.18			(29)
Walls Type2	29.57	1.89	27.68	x	0.18	=	4.98			(29)
Total area of elements, m²			190.65							(31)
Party wall			18.31	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 52.75 (33)

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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 19.49 (36)

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

Total fabric heat loss (33) + (36) = 72.25 (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=	42.3	42.06	41.82	40.68	40.47	39.48	39.48	39.3	39.86	40.47	40.9	41.35	(38)

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

(39)m=	114.55	114.3	114.06	112.93	112.71	111.73	111.73	111.54	112.11	112.71	113.14	113.59	

Average = Sum(39)$_{1...12}$ /12= 112.93 (39)

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

(40)m=	1.42	1.42	1.41	1.4	1.4	1.38	1.38	1.38	1.39	1.4	1.4	1.41	

Average = Sum(40)$_{1...12}$ /12= 1.4 (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 2.48 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

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

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

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

(44)m=	102.31	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.31	

Total = Sum(44)$_{1...12}$ = 1116.12 (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=	151.72	132.7	136.93	119.38	114.55	98.85	91.6	105.11	106.36	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.4 (45)

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

(46)m=	22.76	19.9	20.54	17.91	17.18	14.83	13.74	15.77	15.95	18.59	20.3	22.04	(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:

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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=	198.32	174.78	183.53	164.47	161.14	143.94	138.19	151.7	151.46	170.55	180.4	193.53	(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=	198.32	174.78	183.53	164.47	161.14	143.94	138.19	151.7	151.46	170.55	180.4	193.53	

Output from water heater (annual)$_{1...12}$ — 2012.02 — (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=	87.72	77.79	82.81	75.77	75.36	68.94	67.73	72.22	71.44	78.49	81.06	86.13	(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=	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	(66)

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

(67)m=	19.69	17.49	14.22	10.77	8.05	6.8	7.34	9.54	12.81	16.27	18.98	20.24	(67)

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

(68)m=	220.92	223.21	217.43	205.14	189.61	175.02	165.27	162.98	168.76	181.06	196.58	211.17	(68)

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

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	(71)

Water heating gains (Table 5)

(72)m=	117.91	115.76	111.3	105.23	101.3	95.75	91.04	97.08	99.22	105.5	112.59	115.77	(72)

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

(73)m=	421.66	419.6	406.1	384.28	362.1	340.71	326.8	332.74	343.93	365.96	391.3	410.32

(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)	
North	0.9x 0.77	x	1.28	x	10.63	x	0.63	x	0.7	=	4.16	(74)
North	0.9x 0.77	x	1.28	x	10.63	x	0.63	x	0.7	=	4.16	(74)
North	0.9x 0.77	x	1.28	x	20.32	x	0.63	x	0.7	=	7.95	(74)
North	0.9x 0.77	x	1.28	x	20.32	x	0.63	x	0.7	=	7.95	(74)
North	0.9x 0.77	x	1.28	x	34.53	x	0.63	x	0.7	=	13.51	(74)
North	0.9x 0.77	x	1.28	x	34.53	x	0.63	x	0.7	=	13.51	(74)
North	0.9x 0.77	x	1.28	x	55.46	x	0.63	x	0.7	=	21.7	(74)
North	0.9x 0.77	x	1.28	x	55.46	x	0.63	x	0.7	=	21.7	(74)
North	0.9x 0.77	x	1.28	x	74.72	x	0.63	x	0.7	=	29.23	(74)
North	0.9x 0.77	x	1.28	x	74.72	x	0.63	x	0.7	=	29.23	(74)
North	0.9x 0.77	x	1.28	x	79.99	x	0.63	x	0.7	=	31.29	(74)
North	0.9x 0.77	x	1.28	x	79.99	x	0.63	x	0.7	=	31.29	(74)
North	0.9x 0.77	x	1.28	x	74.68	x	0.63	x	0.7	=	29.21	(74)
North	0.9x 0.77	x	1.28	x	74.68	x	0.63	x	0.7	=	29.21	(74)
North	0.9x 0.77	x	1.28	x	59.25	x	0.63	x	0.7	=	23.18	(74)
North	0.9x 0.77	x	1.28	x	59.25	x	0.63	x	0.7	=	23.18	(74)
North	0.9x 0.77	x	1.28	x	41.52	x	0.63	x	0.7	=	16.24	(74)
North	0.9x 0.77	x	1.28	x	41.52	x	0.63	x	0.7	=	16.24	(74)
North	0.9x 0.77	x	1.28	x	24.19	x	0.63	x	0.7	=	9.46	(74)
North	0.9x 0.77	x	1.28	x	24.19	x	0.63	x	0.7	=	9.46	(74)
North	0.9x 0.77	x	1.28	x	13.12	x	0.63	x	0.7	=	5.13	(74)
North	0.9x 0.77	x	1.28	x	13.12	x	0.63	x	0.7	=	5.13	(74)
North	0.9x 0.77	x	1.28	x	8.86	x	0.63	x	0.7	=	3.47	(74)
North	0.9x 0.77	x	1.28	x	8.86	x	0.63	x	0.7	=	3.47	(74)
Southwest	0.9x 0.77	x	1.28	x	36.79		0.63	x	0.7	=	14.39	(79)
Southwest	0.9x 0.77	x	1.28	x	36.79		0.63	x	0.7	=	14.39	(79)
Southwest	0.9x 0.77	x	1.28	x	36.79		0.63	x	0.7	=	14.39	(79)
Southwest	0.9x 0.77	x	1.28	x	36.79		0.63	x	0.7	=	14.39	(79)
Southwest	0.9x 0.77	x	2	x	36.79		0.63	x	0.7	=	22.49	(79)
Southwest	0.9x 0.77	x	1.28	x	36.79		0.63	x	0.7	=	14.39	(79)
Southwest	0.9x 0.77	x	1.28	x	36.79		0.63	x	0.7	=	14.39	(79)
Southwest	0.9x 0.77	x	1.28	x	62.67		0.63	x	0.7	=	24.52	(79)
Southwest	0.9x 0.77	x	1.28	x	62.67		0.63	x	0.7	=	24.52	(79)
Southwest	0.9x 0.77	x	1.28	x	62.67		0.63	x	0.7	=	24.52	(79)

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Southwest	0.9x	0.77	x	1.28	x	62.67		0.63	x	0.7	=	24.52	(79)
Southwest	0.9x	0.77	x	2	x	62.67		0.63	x	0.7	=	38.31	(79)
Southwest	0.9x	0.77	x	1.28	x	62.67		0.63	x	0.7	=	24.52	(79)
Southwest	0.9x	0.77	x	1.28	x	62.67		0.63	x	0.7	=	24.52	(79)
Southwest	0.9x	0.77	x	1.28	x	85.75		0.63	x	0.7	=	33.55	(79)
Southwest	0.9x	0.77	x	1.28	x	85.75		0.63	x	0.7	=	33.55	(79)
Southwest	0.9x	0.77	x	1.28	x	85.75		0.63	x	0.7	=	33.55	(79)
Southwest	0.9x	0.77	x	1.28	x	85.75		0.63	x	0.7	=	33.55	(79)
Southwest	0.9x	0.77	x	2	x	85.75		0.63	x	0.7	=	52.41	(79)
Southwest	0.9x	0.77	x	1.28	x	85.75		0.63	x	0.7	=	33.55	(79)
Southwest	0.9x	0.77	x	1.28	x	85.75		0.63	x	0.7	=	33.55	(79)
Southwest	0.9x	0.77	x	1.28	x	106.25		0.63	x	0.7	=	41.56	(79)
Southwest	0.9x	0.77	x	1.28	x	106.25		0.63	x	0.7	=	41.56	(79)
Southwest	0.9x	0.77	x	1.28	x	106.25		0.63	x	0.7	=	41.56	(79)
Southwest	0.9x	0.77	x	1.28	x	106.25		0.63	x	0.7	=	41.56	(79)
Southwest	0.9x	0.77	x	2	x	106.25		0.63	x	0.7	=	64.94	(79)
Southwest	0.9x	0.77	x	1.28	x	106.25		0.63	x	0.7	=	41.56	(79)
Southwest	0.9x	0.77	x	1.28	x	106.25		0.63	x	0.7	=	41.56	(79)
Southwest	0.9x	0.77	x	1.28	x	119.01		0.63	x	0.7	=	46.56	(79)
Southwest	0.9x	0.77	x	1.28	x	119.01		0.63	x	0.7	=	46.56	(79)
Southwest	0.9x	0.77	x	1.28	x	119.01		0.63	x	0.7	=	46.56	(79)
Southwest	0.9x	0.77	x	1.28	x	119.01		0.63	x	0.7	=	46.56	(79)
Southwest	0.9x	0.77	x	2	x	119.01		0.63	x	0.7	=	72.74	(79)
Southwest	0.9x	0.77	x	1.28	x	119.01		0.63	x	0.7	=	46.56	(79)
Southwest	0.9x	0.77	x	1.28	x	119.01		0.63	x	0.7	=	46.56	(79)
Southwest	0.9x	0.77	x	1.28	x	118.15		0.63	x	0.7	=	46.22	(79)
Southwest	0.9x	0.77	x	1.28	x	118.15		0.63	x	0.7	=	46.22	(79)
Southwest	0.9x	0.77	x	1.28	x	118.15		0.63	x	0.7	=	46.22	(79)
Southwest	0.9x	0.77	x	1.28	x	118.15		0.63	x	0.7	=	46.22	(79)
Southwest	0.9x	0.77	x	2	x	118.15		0.63	x	0.7	=	72.22	(79)
Southwest	0.9x	0.77	x	1.28	x	118.15		0.63	x	0.7	=	46.22	(79)
Southwest	0.9x	0.77	x	1.28	x	118.15		0.63	x	0.7	=	46.22	(79)
Southwest	0.9x	0.77	x	1.28	x	113.91		0.63	x	0.7	=	44.56	(79)
Southwest	0.9x	0.77	x	1.28	x	113.91		0.63	x	0.7	=	44.56	(79)
Southwest	0.9x	0.77	x	1.28	x	113.91		0.63	x	0.7	=	44.56	(79)
Southwest	0.9x	0.77	x	1.28	x	113.91		0.63	x	0.7	=	44.56	(79)
Southwest	0.9x	0.77	x	2	x	113.91		0.63	x	0.7	=	69.62	(79)
Southwest	0.9x	0.77	x	1.28	x	113.91		0.63	x	0.7	=	44.56	(79)
Southwest	0.9x	0.77	x	1.28	x	113.91		0.63	x	0.7	=	44.56	(79)
Southwest	0.9x	0.77	x	1.28	x	104.39		0.63	x	0.7	=	40.84	(79)
Southwest	0.9x	0.77	x	1.28	x	104.39		0.63	x	0.7	=	40.84	(79)

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Southwest	0.9x	0.77	x	1.28	x	104.39		0.63	x	0.7	=	40.84	(79)
Southwest	0.9x	0.77	x	1.28	x	104.39		0.63	x	0.7	=	40.84	(79)
Southwest	0.9x	0.77	x	2	x	104.39		0.63	x	0.7	=	63.81	(79)
Southwest	0.9x	0.77	x	1.28	x	104.39		0.63	x	0.7	=	40.84	(79)
Southwest	0.9x	0.77	x	1.28	x	104.39		0.63	x	0.7	=	40.84	(79)
Southwest	0.9x	0.77	x	1.28	x	92.85		0.63	x	0.7	=	36.32	(79)
Southwest	0.9x	0.77	x	1.28	x	92.85		0.63	x	0.7	=	36.32	(79)
Southwest	0.9x	0.77	x	1.28	x	92.85		0.63	x	0.7	=	36.32	(79)
Southwest	0.9x	0.77	x	1.28	x	92.85		0.63	x	0.7	=	36.32	(79)
Southwest	0.9x	0.77	x	2	x	92.85		0.63	x	0.7	=	56.75	(79)
Southwest	0.9x	0.77	x	1.28	x	92.85		0.63	x	0.7	=	36.32	(79)
Southwest	0.9x	0.77	x	1.28	x	92.85		0.63	x	0.7	=	36.32	(79)
Southwest	0.9x	0.77	x	1.28	x	69.27		0.63	x	0.7	=	27.1	(79)
Southwest	0.9x	0.77	x	1.28	x	69.27		0.63	x	0.7	=	27.1	(79)
Southwest	0.9x	0.77	x	1.28	x	69.27		0.63	x	0.7	=	27.1	(79)
Southwest	0.9x	0.77	x	1.28	x	69.27		0.63	x	0.7	=	27.1	(79)
Southwest	0.9x	0.77	x	2	x	69.27		0.63	x	0.7	=	42.34	(79)
Southwest	0.9x	0.77	x	1.28	x	69.27		0.63	x	0.7	=	27.1	(79)
Southwest	0.9x	0.77	x	1.28	x	69.27		0.63	x	0.7	=	27.1	(79)
Southwest	0.9x	0.77	x	1.28	x	44.07		0.63	x	0.7	=	17.24	(79)
Southwest	0.9x	0.77	x	1.28	x	44.07		0.63	x	0.7	=	17.24	(79)
Southwest	0.9x	0.77	x	1.28	x	44.07		0.63	x	0.7	=	17.24	(79)
Southwest	0.9x	0.77	x	1.28	x	44.07		0.63	x	0.7	=	17.24	(79)
Southwest	0.9x	0.77	x	2	x	44.07		0.63	x	0.7	=	26.94	(79)
Southwest	0.9x	0.77	x	1.28	x	44.07		0.63	x	0.7	=	17.24	(79)
Southwest	0.9x	0.77	x	1.28	x	44.07		0.63	x	0.7	=	17.24	(79)
Southwest	0.9x	0.77	x	1.28	x	31.49		0.63	x	0.7	=	12.32	(79)
Southwest	0.9x	0.77	x	1.28	x	31.49		0.63	x	0.7	=	12.32	(79)
Southwest	0.9x	0.77	x	1.28	x	31.49		0.63	x	0.7	=	12.32	(79)
Southwest	0.9x	0.77	x	1.28	x	31.49		0.63	x	0.7	=	12.32	(79)
Southwest	0.9x	0.77	x	2	x	31.49		0.63	x	0.7	=	19.25	(79)
Southwest	0.9x	0.77	x	1.28	x	31.49		0.63	x	0.7	=	12.32	(79)
Southwest	0.9x	0.77	x	1.28	x	31.49		0.63	x	0.7	=	12.32	(79)
West	0.9x	0.77	x	6.02	x	19.64	x	0.63	x	0.7	=	36.13	(80)
West	0.9x	0.77	x	6.02	x	38.42	x	0.63	x	0.7	=	70.69	(80)
West	0.9x	0.77	x	6.02	x	63.27	x	0.63	x	0.7	=	116.41	(80)
West	0.9x	0.77	x	6.02	x	92.28	x	0.63	x	0.7	=	169.78	(80)
West	0.9x	0.77	x	6.02	x	113.09	x	0.63	x	0.7	=	208.07	(80)
West	0.9x	0.77	x	6.02	x	115.77	x	0.63	x	0.7	=	212.99	(80)
West	0.9x	0.77	x	6.02	x	110.22	x	0.63	x	0.7	=	202.78	(80)
West	0.9x	0.77	x	6.02	x	94.68	x	0.63	x	0.7	=	174.18	(80)

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West	0.9x	0.77	x	6.02	x	73.59	x	0.63	x	0.7	=	135.39	(80)
West	0.9x	0.77	x	6.02	x	45.59	x	0.63	x	0.7	=	83.87	(80)
West	0.9x	0.77	x	6.02	x	24.49	x	0.63	x	0.7	=	45.05	(80)
West	0.9x	0.77	x	6.02	x	16.15	x	0.63	x	0.7	=	29.71	(80)

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

(83)m=	153.3	271.99	397.11	527.5	618.6	625.1	598.18	529.36	442.56	307.72	185.69	129.8	(83)

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

(84)m=	574.96	691.6	803.21	911.78	980.69	965.81	924.98	862.1	786.49	673.68	576.99	540.12	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.84	0.68	0.51	0.57	0.81	0.96	0.99	1	(86)

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

(87)m=	19.51	19.72	20.03	20.43	20.75	20.93	20.98	20.97	20.84	20.41	19.89	19.48	(87)

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

(88)m=	19.75	19.75	19.75	19.76	19.77	19.78	19.78	19.78	19.77	19.77	19.76	19.76	(88)

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

(89)m=	0.99	0.99	0.97	0.91	0.78	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=	17.8	18.1	18.56	19.12	19.53	19.73	19.77	19.77	19.66	19.11	18.36	17.76	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	18.4	18.66	19.07	19.57	19.95	20.15	20.19	20.19	20.07	19.57	18.89	18.36	(92)

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

(93)m=	18.4	18.66	19.07	19.57	19.95	20.15	20.19	20.19	20.07	19.57	18.89	18.36	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.91	0.79	0.6	0.43	0.48	0.74	0.93	0.98	0.99	(94)

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

(95)m=	570.4	679.84	772.12	825.45	774.65	584.3	395.27	412.63	583.35	629.53	567.99	536.78	(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=	1614.99	1573.34	1434.06	1205.28	930.43	620	401.39	422.53	669.21	1010.59	1333.93	1608.02	(97)

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

(98)m=	777.17	600.43	492.49	273.48	115.9	0	0	0	0	283.51	551.48	797	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3891.45 (98)

Space heating requirement in kWh/m²/year 48.22 (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	
Space heating requirement (calculated above)													kWh/year
	777.17	600.43	492.49	273.48	115.9	0	0	0	0	283.51	551.48	797	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	831.2	642.17	526.73	292.49	123.96	0	0	0	0	303.22	589.81	852.4	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4161.98 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	198.32	174.78	183.53	164.47	161.14	143.94	138.19	151.7	151.46	170.55	180.4	193.53	

Efficiency of water heater 79.8 (216)

(217)m=	88.1	87.84	87.32	86.16	83.95	79.8	79.8	79.8	79.8	86.16	87.6	88.19	(217)

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

(219)m=	225.11	198.97	210.18	190.89	191.95	180.37	173.17	190.1	189.79	197.95	205.93	219.45	

Total = Sum(219a)$_{1...12}$ = 2373.86 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4161.98
Water heating fuel used		2373.86
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		347.75 (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 =	898.99 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	512.75 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1411.74 (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	=	180.48	(268)
Total CO2, kg/year			sum of (265)…(271) =		1631.15	(272)

TER = 20.21 (273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Level 1 - Apt 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	95.04	(1a) x	2.7	(2a) =	256.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	95.04	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		256.61	(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) =	0.12 (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	0.34	0.3	0.3	0.29	0.31	0.34	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			1.89	x	1	=	1.89			(26)
Windows Type 1			1.34	x1/[1/(1.4)+ 0.04]		=	1.78			(27)
Windows Type 2			1.34	x1/[1/(1.4)+ 0.04]		=	1.78			(27)
Windows Type 3			1.34	x1/[1/(1.4)+ 0.04]		=	1.78			(27)
Windows Type 4			1.34	x1/[1/(1.4)+ 0.04]		=	1.78			(27)
Windows Type 5			1.34	x1/[1/(1.4)+ 0.04]		=	1.78			(27)
Windows Type 6			1.34	x1/[1/(1.4)+ 0.04]		=	1.78			(27)
Windows Type 7			2.09	x1/[1/(1.4)+ 0.04]		=	2.77			(27)
Windows Type 8			2.09	x1/[1/(1.4)+ 0.04]		=	2.77			(27)
Windows Type 9			6.28	x1/[1/(1.4)+ 0.04]		=	8.33			(27)
Windows Type 10			1.34	x1/[1/(1.4)+ 0.04]		=	1.78			(27)
Floor Type 1			30.54	x	0.13	=	3.9702			(28)
Floor Type 2			35.35	x	0.13	=	4.5955			(28)
Floor Type 3			29.15	x	0.13	=	3.7895			(28)
Walls Type1	73.22	19.84	53.38	x	0.18	=	9.61			(29)
Walls Type2	11.07	1.89	9.18	x	0.18	=	1.65			(29)
Walls Type3	11.88	0	11.88	x	0.18	=	2.14			(29)
Roof	5.68	0	5.68	x	0.13	=	0.74			(30)
Total area of elements, m²			196.89							(31)

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Party wall	18.31	x	0	=	0	(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	54.69 (33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	51.12 (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 — 18.33 (36)

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

Total fabric heat loss — (33) + (36) = — 73.02 (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=	49.04	48.78	48.52	47.32	47.1	46.06	46.06	45.86	46.46	47.1	47.55	48.03	(38)

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

(39)m=	122.05	121.79	121.54	120.34	120.12	119.08	119.08	118.88	119.48	120.12	120.57	121.05	

Average = Sum(39)$_{1...12}$ /12= 120.34 (39)

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

(40)m=	1.28	1.28	1.28	1.27	1.26	1.25	1.25	1.25	1.26	1.26	1.27	1.27	

Average = Sum(40)$_{1...12}$ /12= 1.27 (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 — 2.69 (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 — 98.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	107.86	103.94	100.02	96.09	92.17	88.25	88.25	92.17	96.09	100.02	103.94	107.86	

Total = Sum(44)$_{1...12}$ = 1176.66 (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=	159.95	139.9	144.36	125.86	120.76	104.21	96.57	110.81	112.13	130.68	142.65	154.91	

Total = Sum(45)$_{1...12}$ = 1542.78 (45)

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

(46)m=	23.99	20.98	21.65	18.88	18.11	15.63	14.48	16.62	16.82	19.6	21.4	23.24	(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)

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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=	206.55	181.98	190.96	170.95	167.36	149.3	143.16	157.4	157.23	177.28	187.74	201.5	(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=	206.55	181.98	190.96	170.95	167.36	149.3	143.16	157.4	157.23	177.28	187.74	201.5	

Output from water heater (annual)$_{1...12}$: 2091.4 (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=	90.46	80.18	85.28	77.92	77.43	70.72	69.38	74.12	73.36	80.73	83.5	88.78	(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=	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	(66)

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

(67)m=	22.18	19.7	16.02	12.13	9.07	7.66	8.27	10.75	14.43	18.33	21.39	22.8	(67)

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

(68)m=	248.05	250.62	244.14	230.33	212.9	196.52	185.57	183	189.48	203.29	220.72	237.11	(68)

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

(69)m=	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	(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=	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	(71)

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Water heating gains (Table 5)

(72)m=	121.59	119.32	114.62	108.22	104.07	98.23	93.26	99.62	101.89	108.5	115.98	119.33	(72)

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

(73)m=	458.15	455.98	441.11	417.01	392.37	368.73	353.43	359.7	372.13	396.45	424.42	445.57	(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	1.34	x	10.63	x	0.63	x	0.7	=	4.35	(74)
North	0.9x 0.77	x	1.34	x	10.63	x	0.63	x	0.7	=	4.35	(74)
North	0.9x 0.77	x	1.34	x	10.63	x	0.63	x	0.7	=	4.35	(74)
North	0.9x 0.77	x	1.34	x	10.63	x	0.63	x	0.7	=	4.35	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.63	x	0.7	=	8.32	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.63	x	0.7	=	8.32	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.63	x	0.7	=	8.32	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.63	x	0.7	=	8.32	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.63	x	0.7	=	14.14	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.63	x	0.7	=	14.14	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.63	x	0.7	=	14.14	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.63	x	0.7	=	14.14	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.63	x	0.7	=	22.71	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.63	x	0.7	=	22.71	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.63	x	0.7	=	22.71	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.63	x	0.7	=	22.71	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.63	x	0.7	=	30.6	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.63	x	0.7	=	30.6	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.63	x	0.7	=	30.6	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.63	x	0.7	=	30.6	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.63	x	0.7	=	32.76	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.63	x	0.7	=	32.76	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.63	x	0.7	=	32.76	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.63	x	0.7	=	32.76	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.63	x	0.7	=	30.58	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.63	x	0.7	=	30.58	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.63	x	0.7	=	30.58	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.63	x	0.7	=	30.58	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.63	x	0.7	=	24.26	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.63	x	0.7	=	24.26	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.63	x	0.7	=	24.26	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.63	x	0.7	=	24.26	(74)

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North	0.9x	0.77	x	1.34	x	41.52	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.63	x	0.7	=	9.91	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.63	x	0.7	=	9.91	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.63	x	0.7	=	9.91	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.63	x	0.7	=	9.91	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.63	x	0.7	=	5.37	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.63	x	0.7	=	5.37	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.63	x	0.7	=	5.37	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.63	x	0.7	=	5.37	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.63	x	0.7	=	3.63	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.63	x	0.7	=	3.63	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.63	x	0.7	=	3.63	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.63	x	0.7	=	3.63	(74)
East	0.9x	0.77	x	1.34	x	19.64	x	0.63	x	0.7	=	8.04	(76)
East	0.9x	0.77	x	1.34	x	19.64	x	0.63	x	0.7	=	8.04	(76)
East	0.9x	0.77	x	2.09	x	19.64	x	0.63	x	0.7	=	12.54	(76)
East	0.9x	0.77	x	1.34	x	38.42	x	0.63	x	0.7	=	15.73	(76)
East	0.9x	0.77	x	1.34	x	38.42	x	0.63	x	0.7	=	15.73	(76)
East	0.9x	0.77	x	2.09	x	38.42	x	0.63	x	0.7	=	24.54	(76)
East	0.9x	0.77	x	1.34	x	63.27	x	0.63	x	0.7	=	25.91	(76)
East	0.9x	0.77	x	1.34	x	63.27	x	0.63	x	0.7	=	25.91	(76)
East	0.9x	0.77	x	2.09	x	63.27	x	0.63	x	0.7	=	40.41	(76)
East	0.9x	0.77	x	1.34	x	92.28	x	0.63	x	0.7	=	37.79	(76)
East	0.9x	0.77	x	1.34	x	92.28	x	0.63	x	0.7	=	37.79	(76)
East	0.9x	0.77	x	2.09	x	92.28	x	0.63	x	0.7	=	58.94	(76)
East	0.9x	0.77	x	1.34	x	113.09	x	0.63	x	0.7	=	46.31	(76)
East	0.9x	0.77	x	1.34	x	113.09	x	0.63	x	0.7	=	46.31	(76)
East	0.9x	0.77	x	2.09	x	113.09	x	0.63	x	0.7	=	72.24	(76)
East	0.9x	0.77	x	1.34	x	115.77	x	0.63	x	0.7	=	47.41	(76)
East	0.9x	0.77	x	1.34	x	115.77	x	0.63	x	0.7	=	47.41	(76)
East	0.9x	0.77	x	2.09	x	115.77	x	0.63	x	0.7	=	73.95	(76)
East	0.9x	0.77	x	1.34	x	110.22	x	0.63	x	0.7	=	45.14	(76)
East	0.9x	0.77	x	1.34	x	110.22	x	0.63	x	0.7	=	45.14	(76)
East	0.9x	0.77	x	2.09	x	110.22	x	0.63	x	0.7	=	70.4	(76)
East	0.9x	0.77	x	1.34	x	94.68	x	0.63	x	0.7	=	38.77	(76)
East	0.9x	0.77	x	1.34	x	94.68	x	0.63	x	0.7	=	38.77	(76)
East	0.9x	0.77	x	2.09	x	94.68	x	0.63	x	0.7	=	60.47	(76)
East	0.9x	0.77	x	1.34	x	73.59	x	0.63	x	0.7	=	30.14	(76)

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East	0.9x	0.77	x	1.34	x	73.59	x	0.63	x	0.7	=	30.14	(76)
East	0.9x	0.77	x	2.09	x	73.59	x	0.63	x	0.7	=	47	(76)
East	0.9x	0.77	x	1.34	x	45.59	x	0.63	x	0.7	=	18.67	(76)
East	0.9x	0.77	x	1.34	x	45.59	x	0.63	x	0.7	=	18.67	(76)
East	0.9x	0.77	x	2.09	x	45.59	x	0.63	x	0.7	=	29.12	(76)
East	0.9x	0.77	x	1.34	x	24.49	x	0.63	x	0.7	=	10.03	(76)
East	0.9x	0.77	x	1.34	x	24.49	x	0.63	x	0.7	=	10.03	(76)
East	0.9x	0.77	x	2.09	x	24.49	x	0.63	x	0.7	=	15.64	(76)
East	0.9x	0.77	x	1.34	x	16.15	x	0.63	x	0.7	=	6.61	(76)
East	0.9x	0.77	x	1.34	x	16.15	x	0.63	x	0.7	=	6.61	(76)
East	0.9x	0.77	x	2.09	x	16.15	x	0.63	x	0.7	=	10.32	(76)
Southeast	0.9x	0.77	x	2.09	x	36.79	x	0.63	x	0.7	=	23.5	(77)
Southeast	0.9x	0.77	x	1.34	x	36.79	x	0.63	x	0.7	=	15.07	(77)
Southeast	0.9x	0.77	x	2.09	x	62.67	x	0.63	x	0.7	=	40.03	(77)
Southeast	0.9x	0.77	x	1.34	x	62.67	x	0.63	x	0.7	=	25.67	(77)
Southeast	0.9x	0.77	x	2.09	x	85.75	x	0.63	x	0.7	=	54.77	(77)
Southeast	0.9x	0.77	x	1.34	x	85.75	x	0.63	x	0.7	=	35.12	(77)
Southeast	0.9x	0.77	x	2.09	x	106.25	x	0.63	x	0.7	=	67.87	(77)
Southeast	0.9x	0.77	x	1.34	x	106.25	x	0.63	x	0.7	=	43.51	(77)
Southeast	0.9x	0.77	x	2.09	x	119.01	x	0.63	x	0.7	=	76.02	(77)
Southeast	0.9x	0.77	x	1.34	x	119.01	x	0.63	x	0.7	=	48.74	(77)
Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.63	x	0.7	=	75.47	(77)
Southeast	0.9x	0.77	x	1.34	x	118.15	x	0.63	x	0.7	=	48.38	(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.63	x	0.7	=	72.76	(77)
Southeast	0.9x	0.77	x	1.34	x	113.91	x	0.63	x	0.7	=	46.65	(77)
Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.63	x	0.7	=	66.68	(77)
Southeast	0.9x	0.77	x	1.34	x	104.39	x	0.63	x	0.7	=	42.75	(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.63	x	0.7	=	59.31	(77)
Southeast	0.9x	0.77	x	1.34	x	92.85	x	0.63	x	0.7	=	38.02	(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.63	x	0.7	=	44.24	(77)
Southeast	0.9x	0.77	x	1.34	x	69.27	x	0.63	x	0.7	=	28.37	(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.63	x	0.7	=	28.15	(77)
Southeast	0.9x	0.77	x	1.34	x	44.07	x	0.63	x	0.7	=	18.05	(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.63	x	0.7	=	20.11	(77)
Southeast	0.9x	0.77	x	1.34	x	31.49	x	0.63	x	0.7	=	12.89	(77)
South	0.9x	0.77	x	6.28	x	46.75	x	0.63	x	0.7	=	89.73	(78)
South	0.9x	0.77	x	6.28	x	76.57	x	0.63	x	0.7	=	146.95	(78)
South	0.9x	0.77	x	6.28	x	97.53	x	0.63	x	0.7	=	187.19	(78)
South	0.9x	0.77	x	6.28	x	110.23	x	0.63	x	0.7	=	211.57	(78)
South	0.9x	0.77	x	6.28	x	114.87	x	0.63	x	0.7	=	220.47	(78)
South	0.9x	0.77	x	6.28	x	110.55	x	0.63	x	0.7	=	212.17	(78)

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South	0.9x	0.77	x	6.28	x	108.01	x	0.63	x	0.7	=	207.3	(78)
South	0.9x	0.77	x	6.28	x	104.89	x	0.63	x	0.7	=	201.32	(78)
South	0.9x	0.77	x	6.28	x	101.89	x	0.63	x	0.7	=	195.54	(78)
South	0.9x	0.77	x	6.28	x	82.59	x	0.63	x	0.7	=	158.5	(78)
South	0.9x	0.77	x	6.28	x	55.42	x	0.63	x	0.7	=	106.36	(78)
South	0.9x	0.77	x	6.28	x	40.4	x	0.63	x	0.7	=	77.53	(78)

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

(83)m=	174.35	301.95	425.88	548.32	632.47	635.81	609.71	545.81	468.16	337.2	209.74	148.61	(83)

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

(84)m=	632.5	757.93	866.99	965.34	1024.84	1004.54	963.14	905.52	840.29	733.65	634.16	594.17	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.86	0.7	0.53	0.58	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=	19.64	19.83	20.12	20.47	20.77	20.94	20.99	20.98	20.87	20.48	19.99	19.61	(87)

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

(88)m=	19.85	19.86	19.86	19.87	19.87	19.88	19.88	19.88	19.87	19.87	19.87	19.86	(88)

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

(89)m=	1	0.99	0.97	0.92	0.81	0.6	0.4	0.45	0.73	0.95	0.99	1	(89)

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

(90)m=	18.06	18.34	18.76	19.26	19.65	19.84	19.87	19.87	19.77	19.27	18.57	18.02	(90)

fLA = Living area ÷ (4) = 0.37 (91)

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

(92)m=	18.65	18.9	19.26	19.71	20.06	20.25	20.29	20.28	20.18	19.72	19.1	18.61	(92)

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

(93)m=	18.65	18.9	19.26	19.71	20.06	20.25	20.29	20.28	20.18	19.72	19.1	18.61	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.92	0.82	0.63	0.45	0.5	0.76	0.94	0.99	1	(94)

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

(95)m=	628.77	747.81	839.95	889.23	835.42	634.87	433.01	451.93	637.88	692	626.4	591.5	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1751.37	1704.65	1551.16	1301.2	1004.76	672.48	439.05	461.68	726.22	1095.63	1446.92	1744.06	(97)

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

(98)m=	835.21	643	529.14	296.62	125.99	0	0	0	0	300.3	590.78	857.5	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	4178.54	(98)
Space heating requirement in kWh/m²/year	43.97	(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)	835.21	643	529.14	296.62	125.99	0	0	0	0	300.3	590.78	857.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	893.27	687.7	565.93	317.24	134.75	0	0	0	0	321.18	631.85	917.12	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4469.03 (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)	206.55	181.98	190.96	170.95	167.36	149.3	143.16	157.4	157.23	177.28	187.74	201.5	

Efficiency of water heater 79.8 (216)

(217)m=	88.16	87.9	87.39	86.27	84.07	79.8	79.8	79.8	79.8	86.21	87.67	88.25	(217)

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

(219)m=	234.3	207.03	218.5	198.15	199.07	187.09	179.4	197.25	197.02	205.63	214.16	228.33	

Total = Sum(219a)$_{1...12}$ = 2465.95 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4469.03
Water heating fuel used		2465.95
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		391.78 (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 =	965.31 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	532.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1497.96	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	203.33	(268)
Total CO2, kg/year	sum of (265)…(271) =			1740.21	(272)

TER = 18.31 (273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Level 2 - Apt 3

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.49	(1a) x	2.7	(2a) =	136.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.49	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.32	(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) =	0.15	(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

0.43	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	0.59	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=	0.59	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			1.89	x	1	=	1.89			(26)
Windows Type 1			1.34	x	1/[1/(1.4)+ 0.04]	=	1.78			(27)
Windows Type 2			2.68	x	1/[1/(1.4)+ 0.04]	=	3.55			(27)
Windows Type 3			4.02	x	1/[1/(1.4)+ 0.04]	=	5.33			(27)
Windows Type 4			2.68	x	1/[1/(1.4)+ 0.04]	=	3.55			(27)
Floor			3.66	x	0.13	=	0.4758			(28)
Walls Type1	50.65	10.72	39.93	x	0.18	=	7.19			(29)
Walls Type2	16.79	1.89	14.9	x	0.18	=	2.68			(29)
Total area of elements, m²			71.11							(31)
Party wall			8.96	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.45 (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 7.14 (36)

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

Total fabric heat loss (33) + (36) = 33.59 (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=	26.65	26.49	26.33	25.59	25.45	24.8	24.8	24.68	25.05	25.45	25.73	26.02	(38)

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

(39)m=	60.24	60.08	59.92	59.18	59.04	58.39	58.39	58.27	58.64	59.04	59.32	59.62	

Average = Sum(39)$_{1...12}$ /12= 59.18 (39)

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

(40)m=	1.19	1.19	1.19	1.17	1.17	1.16	1.16	1.15	1.16	1.17	1.17	1.18	

Average = Sum(40)$_{1...12}$ /12= 1.17 (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 1.7 (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 74.68 (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=	82.15	79.16	76.18	73.19	70.2	67.21	67.21	70.2	73.19	76.18	79.16	82.15	

Total = Sum(44)$_{1...12}$ = 896.19 (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=	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.4	85.41	99.53	108.65	117.98	

Total = Sum(45)$_{1...12}$ = 1175.05 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(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=	168.42	148.64	156.55	140.95	138.57	124.46	120.14	130.99	130.5	146.13	153.74	164.58	(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=	168.42	148.64	156.55	140.95	138.57	124.46	120.14	130.99	130.5	146.13	153.74	164.58	

Output from water heater (annual)$_{1...12}$ | 1723.67 | (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=	77.78	69.1	73.83	67.95	67.86	62.46	61.73	65.34	64.47	70.37	72.2	76.51	(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=	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(66)

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

(67)m=	13.27	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

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

(68)m=	148.51	150.05	146.16	137.9	127.46	117.65	111.1	109.56	113.44	121.71	132.15	141.95	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains (Table 5)

(72)m=	104.55	102.82	99.24	94.37	91.21	86.76	82.97	87.82	89.54	94.58	100.28	102.83	(72)

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

(73)m=	317.89	316.22	306.55	291.09	275.66	260.55	250.59	255.38	263.18	278.82	296.78	309.99	(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	2.68	x	10.63	x	0.63	x	0.7	=	8.71	(74)
North	0.9x 0.77	x	2.68	x	20.32	x	0.63	x	0.7	=	16.64	(74)

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North	0.9x	0.77	x	2.68	x	34.53	x	0.63	x	0.7	=	28.28	(74)
North	0.9x	0.77	x	2.68	x	55.46	x	0.63	x	0.7	=	45.43	(74)
North	0.9x	0.77	x	2.68	x	74.72	x	0.63	x	0.7	=	61.2	(74)
North	0.9x	0.77	x	2.68	x	79.99	x	0.63	x	0.7	=	65.51	(74)
North	0.9x	0.77	x	2.68	x	74.68	x	0.63	x	0.7	=	61.16	(74)
North	0.9x	0.77	x	2.68	x	59.25	x	0.63	x	0.7	=	48.53	(74)
North	0.9x	0.77	x	2.68	x	41.52	x	0.63	x	0.7	=	34	(74)
North	0.9x	0.77	x	2.68	x	24.19	x	0.63	x	0.7	=	19.81	(74)
North	0.9x	0.77	x	2.68	x	13.12	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	2.68	x	8.86	x	0.63	x	0.7	=	7.26	(74)
Southwest	0.9x	0.77	x	1.34	x	36.79		0.63	x	0.7	=	15.07	(79)
Southwest	0.9x	0.77	x	2.68	x	36.79		0.63	x	0.7	=	30.14	(79)
Southwest	0.9x	0.77	x	1.34	x	62.67		0.63	x	0.7	=	25.67	(79)
Southwest	0.9x	0.77	x	2.68	x	62.67		0.63	x	0.7	=	51.33	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.63	x	0.7	=	35.12	(79)
Southwest	0.9x	0.77	x	2.68	x	85.75		0.63	x	0.7	=	70.24	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.63	x	0.7	=	43.51	(79)
Southwest	0.9x	0.77	x	2.68	x	106.25		0.63	x	0.7	=	87.02	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.63	x	0.7	=	48.74	(79)
Southwest	0.9x	0.77	x	2.68	x	119.01		0.63	x	0.7	=	97.47	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.63	x	0.7	=	48.38	(79)
Southwest	0.9x	0.77	x	2.68	x	118.15		0.63	x	0.7	=	96.77	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.63	x	0.7	=	46.65	(79)
Southwest	0.9x	0.77	x	2.68	x	113.91		0.63	x	0.7	=	93.3	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.63	x	0.7	=	42.75	(79)
Southwest	0.9x	0.77	x	2.68	x	104.39		0.63	x	0.7	=	85.5	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.63	x	0.7	=	38.02	(79)
Southwest	0.9x	0.77	x	2.68	x	92.85		0.63	x	0.7	=	76.05	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.63	x	0.7	=	28.37	(79)
Southwest	0.9x	0.77	x	2.68	x	69.27		0.63	x	0.7	=	56.73	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.63	x	0.7	=	18.05	(79)
Southwest	0.9x	0.77	x	2.68	x	44.07		0.63	x	0.7	=	36.1	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.63	x	0.7	=	12.89	(79)
Southwest	0.9x	0.77	x	2.68	x	31.49		0.63	x	0.7	=	25.79	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)
West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23	(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41	(80)

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West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32	(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41	(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01	(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09	(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84	(80)

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

(83)m=	78.04	140.84	211.37	289.34	346.35	352.9	336.52	293.09	238.49	160.92	94.97	65.79	(83)

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

(84)m=	395.93	457.07	517.92	580.43	622.01	613.45	587.11	548.47	501.67	439.74	391.75	375.77	(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	0.97	0.91	0.78	0.59	0.43	0.48	0.73	0.94	0.99	0.99	(86)

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

(87)m=	19.87	20.05	20.32	20.65	20.88	20.98	21	20.99	20.93	20.63	20.19	19.84	(87)

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

(88)m=	19.93	19.93	19.93	19.94	19.94	19.95	19.95	19.96	19.95	19.94	19.94	19.94	(88)

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

(89)m=	0.99	0.98	0.96	0.88	0.72	0.5	0.33	0.38	0.65	0.91	0.98	0.99	(89)

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

(90)m=	18.44	18.7	19.09	19.55	19.83	19.94	19.95	19.95	19.9	19.53	18.92	18.41	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.12	19.34	19.67	20.07	20.33	20.43	20.45	20.45	20.39	20.05	19.52	19.08	(92)

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

(93)m=	19.12	19.34	19.67	20.07	20.33	20.43	20.45	20.45	20.39	20.05	19.52	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

	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	0.88	0.74	0.54	0.38	0.43	0.69	0.91	0.98	0.99	(94)

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

(95)m=	391.73	447.42	493.29	511.39	460.14	332.23	223.45	233.76	343.74	402	383.46	372.6	(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=	892.59	867.35	789.31	660.99	509.34	340.43	224.59	235.73	368.76	557.95	736.67	887.26	(97)

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

(98)m=	372.65	282.19	220.24	107.71	36.61	0	0	0	0	116.03	254.31	382.91	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1772.64 (98)

Space heating requirement in kWh/m²/year 35.11 (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)												
372.65	282.19	220.24	107.71	36.61	0	0	0	0	116.03	254.31	382.91	

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

398.55	301.81	235.55	115.2	39.15	0	0	0	0	124.09	271.99	409.53	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1895.87 (211)

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

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

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

Water heating

Output from water heater (calculated above)

168.42	148.64	156.55	140.95	138.57	124.46	120.14	130.99	130.5	146.13	153.74	164.58	

Efficiency of water heater 79.8 (216)

(217)m=	86.87	86.5	85.72	84.11	81.82	79.8	79.8	79.8	79.8	84.21	86.15	86.99	(217)

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

(219)m=	193.87	171.84	182.62	167.58	169.36	155.97	150.56	164.15	163.53	173.53	178.46	189.18	

Total = Sum(219a)$_{1...12}$ = 2060.65 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1895.87
Water heating fuel used		2060.65
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		234.28 (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 =	409.51 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	445.1 (264)
Space and water heating	(261) + (262) + (263) + (264) =		854.61 (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	=	121.59	(268)
Total CO2, kg/year			sum of (265)…(271) =		1015.13	(272)

TER = 20.11 (273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Level 2 - Apt 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.58	(1a) x	2.7	(2a) =	190.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		190.57	(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) =	0.16 (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)			0.41 (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) =			0.35 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	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	0.58	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			1.89	x	1	=	1.89			(26)
Windows Type 1			3.94	x	1/[1/(1.4)+ 0.04]	=	5.22			(27)
Windows Type 2			3.94	x	1/[1/(1.4)+ 0.04]	=	5.22			(27)
Windows Type 3			1.97	x	1/[1/(1.4)+ 0.04]	=	2.61			(27)
Windows Type 4			5.91	x	1/[1/(1.4)+ 0.04]	=	7.84			(27)
Walls Type1	46.14	15.76	30.38	x	0.18	=	5.47			(29)
Walls Type2	18.71	1.89	16.82	x	0.18	=	3.03			(29)
Total area of elements, m²			64.85							(31)
Party wall			25.6	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.28 (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 5.8 (36)

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

Total fabric heat loss (33) + (36) = 37.08 (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=	37.57	37.34	37.1	36.01	35.8	34.85	34.85	34.67	35.21	35.8	36.22	36.65	(38)

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

(39)m=	74.66	74.42	74.19	73.09	72.88	71.93	71.93	71.75	72.3	72.88	73.3	73.73	

Average = Sum(39)$_{1...12}$ /12= 73.09 (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=	1.06	1.05	1.05	1.04	1.03	1.02	1.02	1.02	1.02	1.03	1.04	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.04 (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 2.26 (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 87.88 (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=	96.67	93.15	89.64	86.12	82.61	79.09	79.09	82.61	86.12	89.64	93.15	96.67	

Total = Sum(44)$_{1...12}$ = 1054.54 (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=	143.35	125.38	129.38	112.79	108.23	93.39	86.54	99.31	100.5	117.12	127.84	138.83	

Total = Sum(45)$_{1...12}$ = 1382.66 (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=	21.5	18.81	19.41	16.92	16.23	14.01	12.98	14.9	15.07	17.57	19.18	20.82	(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=	189.95	167.46	175.97	157.89	154.82	138.49	133.14	145.9	145.59	163.71	172.93	185.42	(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=	189.95	167.46	175.97	157.89	154.82	138.49	133.14	145.9	145.59	163.71	172.93	185.42	

Output from water heater (annual)$_{1...12}$ 1931.28 (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=	84.94	75.36	80.29	73.58	73.26	67.13	66.05	70.3	69.49	76.22	78.58	83.44	(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=	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	(66)

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

(67)m=	17.71	15.73	12.79	9.68	7.24	6.11	6.6	8.58	11.52	14.63	17.07	18.2	(67)

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

(68)m=	198.65	200.71	195.51	184.46	170.5	157.38	148.61	146.55	151.74	162.8	176.76	189.88	(68)

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

(69)m=	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	(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=	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	(71)

Water heating gains (Table 5)

(72)m=	114.17	112.14	107.92	102.19	98.47	93.23	88.78	94.48	96.51	102.44	109.14	112.15	(72)

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

(73)m=	390.43	388.48	376.13	356.23	336.11	316.62	303.9	309.52	319.68	339.78	362.88	380.13	(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)	
Southeast 0.9x	0.77	x	1.97	x	36.79	x	0.63	x	0.7	=	22.15	(77)
Southeast 0.9x	0.77	x	1.97	x	62.67	x	0.63	x	0.7	=	37.73	(77)
Southeast 0.9x	0.77	x	1.97	x	85.75	x	0.63	x	0.7	=	51.63	(77)
Southeast 0.9x	0.77	x	1.97	x	106.25	x	0.63	x	0.7	=	63.97	(77)
Southeast 0.9x	0.77	x	1.97	x	119.01	x	0.63	x	0.7	=	71.65	(77)

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Southeast	0.9x	0.77	x	1.97	x	118.15	x	0.63	x	0.7	=	71.13	(77)
Southeast	0.9x	0.77	x	1.97	x	113.91	x	0.63	x	0.7	=	68.58	(77)
Southeast	0.9x	0.77	x	1.97	x	104.39	x	0.63	x	0.7	=	62.85	(77)
Southeast	0.9x	0.77	x	1.97	x	92.85	x	0.63	x	0.7	=	55.9	(77)
Southeast	0.9x	0.77	x	1.97	x	69.27	x	0.63	x	0.7	=	41.7	(77)
Southeast	0.9x	0.77	x	1.97	x	44.07	x	0.63	x	0.7	=	26.53	(77)
Southeast	0.9x	0.77	x	1.97	x	31.49	x	0.63	x	0.7	=	18.96	(77)
South	0.9x	0.77	x	5.91	x	46.75	x	0.63	x	0.7	=	84.44	(78)
South	0.9x	0.77	x	5.91	x	76.57	x	0.63	x	0.7	=	138.29	(78)
South	0.9x	0.77	x	5.91	x	97.53	x	0.63	x	0.7	=	176.16	(78)
South	0.9x	0.77	x	5.91	x	110.23	x	0.63	x	0.7	=	199.1	(78)
South	0.9x	0.77	x	5.91	x	114.87	x	0.63	x	0.7	=	207.48	(78)
South	0.9x	0.77	x	5.91	x	110.55	x	0.63	x	0.7	=	199.67	(78)
South	0.9x	0.77	x	5.91	x	108.01	x	0.63	x	0.7	=	195.09	(78)
South	0.9x	0.77	x	5.91	x	104.89	x	0.63	x	0.7	=	189.46	(78)
South	0.9x	0.77	x	5.91	x	101.89	x	0.63	x	0.7	=	184.02	(78)
South	0.9x	0.77	x	5.91	x	82.59	x	0.63	x	0.7	=	149.16	(78)
South	0.9x	0.77	x	5.91	x	55.42	x	0.63	x	0.7	=	100.09	(78)
South	0.9x	0.77	x	5.91	x	40.4	x	0.63	x	0.7	=	72.97	(78)
Southwest	0.9x	0.77	x	3.94	x	36.79	x	0.63	x	0.7	=	44.3	(79)
Southwest	0.9x	0.77	x	3.94	x	36.79	x	0.63	x	0.7	=	44.3	(79)
Southwest	0.9x	0.77	x	3.94	x	62.67	x	0.63	x	0.7	=	75.47	(79)
Southwest	0.9x	0.77	x	3.94	x	62.67	x	0.63	x	0.7	=	75.47	(79)
Southwest	0.9x	0.77	x	3.94	x	85.75	x	0.63	x	0.7	=	103.26	(79)
Southwest	0.9x	0.77	x	3.94	x	85.75	x	0.63	x	0.7	=	103.26	(79)
Southwest	0.9x	0.77	x	3.94	x	106.25	x	0.63	x	0.7	=	127.94	(79)
Southwest	0.9x	0.77	x	3.94	x	106.25	x	0.63	x	0.7	=	127.94	(79)
Southwest	0.9x	0.77	x	3.94	x	119.01	x	0.63	x	0.7	=	143.3	(79)
Southwest	0.9x	0.77	x	3.94	x	119.01	x	0.63	x	0.7	=	143.3	(79)
Southwest	0.9x	0.77	x	3.94	x	118.15	x	0.63	x	0.7	=	142.27	(79)
Southwest	0.9x	0.77	x	3.94	x	118.15	x	0.63	x	0.7	=	142.27	(79)
Southwest	0.9x	0.77	x	3.94	x	113.91	x	0.63	x	0.7	=	137.16	(79)
Southwest	0.9x	0.77	x	3.94	x	113.91	x	0.63	x	0.7	=	137.16	(79)
Southwest	0.9x	0.77	x	3.94	x	104.39	x	0.63	x	0.7	=	125.7	(79)
Southwest	0.9x	0.77	x	3.94	x	104.39	x	0.63	x	0.7	=	125.7	(79)
Southwest	0.9x	0.77	x	3.94	x	92.85	x	0.63	x	0.7	=	111.8	(79)
Southwest	0.9x	0.77	x	3.94	x	92.85	x	0.63	x	0.7	=	111.8	(79)
Southwest	0.9x	0.77	x	3.94	x	69.27	x	0.63	x	0.7	=	83.41	(79)
Southwest	0.9x	0.77	x	3.94	x	69.27	x	0.63	x	0.7	=	83.41	(79)
Southwest	0.9x	0.77	x	3.94	x	44.07	x	0.63	x	0.7	=	53.07	(79)
Southwest	0.9x	0.77	x	3.94	x	44.07	x	0.63	x	0.7	=	53.07	(79)

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Southwest 0.9x	0.77	x	3.94	x	31.49	0.63	x	0.7	=	37.91	(79)
Southwest 0.9x	0.77	x	3.94	x	31.49	0.63	x	0.7	=	37.91	(79)

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

(83)m=	195.2	326.96	434.3	518.95	565.73	555.33	537.99	503.7	463.53	357.68	232.76	167.75	(83)

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

(84)m=	585.63	715.44	810.43	875.18	901.84	871.96	841.88	813.22	783.21	697.46	595.64	547.88	(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	0.94	0.85	0.71	0.52	0.37	0.4	0.62	0.88	0.98	0.99	(86)

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

(87)m=	20.1	20.32	20.57	20.81	20.94	20.99	21	21	20.98	20.8	20.41	20.06	(87)

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

(88)m=	20.04	20.04	20.04	20.05	20.06	20.07	20.07	20.07	20.06	20.06	20.05	20.05	(88)

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

(89)m=	0.99	0.97	0.92	0.81	0.65	0.45	0.3	0.32	0.54	0.84	0.97	0.99	(89)

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

(90)m=	18.85	19.18	19.53	19.85	20.01	20.06	20.07	20.07	20.05	19.85	19.31	18.8	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	19.37	19.65	19.96	20.25	20.39	20.45	20.45	20.45	20.43	20.24	19.76	19.32	(92)

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

(93)m=	19.37	19.65	19.96	20.25	20.39	20.45	20.45	20.45	20.43	20.24	19.76	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	0.96	0.92	0.82	0.67	0.48	0.33	0.36	0.57	0.85	0.97	0.99	(94)

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

(95)m=	577.1	688.92	743.36	719.2	603.34	416.63	276.66	290.17	447.7	592.16	575.54	541.95	(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=	1124.89	1097.57	998.31	829.23	633.61	420.49	277.06	290.78	457.82	702.91	928.23	1114.96	(97)

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

(98)m=	407.56	274.61	189.68	79.22	22.52	0	0	0	0	82.4	253.94	426.32	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1736.25 (98)

Space heating requirement in kWh/m²/year 24.6 (99)

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

Space heating:

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

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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)	407.56	274.61	189.68	79.22	22.52	0	0	0	0	82.4	253.94	426.32	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	435.89	293.7	202.87	84.73	24.09	0	0	0	0	88.12	271.59	455.96	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1856.96 (211)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

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

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	189.95	167.46	175.97	157.89	154.82	138.49	133.14	145.9	145.59	163.71	172.93	185.42	
Efficiency of water heater													79.8 (216)
(217)m=	86.8	86.13	85.01	83.08	81.02	79.8	79.8	79.8	79.8	83.09	85.84	86.97	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	218.83	194.44	206.99	190.04	191.1	173.54	166.84	182.84	182.44	197.03	201.47	213.22	

Total = Sum(219a)$_{1...12}$ = 2318.78 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1856.96
Water heating fuel used		2318.78
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		312.75 (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	=	401.1	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	500.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				901.96	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	162.32	(268)

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Total CO2, kg/year	sum of (265)…(271) =	1103.2	(272)
TER =		15.63	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Level 2 - Apt 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.96	(1a) x	2.7	(2a) =	140.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		140.29	(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			1.89	x	1	=	1.89			(26)
Windows Type 1			3.17	x	1/[1/(1.4)+ 0.04]	=	4.2			(27)
Windows Type 2			1.58	x	1/[1/(1.4)+ 0.04]	=	2.09			(27)
Windows Type 3			4.76	x	1/[1/(1.4)+ 0.04]	=	6.31			(27)
Windows Type 4			1.58	x	1/[1/(1.4)+ 0.04]	=	2.09			(27)
Walls Type1	44.06	11.09	32.97	x	0.18	=	5.94			(29)
Walls Type2	4.02	1.89	2.13	x	0.18	=	0.38			(29)
Walls Type3	11.88	0	11.88	x	0.18	=	2.14			(29)
Total area of elements, m²			59.97							(31)
Party wall			16.5	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.05 (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 5.89 (36)

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

Total fabric heat loss (33) + (36) = 30.94 (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=	27.34	27.18	27.02	26.27	26.13	25.47	25.47	25.35	25.73	26.13	26.41	26.71	(38)

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

(39)m=	58.27	58.11	57.95	57.2	57.06	56.41	56.41	56.29	56.66	57.06	57.35	57.64	

Average = Sum(39)$_{1...12}$ /12= 57.2 (39)

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

(40)m=	1.12	1.12	1.12	1.1	1.1	1.09	1.09	1.08	1.09	1.1	1.1	1.11	

Average = Sum(40)$_{1...12}$ /12= 1.1 (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 1.75 (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 75.71 (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=	83.28	80.26	77.23	74.2	71.17	68.14	68.14	71.17	74.2	77.23	80.26	83.28	

Total = Sum(44)$_{1...12}$ = 908.55 (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=	123.51	108.02	111.47	97.18	93.25	80.46	74.56	85.56	86.58	100.9	110.14	119.61	

Total = Sum(45)$_{1...12}$ = 1191.25 (45)

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

(46)m=	18.53	16.2	16.72	14.58	13.99	12.07	11.18	12.83	12.99	15.14	16.52	17.94	(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=	170.1	150.11	158.06	142.27	139.84	125.56	121.16	132.16	131.67	147.5	155.24	166.21	(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=	170.1	150.11	158.06	142.27	139.84	125.56	121.16	132.16	131.67	147.5	155.24	166.21	

Output from water heater (annual)$_{1...12}$ | 1739.87 | (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=	78.34	69.59	74.34	68.39	68.28	62.83	62.07	65.73	64.86	70.83	72.7	77.05	(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=	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	(66)

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

(67)m=	13.6	12.08	9.83	7.44	5.56	4.69	5.07	6.59	8.85	11.24	13.11	13.98	(67)

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

(68)m=	152.32	153.9	149.92	141.44	130.74	120.68	113.95	112.37	116.36	124.84	135.54	145.6	(68)

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

(69)m=	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	(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=	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	(71)

Water heating gains (Table 5)

(72)m=	105.3	103.55	99.92	94.98	91.77	87.26	83.42	88.34	90.09	95.2	100.97	103.56	(72)

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

(73)m=	323.44	321.75	311.88	296.08	280.29	264.85	254.67	259.53	267.51	283.49	301.84	315.36	(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	3.17	x	10.63	x	0.63	x	0.7	=	10.3	(74)
North	0.9x 0.77	x	3.17	x	20.32	x	0.63	x	0.7	=	19.69	(74)

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North	0.9x	0.77	x	3.17	x	34.53	x	0.63	x	0.7	=	33.45	(74)
North	0.9x	0.77	x	3.17	x	55.46	x	0.63	x	0.7	=	53.73	(74)
North	0.9x	0.77	x	3.17	x	74.72	x	0.63	x	0.7	=	72.38	(74)
North	0.9x	0.77	x	3.17	x	79.99	x	0.63	x	0.7	=	77.49	(74)
North	0.9x	0.77	x	3.17	x	74.68	x	0.63	x	0.7	=	72.35	(74)
North	0.9x	0.77	x	3.17	x	59.25	x	0.63	x	0.7	=	57.4	(74)
North	0.9x	0.77	x	3.17	x	41.52	x	0.63	x	0.7	=	40.22	(74)
North	0.9x	0.77	x	3.17	x	24.19	x	0.63	x	0.7	=	23.43	(74)
North	0.9x	0.77	x	3.17	x	13.12	x	0.63	x	0.7	=	12.71	(74)
North	0.9x	0.77	x	3.17	x	8.86	x	0.63	x	0.7	=	8.59	(74)
Northeast	0.9x	0.77	x	4.76	x	11.28	x	0.63	x	0.7	=	16.41	(75)
Northeast	0.9x	0.77	x	4.76	x	22.97	x	0.63	x	0.7	=	33.41	(75)
Northeast	0.9x	0.77	x	4.76	x	41.38	x	0.63	x	0.7	=	60.19	(75)
Northeast	0.9x	0.77	x	4.76	x	67.96	x	0.63	x	0.7	=	98.86	(75)
Northeast	0.9x	0.77	x	4.76	x	91.35	x	0.63	x	0.7	=	132.88	(75)
Northeast	0.9x	0.77	x	4.76	x	97.38	x	0.63	x	0.7	=	141.67	(75)
Northeast	0.9x	0.77	x	4.76	x	91.1	x	0.63	x	0.7	=	132.53	(75)
Northeast	0.9x	0.77	x	4.76	x	72.63	x	0.63	x	0.7	=	105.65	(75)
Northeast	0.9x	0.77	x	4.76	x	50.42	x	0.63	x	0.7	=	73.35	(75)
Northeast	0.9x	0.77	x	4.76	x	28.07	x	0.63	x	0.7	=	40.83	(75)
Northeast	0.9x	0.77	x	4.76	x	14.2	x	0.63	x	0.7	=	20.65	(75)
Northeast	0.9x	0.77	x	4.76	x	9.21	x	0.63	x	0.7	=	13.4	(75)
East	0.9x	0.77	x	1.58	x	19.64	x	0.63	x	0.7	=	9.48	(76)
East	0.9x	0.77	x	1.58	x	38.42	x	0.63	x	0.7	=	18.55	(76)
East	0.9x	0.77	x	1.58	x	63.27	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	1.58	x	92.28	x	0.63	x	0.7	=	44.56	(76)
East	0.9x	0.77	x	1.58	x	113.09	x	0.63	x	0.7	=	54.61	(76)
East	0.9x	0.77	x	1.58	x	115.77	x	0.63	x	0.7	=	55.9	(76)
East	0.9x	0.77	x	1.58	x	110.22	x	0.63	x	0.7	=	53.22	(76)
East	0.9x	0.77	x	1.58	x	94.68	x	0.63	x	0.7	=	45.72	(76)
East	0.9x	0.77	x	1.58	x	73.59	x	0.63	x	0.7	=	35.53	(76)
East	0.9x	0.77	x	1.58	x	45.59	x	0.63	x	0.7	=	22.01	(76)
East	0.9x	0.77	x	1.58	x	24.49	x	0.63	x	0.7	=	11.83	(76)
East	0.9x	0.77	x	1.58	x	16.15	x	0.63	x	0.7	=	7.8	(76)
Southeast	0.9x	0.77	x	1.58	x	36.79	x	0.63	x	0.7	=	17.77	(77)
Southeast	0.9x	0.77	x	1.58	x	62.67	x	0.63	x	0.7	=	30.26	(77)
Southeast	0.9x	0.77	x	1.58	x	85.75	x	0.63	x	0.7	=	41.41	(77)
Southeast	0.9x	0.77	x	1.58	x	106.25	x	0.63	x	0.7	=	51.31	(77)
Southeast	0.9x	0.77	x	1.58	x	119.01	x	0.63	x	0.7	=	57.47	(77)
Southeast	0.9x	0.77	x	1.58	x	118.15	x	0.63	x	0.7	=	57.05	(77)
Southeast	0.9x	0.77	x	1.58	x	113.91	x	0.63	x	0.7	=	55	(77)

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Southeast 0.9x	0.77	x	1.58	x	104.39	x	0.63	x	0.7	=	50.41	(77)
Southeast 0.9x	0.77	x	1.58	x	92.85	x	0.63	x	0.7	=	44.84	(77)
Southeast 0.9x	0.77	x	1.58	x	69.27	x	0.63	x	0.7	=	33.45	(77)
Southeast 0.9x	0.77	x	1.58	x	44.07	x	0.63	x	0.7	=	21.28	(77)
Southeast 0.9x	0.77	x	1.58	x	31.49	x	0.63	x	0.7	=	15.2	(77)

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

(83)m=	53.97	101.91	165.61	248.45	317.34	332.11	313.1	259.17	193.94	119.73	66.47	45	(83)

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

(84)m=	377.41	423.66	477.49	544.53	597.63	596.96	567.77	518.7	461.45	403.21	368.31	360.35	(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	0.59	0.43	0.49	0.76	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	20.32	20.65	20.89	20.98	21	20.99	20.93	20.62	20.21	19.89	(87)

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

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

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

(89)m=	0.99	0.99	0.97	0.9	0.73	0.5	0.34	0.39	0.68	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=	18.55	18.77	19.14	19.61	19.9	20	20.01	20.01	19.96	19.57	18.99	18.52	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.18	19.36	19.68	20.09	20.36	20.45	20.47	20.47	20.41	20.06	19.56	19.15	(92)

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

(93)m=	19.18	19.36	19.68	20.09	20.36	20.45	20.47	20.47	20.41	20.06	19.56	19.15	(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	0.9	0.75	0.54	0.38	0.44	0.72	0.93	0.98	0.99	(94)

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

(95)m=	374.4	417.36	460.65	489.21	448.26	323.51	217.26	227.15	330.87	376.56	362.5	358.04	(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=	867.13	840.58	764	640.11	493.98	330.21	218.13	228.87	357.29	539.61	714.33	862	(97)

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

(98)m=	366.6	284.4	225.69	108.65	34.01	0	0	0	0	121.31	253.32	374.95	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1768.93 (98)

Space heating requirement in kWh/m²/year 34.04 (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)	366.6	284.4	225.69	108.65	34.01	0	0	0	0	121.31	253.32	374.95	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	392.08	304.17	241.38	116.2	36.38	0	0	0	0	129.74	270.93	401.01	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1891.9 (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)	170.1	150.11	158.06	142.27	139.84	125.56	121.16	132.16	131.67	147.5	155.24	166.21	
Efficiency of water heater													79.8 (216)
(217)m=	86.81	86.49	85.76	84.11	81.69	79.8	79.8	79.8	79.8	84.3	86.11	86.92	(217)

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

(219)m=	195.95	173.55	184.3	169.16	171.19	157.34	151.83	165.61	165.01	174.97	180.27	191.22	

Total = Sum(219a)$_{1...12}$ = 2080.38 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1891.9
Water heating fuel used		2080.38
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		240.23 (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 =	408.65 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	449.36 (264)
Space and water heating	(261) + (262) + (263) + (264) =		858.01 (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	=	124.68	(268)
Total CO2, kg/year			sum of (265)…(271) =		1021.62	(272)

TER = 19.66 (273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Level 3 - Apt 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.49	(1a) x	2.7	(2a) =	136.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.49	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.32	(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) =	0.15	(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

0.43	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	0.59	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=	0.59	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			1.89	x	1	=	1.89			(26)
Windows Type 1			1.34	x	1/[1/(1.4)+ 0.04]	=	1.78			(27)
Windows Type 2			2.68	x	1/[1/(1.4)+ 0.04]	=	3.55			(27)
Windows Type 3			4.02	x	1/[1/(1.4)+ 0.04]	=	5.33			(27)
Windows Type 4			2.68	x	1/[1/(1.4)+ 0.04]	=	3.55			(27)
Walls Type1	50.65	10.72	39.93	x	0.18	=	7.19			(29)
Walls Type2	16.79	1.89	14.9	x	0.18	=	2.68			(29)
Total area of elements, m²			67.45							(31)
Party wall			17.93	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.97 (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 6.19 (36)

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

Total fabric heat loss (33) + (36) = 32.16 (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=	26.65	26.49	26.33	25.59	25.45	24.8	24.8	24.68	25.05	25.45	25.73	26.02	(38)

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

(39)m=	58.81	58.65	58.49	57.75	57.61	56.96	56.96	56.84	57.21	57.61	57.89	58.18	

Average = Sum(39)$_{1...12}$ /12= 57.75 (39)

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

(40)m=	1.16	1.16	1.16	1.14	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15

Average = Sum(40)$_{1...12}$ /12= 1.14 (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 1.7 (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 74.68 (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=	82.15	79.16	76.18	73.19	70.2	67.21	67.21	70.2	73.19	76.18	79.16	82.15

Total = Sum(44)$_{1...12}$ = 896.19 (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=	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.4	85.41	99.53	108.65	117.98

Total = Sum(45)$_{1...12}$ = 1175.05 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7

(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=	168.42	148.64	156.55	140.95	138.57	124.46	120.14	130.99	130.5	146.13	153.74	164.58	(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=	168.42	148.64	156.55	140.95	138.57	124.46	120.14	130.99	130.5	146.13	153.74	164.58	

Output from water heater (annual)$_{1...12}$ 1723.67 (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=	77.78	69.1	73.83	67.95	67.86	62.46	61.73	65.34	64.47	70.37	72.2	76.51	(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=	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(66)

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

(67)m=	13.27	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

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

(68)m=	148.51	150.05	146.16	137.9	127.46	117.65	111.1	109.56	113.44	121.71	132.15	141.95	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains (Table 5)

(72)m=	104.55	102.82	99.24	94.37	91.21	86.76	82.97	87.82	89.54	94.58	100.28	102.83	(72)

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

(73)m=	317.89	316.22	306.55	291.09	275.66	260.55	250.59	255.38	263.18	278.82	296.78	309.99	(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	2.68	x	10.63	x	0.63	x	0.7	=	8.71	(74)
North	0.9x 0.77	x	2.68	x	20.32	x	0.63	x	0.7	=	16.64	(74)
North	0.9x 0.77	x	2.68	x	34.53	x	0.63	x	0.7	=	28.28	(74)
North	0.9x 0.77	x	2.68	x	55.46	x	0.63	x	0.7	=	45.43	(74)
North	0.9x 0.77	x	2.68	x	74.72	x	0.63	x	0.7	=	61.2	(74)

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North	0.9x	0.77	x	2.68	x	79.99	x	0.63	x	0.7	=	65.51	(74)
North	0.9x	0.77	x	2.68	x	74.68	x	0.63	x	0.7	=	61.16	(74)
North	0.9x	0.77	x	2.68	x	59.25	x	0.63	x	0.7	=	48.53	(74)
North	0.9x	0.77	x	2.68	x	41.52	x	0.63	x	0.7	=	34	(74)
North	0.9x	0.77	x	2.68	x	24.19	x	0.63	x	0.7	=	19.81	(74)
North	0.9x	0.77	x	2.68	x	13.12	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	2.68	x	8.86	x	0.63	x	0.7	=	7.26	(74)
Southwest	0.9x	0.77	x	1.34	x	36.79		0.63	x	0.7	=	15.07	(79)
Southwest	0.9x	0.77	x	2.68	x	36.79		0.63	x	0.7	=	30.14	(79)
Southwest	0.9x	0.77	x	1.34	x	62.67		0.63	x	0.7	=	25.67	(79)
Southwest	0.9x	0.77	x	2.68	x	62.67		0.63	x	0.7	=	51.33	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.63	x	0.7	=	35.12	(79)
Southwest	0.9x	0.77	x	2.68	x	85.75		0.63	x	0.7	=	70.24	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.63	x	0.7	=	43.51	(79)
Southwest	0.9x	0.77	x	2.68	x	106.25		0.63	x	0.7	=	87.02	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.63	x	0.7	=	48.74	(79)
Southwest	0.9x	0.77	x	2.68	x	119.01		0.63	x	0.7	=	97.47	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.63	x	0.7	=	48.38	(79)
Southwest	0.9x	0.77	x	2.68	x	118.15		0.63	x	0.7	=	96.77	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.63	x	0.7	=	46.65	(79)
Southwest	0.9x	0.77	x	2.68	x	113.91		0.63	x	0.7	=	93.3	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.63	x	0.7	=	42.75	(79)
Southwest	0.9x	0.77	x	2.68	x	104.39		0.63	x	0.7	=	85.5	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.63	x	0.7	=	38.02	(79)
Southwest	0.9x	0.77	x	2.68	x	92.85		0.63	x	0.7	=	76.05	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.63	x	0.7	=	28.37	(79)
Southwest	0.9x	0.77	x	2.68	x	69.27		0.63	x	0.7	=	56.73	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.63	x	0.7	=	18.05	(79)
Southwest	0.9x	0.77	x	2.68	x	44.07		0.63	x	0.7	=	36.1	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.63	x	0.7	=	12.89	(79)
Southwest	0.9x	0.77	x	2.68	x	31.49		0.63	x	0.7	=	25.79	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)
West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23	(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41	(80)
West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32	(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41	(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01	(80)

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West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09	(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84	(80)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	78.04	140.84	211.37	289.34	346.35	352.9	336.52	293.09	238.49	160.92	94.97	65.79	(83)

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

(84)m=	395.93	457.07	517.92	580.43	622.01	613.45	587.11	548.47	501.67	439.74	391.75	375.77	(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	0.97	0.9	0.77	0.58	0.42	0.47	0.72	0.93	0.99	0.99	(86)

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

(87)m=	19.91	20.08	20.35	20.67	20.89	20.98	21	20.99	20.94	20.65	20.22	19.88	(87)

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

(88)m=	19.95	19.95	19.95	19.97	19.97	19.98	19.98	19.98	19.97	19.97	19.96	19.96	(88)

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

(89)m=	0.99	0.98	0.95	0.87	0.71	0.49	0.33	0.37	0.64	0.91	0.98	0.99	(89)

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

(90)m=	18.51	18.77	19.16	19.6	19.87	19.97	19.98	19.98	19.93	19.58	18.98	18.48	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.17	19.39	19.72	20.11	20.35	20.45	20.46	20.46	20.41	20.09	19.57	19.14	(92)

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

(93)m=	19.17	19.39	19.72	20.11	20.35	20.45	20.46	20.46	20.41	20.09	19.57	19.14	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.88	0.73	0.53	0.37	0.42	0.68	0.91	0.98	0.99	(94)

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

(95)m=	391.69	447.24	492.56	508.81	454.7	326.05	218.89	229.07	338.95	400.66	383.3	372.58	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	874.7	849.92	773.4	647.3	498.44	332.95	219.81	230.68	360.87	546.57	721.74	869.26	(97)

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

(98)m=	359.36	270.6	208.95	99.71	32.54	0	0	0	0	108.56	243.68	369.53	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1692.93 (98)

Space heating requirement in kWh/m²/year 33.53 (99)

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

Space heating:

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

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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)	359.36	270.6	208.95	99.71	32.54	0	0	0	0	108.56	243.68	369.53	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	384.34	289.42	223.47	106.64	34.8	0	0	0	0	116.1	260.62	395.22	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1810.62 (211)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

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

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	168.42	148.64	156.55	140.95	138.57	124.46	120.14	130.99	130.5	146.13	153.74	164.58	
Efficiency of water heater													79.8 (216)
(217)m=	86.79	86.39	85.58	83.91	81.64	79.8	79.8	79.8	79.8	84.03	86.04	86.91	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	194.07	172.05	182.91	167.98	169.75	155.97	150.56	164.15	163.53	173.89	178.69	189.37	

Total = Sum(219a)$_{1...12}$ = 2062.9 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1810.62
Water heating fuel used		2062.9
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		234.28 (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	=	391.09	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	445.59	(264)
Space and water heating	(261) + (262) + (263) + (264) =				836.68	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	121.59	(268)

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Total CO2, kg/year	sum of (265)…(271) =	997.2	(272)
TER =		19.75	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Level 8 - Apt 21

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.49	(1a) x	2.7	(2a) =	136.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.49	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.32	(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) =	0.15	(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

0.43	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	0.59	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=	0.59	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			1.89	x	1	=	1.89			(26)
Windows Type 1			1.34	x	1/[1/(1.4)+ 0.04]	=	1.78			(27)
Windows Type 2			2.68	x	1/[1/(1.4)+ 0.04]	=	3.55			(27)
Windows Type 3			4.02	x	1/[1/(1.4)+ 0.04]	=	5.33			(27)
Windows Type 4			2.68	x	1/[1/(1.4)+ 0.04]	=	3.55			(27)
Walls Type1	50.65	10.72	39.93	x	0.18	=	7.19			(29)
Walls Type2	16.79	1.89	14.9	x	0.18	=	2.68			(29)
Roof	50.49	0	50.49	x	0.13	=	6.56			(30)
Total area of elements, m²			117.94							(31)
Party wall			17.93	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 454.41 (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 6.84 (36)

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

Total fabric heat loss (33) + (36) = 39.37 (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

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(38)m=	26.65	26.49	26.33	25.59	25.45	24.8	24.8	24.68	25.05	25.45	25.73	26.02	(38)

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

(39)m=	66.02	65.86	65.7	64.96	64.82	64.17	64.17	64.05	64.42	64.82	65.1	65.4	

Average = Sum(39)$_{1...12}$ /12= 64.96 (39)

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

(40)m=	1.31	1.3	1.3	1.29	1.28	1.27	1.27	1.27	1.28	1.28	1.29	1.3	

Average = Sum(40)$_{1...12}$ /12= 1.29 (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 1.7 (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 74.68 (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=	82.15	79.16	76.18	73.19	70.2	67.21	67.21	70.2	73.19	76.18	79.16	82.15	

Total = Sum(44)$_{1...12}$ = 896.19 (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=	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.4	85.41	99.53	108.65	117.98	

Total = Sum(45)$_{1...12}$ = 1175.05 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(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=	168.42	148.64	156.55	140.95	138.57	124.46	120.14	130.99	130.5	146.13	153.74	164.58	(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=	168.42	148.64	156.55	140.95	138.57	124.46	120.14	130.99	130.5	146.13	153.74	164.58	

Output from water heater (annual)$_{1...12}$ | 1723.67 | (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=	77.78	69.1	73.83	67.95	67.86	62.46	61.73	65.34	64.47	70.37	72.2	76.51	(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=	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(66)

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

(67)m=	13.27	11.78	9.58	7.25	5.42	4.58	4.95	6.43	8.63	10.96	12.79	13.63	(67)

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

(68)m=	148.51	150.05	146.16	137.9	127.46	117.65	111.1	109.56	113.44	121.71	132.15	141.95	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains (Table 5)

(72)m=	104.55	102.82	99.24	94.37	91.21	86.76	82.97	87.82	89.54	94.58	100.28	102.83	(72)

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

(73)m=	317.89	316.22	306.55	291.09	275.66	260.55	250.59	255.38	263.18	278.82	296.78	309.99	(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	2.68	x	10.63	x	0.63	x	0.7	=	8.71	(74)
North	0.9x 0.77	x	2.68	x	20.32	x	0.63	x	0.7	=	16.64	(74)

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North	0.9x	0.77	x	2.68	x	34.53	x	0.63	x	0.7	=	28.28	(74)
North	0.9x	0.77	x	2.68	x	55.46	x	0.63	x	0.7	=	45.43	(74)
North	0.9x	0.77	x	2.68	x	74.72	x	0.63	x	0.7	=	61.2	(74)
North	0.9x	0.77	x	2.68	x	79.99	x	0.63	x	0.7	=	65.51	(74)
North	0.9x	0.77	x	2.68	x	74.68	x	0.63	x	0.7	=	61.16	(74)
North	0.9x	0.77	x	2.68	x	59.25	x	0.63	x	0.7	=	48.53	(74)
North	0.9x	0.77	x	2.68	x	41.52	x	0.63	x	0.7	=	34	(74)
North	0.9x	0.77	x	2.68	x	24.19	x	0.63	x	0.7	=	19.81	(74)
North	0.9x	0.77	x	2.68	x	13.12	x	0.63	x	0.7	=	10.74	(74)
North	0.9x	0.77	x	2.68	x	8.86	x	0.63	x	0.7	=	7.26	(74)
Southwest	0.9x	0.77	x	1.34	x	36.79		0.63	x	0.7	=	15.07	(79)
Southwest	0.9x	0.77	x	2.68	x	36.79		0.63	x	0.7	=	30.14	(79)
Southwest	0.9x	0.77	x	1.34	x	62.67		0.63	x	0.7	=	25.67	(79)
Southwest	0.9x	0.77	x	2.68	x	62.67		0.63	x	0.7	=	51.33	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.63	x	0.7	=	35.12	(79)
Southwest	0.9x	0.77	x	2.68	x	85.75		0.63	x	0.7	=	70.24	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.63	x	0.7	=	43.51	(79)
Southwest	0.9x	0.77	x	2.68	x	106.25		0.63	x	0.7	=	87.02	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.63	x	0.7	=	48.74	(79)
Southwest	0.9x	0.77	x	2.68	x	119.01		0.63	x	0.7	=	97.47	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.63	x	0.7	=	48.38	(79)
Southwest	0.9x	0.77	x	2.68	x	118.15		0.63	x	0.7	=	96.77	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.63	x	0.7	=	46.65	(79)
Southwest	0.9x	0.77	x	2.68	x	113.91		0.63	x	0.7	=	93.3	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.63	x	0.7	=	42.75	(79)
Southwest	0.9x	0.77	x	2.68	x	104.39		0.63	x	0.7	=	85.5	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.63	x	0.7	=	38.02	(79)
Southwest	0.9x	0.77	x	2.68	x	92.85		0.63	x	0.7	=	76.05	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.63	x	0.7	=	28.37	(79)
Southwest	0.9x	0.77	x	2.68	x	69.27		0.63	x	0.7	=	56.73	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.63	x	0.7	=	18.05	(79)
Southwest	0.9x	0.77	x	2.68	x	44.07		0.63	x	0.7	=	36.1	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.63	x	0.7	=	12.89	(79)
Southwest	0.9x	0.77	x	2.68	x	31.49		0.63	x	0.7	=	25.79	(79)
West	0.9x	0.77	x	4.02	x	19.64	x	0.63	x	0.7	=	24.13	(80)
West	0.9x	0.77	x	4.02	x	38.42	x	0.63	x	0.7	=	47.2	(80)
West	0.9x	0.77	x	4.02	x	63.27	x	0.63	x	0.7	=	77.74	(80)
West	0.9x	0.77	x	4.02	x	92.28	x	0.63	x	0.7	=	113.37	(80)
West	0.9x	0.77	x	4.02	x	113.09	x	0.63	x	0.7	=	138.94	(80)
West	0.9x	0.77	x	4.02	x	115.77	x	0.63	x	0.7	=	142.23	(80)
West	0.9x	0.77	x	4.02	x	110.22	x	0.63	x	0.7	=	135.41	(80)

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West	0.9x	0.77	x	4.02	x	94.68	x	0.63	x	0.7	=	116.32	(80)
West	0.9x	0.77	x	4.02	x	73.59	x	0.63	x	0.7	=	90.41	(80)
West	0.9x	0.77	x	4.02	x	45.59	x	0.63	x	0.7	=	56.01	(80)
West	0.9x	0.77	x	4.02	x	24.49	x	0.63	x	0.7	=	30.09	(80)
West	0.9x	0.77	x	4.02	x	16.15	x	0.63	x	0.7	=	19.84	(80)

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

(83)m=	78.04	140.84	211.37	289.34	346.35	352.9	336.52	293.09	238.49	160.92	94.97	65.79	(83)

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

(84)m=	395.93	457.07	517.92	580.43	622.01	613.45	587.11	548.47	501.67	439.74	391.75	375.77	(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	0.97	0.92	0.81	0.63	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=	19.72	19.9	20.19	20.54	20.82	20.96	20.99	20.99	20.89	20.53	20.06	19.69	(87)

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

(88)m=	19.83	19.84	19.84	19.85	19.85	19.86	19.86	19.87	19.86	19.85	19.85	19.84	(88)

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

(89)m=	0.99	0.98	0.96	0.89	0.75	0.53	0.35	0.4	0.68	0.92	0.98	0.99	(89)

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

(90)m=	18.16	18.42	18.84	19.34	19.69	19.84	19.86	19.86	19.78	19.34	18.67	18.12	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	18.9	19.12	19.47	19.91	20.22	20.37	20.39	20.39	20.31	19.9	19.33	18.86	(92)

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

(93)m=	18.9	19.12	19.47	19.91	20.22	20.37	20.39	20.39	20.31	19.9	19.33	18.86	(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	0.96	0.9	0.77	0.58	0.41	0.46	0.72	0.92	0.98	0.99	(94)

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

(95)m=	391.79	447.94	495.54	519.66	478.75	355.16	241.12	251.74	360.49	406.22	383.92	372.61	(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=	963.66	936.53	852.41	715.11	552.4	370.08	243.54	255.72	399.89	602.96	795.93	958.76	(97)

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

(98)m=	425.47	328.33	265.51	140.73	54.79	0	0	0	0	146.38	296.64	436.1	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 2093.95 (98)

Space heating requirement in kWh/m²/year 41.47 (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)	425.47	328.33	265.51	140.73	54.79	0	0	0	0	146.38	296.64	436.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	455.05	351.16	283.97	150.51	58.6	0	0	0	0	156.55	317.27	466.41	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2239.52 (211)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

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

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	168.42	148.64	156.55	140.95	138.57	124.46	120.14	130.99	130.5	146.13	153.74	164.58	
Efficiency of water heater													79.8 (216)
(217)m=	87.18	86.87	86.21	84.81	82.57	79.8	79.8	79.8	79.8	84.82	86.54	87.29	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	193.18	171.1	181.58	166.2	167.83	155.97	150.56	164.15	163.53	172.28	177.65	188.54	

Total = Sum(219a)$_{1...12}$ = 2052.57 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2239.52
Water heating fuel used		2052.57
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		234.28 (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 =	483.74 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	443.35 (264)
Space and water heating	(261) + (262) + (263) + (264) =		927.09 (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	=	121.59	(268)
Total CO2, kg/year			sum of (265)…(271) =		1087.61	(272)

TER = 21.54 (273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Level 8 - Apt 22

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.58	(1a) x	2.7	(2a) =	190.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		190.57	(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) =	0.16	(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)			0.41	(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) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	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	0.58	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			1.89	x	1	=	1.89			(26)
Windows Type 1			3.94	x	1/[1/(1.4)+ 0.04]	=	5.22			(27)
Windows Type 2			3.94	x	1/[1/(1.4)+ 0.04]	=	5.22			(27)
Windows Type 3			1.97	x	1/[1/(1.4)+ 0.04]	=	2.61			(27)
Windows Type 4			5.91	x	1/[1/(1.4)+ 0.04]	=	7.84			(27)
Walls Type1	46.14	15.76	30.38	x	0.18	=	5.47			(29)
Walls Type2	18.71	1.89	16.82	x	0.18	=	3.03			(29)
Roof	70.58	0	70.58	x	0.13	=	9.18			(30)
Total area of elements, m²			135.43							(31)
Party wall			25.6	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 635.22 (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 7.18 (36)

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

Total fabric heat loss (33) + (36) = 47.64 (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=	37.57	37.34	37.1	36.01	35.8	34.85	34.85	34.67	35.21	35.8	36.22	36.65	(38)

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

(39)m=	85.21	84.97	84.74	83.64	83.44	82.48	82.48	82.31	82.85	83.44	83.85	84.29	

Average = Sum(39)$_{1...12}$ /12= 83.64 (39)

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

(40)m=	1.21	1.2	1.2	1.19	1.18	1.17	1.17	1.17	1.17	1.18	1.19	1.19	

Average = Sum(40)$_{1...12}$ /12= 1.19 (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 2.26 (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 87.88 (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=	96.67	93.15	89.64	86.12	82.61	79.09	79.09	82.61	86.12	89.64	93.15	96.67	

Total = Sum(44)$_{1...12}$ = 1054.54 (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=	143.35	125.38	129.38	112.79	108.23	93.39	86.54	99.31	100.5	117.12	127.84	138.83	

Total = Sum(45)$_{1...12}$ = 1382.66 (45)

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

(46)m=	21.5	18.81	19.41	16.92	16.23	14.01	12.98	14.9	15.07	17.57	19.18	20.82	(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=	189.95	167.46	175.97	157.89	154.82	138.49	133.14	145.9	145.59	163.71	172.93	185.42	(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=	189.95	167.46	175.97	157.89	154.82	138.49	133.14	145.9	145.59	163.71	172.93	185.42	

Output from water heater (annual)$_{1...12}$ | 1931.28 | (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=	84.94	75.36	80.29	73.58	73.26	67.13	66.05	70.3	69.49	76.22	78.58	83.44	(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=	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	(66)

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

(67)m=	17.71	15.73	12.79	9.68	7.24	6.11	6.6	8.58	11.52	14.63	17.07	18.2	(67)

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

(68)m=	198.65	200.71	195.51	184.46	170.5	157.38	148.61	146.55	151.74	162.8	176.76	189.88	(68)

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

(69)m=	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	(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=	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	(71)

Water heating gains (Table 5)

(72)m=	114.17	112.14	107.92	102.19	98.47	93.23	88.78	94.48	96.51	102.44	109.14	112.15	(72)

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

(73)m=	390.43	388.48	376.13	356.23	336.11	316.62	303.9	309.52	319.68	339.78	362.88	380.13	(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)	
Southeast 0.9x	0.77	x	1.97	x	36.79	x	0.63	x	0.7	=	22.15	(77)
Southeast 0.9x	0.77	x	1.97	x	62.67	x	0.63	x	0.7	=	37.73	(77)

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Southeast	0.9x	0.77	x	1.97	x	85.75	x	0.63	x	0.7	=	51.63	(77)
Southeast	0.9x	0.77	x	1.97	x	106.25	x	0.63	x	0.7	=	63.97	(77)
Southeast	0.9x	0.77	x	1.97	x	119.01	x	0.63	x	0.7	=	71.65	(77)
Southeast	0.9x	0.77	x	1.97	x	118.15	x	0.63	x	0.7	=	71.13	(77)
Southeast	0.9x	0.77	x	1.97	x	113.91	x	0.63	x	0.7	=	68.58	(77)
Southeast	0.9x	0.77	x	1.97	x	104.39	x	0.63	x	0.7	=	62.85	(77)
Southeast	0.9x	0.77	x	1.97	x	92.85	x	0.63	x	0.7	=	55.9	(77)
Southeast	0.9x	0.77	x	1.97	x	69.27	x	0.63	x	0.7	=	41.7	(77)
Southeast	0.9x	0.77	x	1.97	x	44.07	x	0.63	x	0.7	=	26.53	(77)
Southeast	0.9x	0.77	x	1.97	x	31.49	x	0.63	x	0.7	=	18.96	(77)
South	0.9x	0.77	x	5.91	x	46.75	x	0.63	x	0.7	=	84.44	(78)
South	0.9x	0.77	x	5.91	x	76.57	x	0.63	x	0.7	=	138.29	(78)
South	0.9x	0.77	x	5.91	x	97.53	x	0.63	x	0.7	=	176.16	(78)
South	0.9x	0.77	x	5.91	x	110.23	x	0.63	x	0.7	=	199.1	(78)
South	0.9x	0.77	x	5.91	x	114.87	x	0.63	x	0.7	=	207.48	(78)
South	0.9x	0.77	x	5.91	x	110.55	x	0.63	x	0.7	=	199.67	(78)
South	0.9x	0.77	x	5.91	x	108.01	x	0.63	x	0.7	=	195.09	(78)
South	0.9x	0.77	x	5.91	x	104.89	x	0.63	x	0.7	=	189.46	(78)
South	0.9x	0.77	x	5.91	x	101.89	x	0.63	x	0.7	=	184.02	(78)
South	0.9x	0.77	x	5.91	x	82.59	x	0.63	x	0.7	=	149.16	(78)
South	0.9x	0.77	x	5.91	x	55.42	x	0.63	x	0.7	=	100.09	(78)
South	0.9x	0.77	x	5.91	x	40.4	x	0.63	x	0.7	=	72.97	(78)
Southwest	0.9x	0.77	x	3.94	x	36.79	x	0.63	x	0.7	=	44.3	(79)
Southwest	0.9x	0.77	x	3.94	x	36.79	x	0.63	x	0.7	=	44.3	(79)
Southwest	0.9x	0.77	x	3.94	x	62.67	x	0.63	x	0.7	=	75.47	(79)
Southwest	0.9x	0.77	x	3.94	x	62.67	x	0.63	x	0.7	=	75.47	(79)
Southwest	0.9x	0.77	x	3.94	x	85.75	x	0.63	x	0.7	=	103.26	(79)
Southwest	0.9x	0.77	x	3.94	x	85.75	x	0.63	x	0.7	=	103.26	(79)
Southwest	0.9x	0.77	x	3.94	x	106.25	x	0.63	x	0.7	=	127.94	(79)
Southwest	0.9x	0.77	x	3.94	x	106.25	x	0.63	x	0.7	=	127.94	(79)
Southwest	0.9x	0.77	x	3.94	x	119.01	x	0.63	x	0.7	=	143.3	(79)
Southwest	0.9x	0.77	x	3.94	x	119.01	x	0.63	x	0.7	=	143.3	(79)
Southwest	0.9x	0.77	x	3.94	x	118.15	x	0.63	x	0.7	=	142.27	(79)
Southwest	0.9x	0.77	x	3.94	x	118.15	x	0.63	x	0.7	=	142.27	(79)
Southwest	0.9x	0.77	x	3.94	x	113.91	x	0.63	x	0.7	=	137.16	(79)
Southwest	0.9x	0.77	x	3.94	x	113.91	x	0.63	x	0.7	=	137.16	(79)
Southwest	0.9x	0.77	x	3.94	x	104.39	x	0.63	x	0.7	=	125.7	(79)
Southwest	0.9x	0.77	x	3.94	x	104.39	x	0.63	x	0.7	=	125.7	(79)
Southwest	0.9x	0.77	x	3.94	x	92.85	x	0.63	x	0.7	=	111.8	(79)
Southwest	0.9x	0.77	x	3.94	x	92.85	x	0.63	x	0.7	=	111.8	(79)
Southwest	0.9x	0.77	x	3.94	x	69.27	x	0.63	x	0.7	=	83.41	(79)

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Southwest 0.9x	0.77	x	3.94	x	69.27		0.63	x	0.7	=	83.41	(79)
Southwest 0.9x	0.77	x	3.94	x	44.07		0.63	x	0.7	=	53.07	(79)
Southwest 0.9x	0.77	x	3.94	x	44.07		0.63	x	0.7	=	53.07	(79)
Southwest 0.9x	0.77	x	3.94	x	31.49		0.63	x	0.7	=	37.91	(79)
Southwest 0.9x	0.77	x	3.94	x	31.49		0.63	x	0.7	=	37.91	(79)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	195.2	326.96	434.3	518.95	565.73	555.33	537.99	503.7	463.53	357.68	232.76	167.75	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	585.63	715.44	810.43	875.18	901.84	871.96	841.88	813.22	783.21	697.46	595.64	547.88	(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	0.88	0.76	0.58	0.43	0.46	0.68	0.91	0.98	0.99	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.89	20.12	20.4	20.69	20.88	20.98	21	20.99	20.95	20.69	20.23	19.85	(87)

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=	19.91	19.92	19.92	19.93	19.93	19.95	19.95	19.95	19.94	19.93	19.93	19.92	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.97	0.94	0.85	0.7	0.5	0.33	0.36	0.59	0.87	0.97	0.99	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.47	18.8	19.19	19.59	19.83	19.93	19.94	19.94	19.91	19.61	18.97	18.41	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.05	19.34	19.69	20.04	20.27	20.36	20.38	20.38	20.34	20.05	19.49	19.01	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.05	19.34	19.69	20.04	20.27	20.36	20.38	20.38	20.34	20.05	19.49	19.01	(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:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.97	0.93	0.86	0.72	0.53	0.37	0.4	0.63	0.88	0.97	0.99	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	577.75	692.63	755.22	748.88	651.43	464.34	310.21	325.28	492.14	612.16	578.32	542.29	(95)

Monthly average external temperature from Table 8

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1257.2	1227.28	1117.42	931.93	714.67	475.28	311.63	327.42	516.7	788.74	1039.08	1247.97	(97)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	505.51	359.28	269.48	131.8	47.05	0	0	0	0	131.37	331.74	525.02	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2301.25 (98)

Space heating requirement in kWh/m²/year 32.6 (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)													
	505.51	359.28	269.48	131.8	47.05	0	0	0	0	131.37	331.74	525.02	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	540.65	384.26	288.21	140.96	50.32	0	0	0	0	140.5	354.8	561.52	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2461.22 (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)													
	189.95	167.46	175.97	157.89	154.82	138.49	133.14	145.9	145.59	163.71	172.93	185.42	

Efficiency of water heater 79.8 (216)

(217)m=	87.3	86.8	85.95	84.34	82.06	79.8	79.8	79.8	79.8	84.23	86.52	87.44	(217)

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

(219)m=	217.57	192.93	204.74	187.21	188.67	173.54	166.84	182.84	182.44	194.35	199.87	212.06	

Total = Sum(219a)$_{1...12}$ = 2303.07 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2461.22
Water heating fuel used		2303.07
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		312.75 (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	=	531.62 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	497.46 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1029.09 (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	=	162.32	(268)
Total CO2, kg/year			sum of (265)…(271) =		1230.33	(272)

TER = 17.43 (273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Level 8 - Apt 23

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.96	(1a) x	2.7	(2a) =	140.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		140.29	(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			1.89	x	1	=	1.89			(26)
Windows Type 1			3.17	x	1/[1/(1.4)+ 0.04]	=	4.2			(27)
Windows Type 2			1.58	x	1/[1/(1.4)+ 0.04]	=	2.09			(27)
Windows Type 3			4.76	x	1/[1/(1.4)+ 0.04]	=	6.31			(27)
Windows Type 4			1.58	x	1/[1/(1.4)+ 0.04]	=	2.09			(27)
Walls Type1	44.06	11.09	32.97	x	0.18	=	5.94			(29)
Walls Type2	4.02	1.89	2.13	x	0.18	=	0.38			(29)
Walls Type3	11.88	0	11.88	x	0.18	=	2.14			(29)
Roof	51.96	0	51.96	x	0.13	=	6.75			(30)
Total area of elements, m²			111.93							(31)
Party wall			16.5	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.81 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 467.64 (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 6.84 (36)

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

Total fabric heat loss (33) + (36) = 38.65 (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=	27.34	27.18	27.02	26.27	26.13	25.47	25.47	25.35	25.73	26.13	26.41	26.71	(38)

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

(39)m=	65.98	65.82	65.66	64.91	64.77	64.12	64.12	64	64.37	64.77	65.06	65.35	

Average = Sum(39)$_{1...12}$ /12= 64.91 (39)

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

(40)m=	1.27	1.27	1.26	1.25	1.25	1.23	1.23	1.23	1.24	1.25	1.25	1.26	

Average = Sum(40)$_{1...12}$ /12= 1.25 (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 75.71 (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=	83.28	80.26	77.23	74.2	71.17	68.14	68.14	71.17	74.2	77.23	80.26	83.28	

Total = Sum(44)$_{1...12}$ = 908.55 (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=	123.51	108.02	111.47	97.18	93.25	80.46	74.56	85.56	86.58	100.9	110.14	119.61	

Total = Sum(45)$_{1...12}$ = 1191.25 (45)

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

(46)m=	18.53	16.2	16.72	14.58	13.99	12.07	11.18	12.83	12.99	15.14	16.52	17.94	(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)

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

(57)m=	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=	170.1	150.11	158.06	142.27	139.84	125.56	121.16	132.16	131.67	147.5	155.24	166.21	(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=	170.1	150.11	158.06	142.27	139.84	125.56	121.16	132.16	131.67	147.5	155.24	166.21	

Output from water heater (annual)$_{1...12}$ — 1739.87 — (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=	78.34	69.59	74.34	68.39	68.28	62.83	62.07	65.73	64.86	70.83	72.7	77.05	(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=	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	(66)

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

(67)m=	13.6	12.08	9.83	7.44	5.56	4.69	5.07	6.59	8.85	11.24	13.11	13.98	(67)

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

(68)m=	152.32	153.9	149.92	141.44	130.74	120.68	113.95	112.37	116.36	124.84	135.54	145.6	(68)

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

(69)m=	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	(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=	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	(71)

Water heating gains (Table 5)

(72)m=	105.3	103.55	99.92	94.98	91.77	87.26	83.42	88.34	90.09	95.2	100.97	103.56	(72)

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

(73)m=	323.44	321.75	311.88	296.08	280.29	264.85	254.67	259.53	267.51	283.49	301.84	315.36	(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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North	0.9x	0.77	x	3.17	x	10.63	x	0.63	x	0.7	=	10.3	(74)
North	0.9x	0.77	x	3.17	x	20.32	x	0.63	x	0.7	=	19.69	(74)
North	0.9x	0.77	x	3.17	x	34.53	x	0.63	x	0.7	=	33.45	(74)
North	0.9x	0.77	x	3.17	x	55.46	x	0.63	x	0.7	=	53.73	(74)
North	0.9x	0.77	x	3.17	x	74.72	x	0.63	x	0.7	=	72.38	(74)
North	0.9x	0.77	x	3.17	x	79.99	x	0.63	x	0.7	=	77.49	(74)
North	0.9x	0.77	x	3.17	x	74.68	x	0.63	x	0.7	=	72.35	(74)
North	0.9x	0.77	x	3.17	x	59.25	x	0.63	x	0.7	=	57.4	(74)
North	0.9x	0.77	x	3.17	x	41.52	x	0.63	x	0.7	=	40.22	(74)
North	0.9x	0.77	x	3.17	x	24.19	x	0.63	x	0.7	=	23.43	(74)
North	0.9x	0.77	x	3.17	x	13.12	x	0.63	x	0.7	=	12.71	(74)
North	0.9x	0.77	x	3.17	x	8.86	x	0.63	x	0.7	=	8.59	(74)
Northeast	0.9x	0.77	x	4.76	x	11.28	x	0.63	x	0.7	=	16.41	(75)
Northeast	0.9x	0.77	x	4.76	x	22.97	x	0.63	x	0.7	=	33.41	(75)
Northeast	0.9x	0.77	x	4.76	x	41.38	x	0.63	x	0.7	=	60.19	(75)
Northeast	0.9x	0.77	x	4.76	x	67.96	x	0.63	x	0.7	=	98.86	(75)
Northeast	0.9x	0.77	x	4.76	x	91.35	x	0.63	x	0.7	=	132.88	(75)
Northeast	0.9x	0.77	x	4.76	x	97.38	x	0.63	x	0.7	=	141.67	(75)
Northeast	0.9x	0.77	x	4.76	x	91.1	x	0.63	x	0.7	=	132.53	(75)
Northeast	0.9x	0.77	x	4.76	x	72.63	x	0.63	x	0.7	=	105.65	(75)
Northeast	0.9x	0.77	x	4.76	x	50.42	x	0.63	x	0.7	=	73.35	(75)
Northeast	0.9x	0.77	x	4.76	x	28.07	x	0.63	x	0.7	=	40.83	(75)
Northeast	0.9x	0.77	x	4.76	x	14.2	x	0.63	x	0.7	=	20.65	(75)
Northeast	0.9x	0.77	x	4.76	x	9.21	x	0.63	x	0.7	=	13.4	(75)
East	0.9x	0.77	x	1.58	x	19.64	x	0.63	x	0.7	=	9.48	(76)
East	0.9x	0.77	x	1.58	x	38.42	x	0.63	x	0.7	=	18.55	(76)
East	0.9x	0.77	x	1.58	x	63.27	x	0.63	x	0.7	=	30.55	(76)
East	0.9x	0.77	x	1.58	x	92.28	x	0.63	x	0.7	=	44.56	(76)
East	0.9x	0.77	x	1.58	x	113.09	x	0.63	x	0.7	=	54.61	(76)
East	0.9x	0.77	x	1.58	x	115.77	x	0.63	x	0.7	=	55.9	(76)
East	0.9x	0.77	x	1.58	x	110.22	x	0.63	x	0.7	=	53.22	(76)
East	0.9x	0.77	x	1.58	x	94.68	x	0.63	x	0.7	=	45.72	(76)
East	0.9x	0.77	x	1.58	x	73.59	x	0.63	x	0.7	=	35.53	(76)
East	0.9x	0.77	x	1.58	x	45.59	x	0.63	x	0.7	=	22.01	(76)
East	0.9x	0.77	x	1.58	x	24.49	x	0.63	x	0.7	=	11.83	(76)
East	0.9x	0.77	x	1.58	x	16.15	x	0.63	x	0.7	=	7.8	(76)
Southeast	0.9x	0.77	x	1.58	x	36.79	x	0.63	x	0.7	=	17.77	(77)
Southeast	0.9x	0.77	x	1.58	x	62.67	x	0.63	x	0.7	=	30.26	(77)
Southeast	0.9x	0.77	x	1.58	x	85.75	x	0.63	x	0.7	=	41.41	(77)
Southeast	0.9x	0.77	x	1.58	x	106.25	x	0.63	x	0.7	=	51.31	(77)
Southeast	0.9x	0.77	x	1.58	x	119.01	x	0.63	x	0.7	=	57.47	(77)

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Southeast 0.9x	0.77	x	1.58	x	118.15	x	0.63	x	0.7	=	57.05	(77)
Southeast 0.9x	0.77	x	1.58	x	113.91	x	0.63	x	0.7	=	55	(77)
Southeast 0.9x	0.77	x	1.58	x	104.39	x	0.63	x	0.7	=	50.41	(77)
Southeast 0.9x	0.77	x	1.58	x	92.85	x	0.63	x	0.7	=	44.84	(77)
Southeast 0.9x	0.77	x	1.58	x	69.27	x	0.63	x	0.7	=	33.45	(77)
Southeast 0.9x	0.77	x	1.58	x	44.07	x	0.63	x	0.7	=	21.28	(77)
Southeast 0.9x	0.77	x	1.58	x	31.49	x	0.63	x	0.7	=	15.2	(77)

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

(83)m=	53.97	101.91	165.61	248.45	317.34	332.11	313.1	259.17	193.94	119.73	66.47	45	(83)

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

(84)m=	377.41	423.66	477.49	544.53	597.63	596.96	567.77	518.7	461.45	403.21	368.31	360.35	(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	0.83	0.65	0.49	0.55	0.81	0.96	0.99	1	(86)

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

(87)m=	19.72	19.87	20.14	20.51	20.81	20.96	20.99	20.98	20.87	20.49	20.04	19.69	(87)

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

(88)m=	19.86	19.87	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.88	19.87	(88)

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

(89)m=	0.99	0.99	0.97	0.92	0.77	0.55	0.37	0.43	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=	18.18	18.4	18.8	19.32	19.7	19.87	19.89	19.89	19.79	19.31	18.66	18.15	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	18.89	19.08	19.42	19.87	20.22	20.37	20.4	20.4	20.29	19.86	19.3	18.86	(92)

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

(93)m=	18.89	19.08	19.42	19.87	20.22	20.37	20.4	20.4	20.29	19.86	19.3	18.86	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.92	0.79	0.59	0.42	0.48	0.76	0.94	0.99	0.99	(94)

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

(95)m=	374.43	417.74	462.6	498.3	472.33	354.5	241.06	251.13	350.88	380.51	362.88	358.03	(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=	962.54	933.22	848.28	712.28	551.55	369.97	243.57	255.68	398.65	599.55	793.77	958.04	(97)

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

(98)m=	437.55	346.41	286.94	154.06	58.94	0	0	0	0	162.97	310.24	446.41	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2203.52	(98)
Space heating requirement in kWh/m²/year	42.41	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	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)	437.55	346.41	286.94	154.06	58.94	0	0	0	0	162.97	310.24	446.41	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	467.97	370.49	306.89	164.77	63.04	0	0	0	0	174.3	331.8	477.44	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2356.7 (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)

	170.1	150.11	158.06	142.27	139.84	125.56	121.16	132.16	131.67	147.5	155.24	166.21	

Efficiency of water heater 79.8 (216)

(217)m=	87.23	86.97	86.39	85.03	82.7	79.8	79.8	79.8	79.8	85.08	86.63	87.32	(217)

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

(219)m=	195.01	172.59	182.97	167.33	169.1	157.34	151.83	165.61	165.01	173.36	179.2	190.33	

Total = Sum(219a)$_{1...12}$ = 2069.68 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2356.7
Water heating fuel used		2069.68
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		240.23 (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 =	509.05 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	447.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =			956.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	124.68	(268)
Total CO2, kg/year	sum of (265)…(271) =			1119.7	(272)

TER = 21.55 (273)

Appendix B – “Be Lean” SAP Output Documents

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 1 - Apt 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.71	(1a) x	2.7	(2a) =	217.92	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.92	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 2			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 3			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 4			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 5			2.09	x1/[1/(0.9)+ 0.04]		=	1.82			(27)
Windows Type 6			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 7			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 8			6.28	x1/[1/(0.9)+ 0.04]		=	5.46			(27)
Windows Type 9			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 10			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Floor Type 1			14.57	x	0.065	=	0.9470499			(28)
Floor Type 2			33.19	x	0.13	=	4.3147			(28)
Floor Type 3			32.95	x	0.13	=	4.2835			(28)
Walls Type1	80.38	19.09	61.29	x	0.18	=	11.03			(29)
Walls Type2	29.57	1.89	27.68	x	0.17	=	4.62			(29)
Total area of elements, m²			190.65							(31)
Party wall			18.31	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.67 (33)

DER WorkSheet: New dwelling design stage

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 21.73 (36)

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

Total fabric heat loss (33) + (36) = 65.4 (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=	21.67	21.44	21.21	20.06	19.83	18.69	18.69	18.46	19.15	19.83	20.29	20.75	(38)

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

(39)m=	87.07	86.84	86.61	85.47	85.24	84.09	84.09	83.86	84.55	85.24	85.7	86.16	

Average = Sum(39)$_{1...12}$ /12= 85.41 (39)

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

(40)m=	1.08	1.08	1.07	1.06	1.06	1.04	1.04	1.04	1.05	1.06	1.06	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 2.48 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

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

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

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

(44)m=	102.31	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.31	

Total = Sum(44)$_{1...12}$ = 1116.12 (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=	151.72	132.7	136.93	119.38	114.55	98.85	91.6	105.11	106.36	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.4 (45)

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

(46)m=	22.76	19.9	20.54	17.91	17.18	14.83	13.74	15.77	15.95	18.59	20.3	22.04	(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:

DER WorkSheet: New dwelling design stage

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=	207	182.63	192.21	172.88	169.83	152.34	146.87	160.39	159.86	179.23	188.8	202.21	(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=	207	182.63	192.21	172.88	169.83	152.34	146.87	160.39	159.86	179.23	188.8	202.21	

Output from water heater (annual)$_{1...12}$ 2114.24 (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=	94.67	84.06	89.75	82.49	82.31	75.66	74.68	79.17	78.16	85.44	87.79	93.08	(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=	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	(66)

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

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

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

(68)m=	220.92	223.21	217.43	205.14	189.61	175.02	165.27	162.98	168.76	181.06	196.58	211.17	(68)

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

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	(71)

Water heating gains (Table 5)

(72)m=	127.24	125.1	120.63	114.57	110.63	105.09	100.37	106.41	108.56	114.83	121.92	125.1	(72)

DER WorkSheet: New dwelling design stage

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

(73)m=	428	425.94	412.44	390.62	368.44	347.05	333.13	339.08	350.27	372.3	397.63	416.66	(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	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North 0.9x	0.77	x	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North 0.9x	0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North 0.9x	0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North 0.9x	0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North 0.9x	0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North 0.9x	0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North 0.9x	0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North 0.9x	0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North 0.9x	0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North 0.9x	0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North 0.9x	0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North 0.9x	0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North 0.9x	0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North 0.9x	0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North 0.9x	0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North 0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North 0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North 0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North 0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North 0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North 0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North 0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
North 0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	2.09	x	36.79		0.46	x	0.8	=	19.61	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest 0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest 0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest	0.9x	0.77	x	2.09	x	62.67		0.46	x	0.8	=	33.4	(79)
Southwest	0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest	0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	2.09	x	85.75		0.46	x	0.8	=	45.71	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	2.09	x	106.25		0.46	x	0.8	=	56.63	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	2.09	x	119.01		0.46	x	0.8	=	63.43	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	2.09	x	118.15		0.46	x	0.8	=	62.97	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	2.09	x	113.91		0.46	x	0.8	=	60.71	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)

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Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	2.09	x	104.39		0.46	x	0.8	=	55.64	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	2.09	x	92.85		0.46	x	0.8	=	49.49	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	2.09	x	69.27		0.46	x	0.8	=	36.92	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	2.09	x	44.07		0.46	x	0.8	=	23.49	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	2.09	x	31.49		0.46	x	0.8	=	16.78	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
West	0.9x	0.77	x	6.28	x	19.64	x	0.46	x	0.8	=	31.45	(80)
West	0.9x	0.77	x	6.28	x	38.42	x	0.46	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	6.28	x	63.27	x	0.46	x	0.8	=	101.34	(80)
West	0.9x	0.77	x	6.28	x	92.28	x	0.46	x	0.8	=	147.79	(80)
West	0.9x	0.77	x	6.28	x	113.09	x	0.46	x	0.8	=	181.12	(80)
West	0.9x	0.77	x	6.28	x	115.77	x	0.46	x	0.8	=	185.41	(80)
West	0.9x	0.77	x	6.28	x	110.22	x	0.46	x	0.8	=	176.52	(80)
West	0.9x	0.77	x	6.28	x	94.68	x	0.46	x	0.8	=	151.63	(80)

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West	0.9x	0.77	x	6.28	x	73.59	x	0.46	x	0.8	=	117.86	(80)
West	0.9x	0.77	x	6.28	x	45.59	x	0.46	x	0.8	=	73.01	(80)
West	0.9x	0.77	x	6.28	x	24.49	x	0.46	x	0.8	=	39.22	(80)
West	0.9x	0.77	x	6.28	x	16.15	x	0.46	x	0.8	=	25.87	(80)

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

(83)m=	133.78	237.33	346.47	460.19	539.64	545.31	521.83	461.8	386.11	268.49	162.04	113.27	(83)

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

(84)m=	561.78	663.27	758.9	850.81	908.08	892.35	854.96	800.88	736.38	640.79	559.67	529.93	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.43	0.48	0.73	0.94	0.99	1	(86)

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

(87)m=	19.95	20.13	20.39	20.7	20.9	20.98	21	21	20.95	20.67	20.25	19.91	(87)

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

(88)m=	20.02	20.02	20.02	20.03	20.04	20.05	20.05	20.05	20.04	20.04	20.03	20.03	(88)

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

(89)m=	0.99	0.99	0.96	0.89	0.73	0.51	0.34	0.38	0.65	0.92	0.99	1	(89)

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

(90)m=	18.62	18.88	19.26	19.69	19.95	20.04	20.05	20.05	20.01	19.67	19.07	18.58	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	19.08	19.32	19.65	20.04	20.28	20.37	20.38	20.38	20.33	20.02	19.48	19.05	(92)

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

(93)m=	19.08	19.32	19.65	20.04	20.28	20.37	20.38	20.38	20.33	20.02	19.48	19.05	(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=	0.99	0.98	0.96	0.89	0.74	0.53	0.37	0.41	0.68	0.92	0.98	0.99	(94)

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

(95)m=	557.82	652.33	727.22	754.18	672.02	476.83	316.84	332.05	499.38	590.36	550.94	527.11	(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=	1287.09	1251.89	1139.29	952.25	731.27	485	317.76	333.69	527.08	802.54	1060.92	1279.05	(97)

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

(98)m=	542.58	402.91	306.58	142.61	44.08	0	0	0	0	157.86	367.18	559.45	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2523.25 (98)

Space heating requirement in kWh/m²/year 31.26 (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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2523.25	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2775.58	(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		2114.24	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2325.67	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	51.01	(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		166.16	(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) =	166.16	(331)
Energy for lighting (calculated in Appendix L)		347.82	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5615.23	(338)

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	=	1224.3	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.48	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1250.77	(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)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			1250.77	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	86.24	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	180.52	(379)
Total CO2, kg/year	sum of (376)…(382) =			1517.53	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.8	(384)
EI rating (section 14)				83.82	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 1 - Apt 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	95.04	(1a) x	2.7	(2a) =	256.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	95.04	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		256.61	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 2			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 3			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 4			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 5			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 6			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 7			2.09	x1/[1/(0.9)+ 0.04]		=	1.82			(27)
Windows Type 8			2.09	x1/[1/(0.9)+ 0.04]		=	1.82			(27)
Windows Type 9			6.28	x1/[1/(0.9)+ 0.04]		=	5.46			(27)
Windows Type 10			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Floor Type 1			30.54	x	0.13	=	3.9702			(28)
Floor Type 2			35.35	x	0.13	=	4.5955			(28)
Floor Type 3			29.15	x	0.13	=	3.7895			(28)
Walls Type1	73.22	19.84	53.38	x	0.18	=	9.61			(29)
Walls Type2	11.07	1.89	9.18	x	0.17	=	1.53			(29)
Walls Type3	11.88	0	11.88	x	0.15	=	1.84			(29)
Roof	5.68	0	5.68	x	0.12	=	0.68			(30)
Total area of elements, m²			196.89							(31)

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Party wall	18.31	x	0	=	0	(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	45.15 (33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	51.12 (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 — 20.68 (36)

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

Total fabric heat loss — (33) + (36) = — 65.82 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.52	25.25	24.98	23.63	23.36	22.01	22.01	21.74	22.55	23.36	23.9	24.44	(38)

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

(39)m=	91.34	91.07	90.8	89.45	89.18	87.83	87.83	87.56	88.37	89.18	89.72	90.26	

Average = Sum(39)$_{1...12}$ /12= 89.38 (39)

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

(40)m=	0.96	0.96	0.96	0.94	0.94	0.92	0.92	0.92	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.94 (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 — 2.69 (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 — 98.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	107.86	103.94	100.02	96.09	92.17	88.25	88.25	92.17	96.09	100.02	103.94	107.86	

Total = Sum(44)$_{1...12}$ = 1176.66 (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=	159.95	139.9	144.36	125.86	120.76	104.21	96.57	110.81	112.13	130.68	142.65	154.91	

Total = Sum(45)$_{1...12}$ = 1542.78 (45)

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

(46)m=	23.99	20.98	21.65	18.88	18.11	15.63	14.48	16.62	16.82	19.6	21.4	23.24	(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)

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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=	215.23	189.82	199.64	179.35	176.04	157.7	151.84	166.09	165.63	185.96	196.14	210.18	(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=	215.23	189.82	199.64	179.35	176.04	157.7	151.84	166.09	165.63	185.96	196.14	210.18	

Output from water heater (annual)$_{1...12}$: 2193.62 (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=	97.41	86.46	92.22	84.64	84.38	77.44	76.33	81.07	80.08	87.67	90.23	95.73	(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=	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	(66)

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

(67)m=	22.11	19.64	15.97	12.09	9.04	7.63	8.25	10.72	14.39	18.27	21.32	22.73	(67)

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

(68)m=	248.05	250.62	244.14	230.33	212.9	196.52	185.57	183	189.48	203.29	220.72	237.11	(68)

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

(69)m=	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	(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=	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	(71)

DER WorkSheet: New dwelling design stage

Water heating gains (Table 5)

(72)m=	130.92	128.66	123.95	117.56	113.41	107.56	102.59	108.96	111.22	117.84	125.31	128.67	(72)

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

(73)m=	464.42	462.25	447.39	423.31	398.68	375.04	359.74	366	378.42	402.73	430.69	451.83	(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	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North	0.9x 0.77	x	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North	0.9x 0.77	x	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North	0.9x 0.77	x	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)

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North	0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
East	0.9x	0.77	x	1.34	x	19.64	x	0.46	x	0.8	=	6.71	(76)
East	0.9x	0.77	x	1.34	x	19.64	x	0.46	x	0.8	=	6.71	(76)
East	0.9x	0.77	x	2.09	x	19.64	x	0.46	x	0.8	=	10.47	(76)
East	0.9x	0.77	x	1.34	x	38.42	x	0.46	x	0.8	=	13.13	(76)
East	0.9x	0.77	x	1.34	x	38.42	x	0.46	x	0.8	=	13.13	(76)
East	0.9x	0.77	x	2.09	x	38.42	x	0.46	x	0.8	=	20.48	(76)
East	0.9x	0.77	x	1.34	x	63.27	x	0.46	x	0.8	=	21.62	(76)
East	0.9x	0.77	x	1.34	x	63.27	x	0.46	x	0.8	=	21.62	(76)
East	0.9x	0.77	x	2.09	x	63.27	x	0.46	x	0.8	=	33.72	(76)
East	0.9x	0.77	x	1.34	x	92.28	x	0.46	x	0.8	=	31.54	(76)
East	0.9x	0.77	x	1.34	x	92.28	x	0.46	x	0.8	=	31.54	(76)
East	0.9x	0.77	x	2.09	x	92.28	x	0.46	x	0.8	=	49.19	(76)
East	0.9x	0.77	x	1.34	x	113.09	x	0.46	x	0.8	=	38.65	(76)
East	0.9x	0.77	x	1.34	x	113.09	x	0.46	x	0.8	=	38.65	(76)
East	0.9x	0.77	x	2.09	x	113.09	x	0.46	x	0.8	=	60.28	(76)
East	0.9x	0.77	x	1.34	x	115.77	x	0.46	x	0.8	=	39.56	(76)
East	0.9x	0.77	x	1.34	x	115.77	x	0.46	x	0.8	=	39.56	(76)
East	0.9x	0.77	x	2.09	x	115.77	x	0.46	x	0.8	=	61.71	(76)
East	0.9x	0.77	x	1.34	x	110.22	x	0.46	x	0.8	=	37.67	(76)
East	0.9x	0.77	x	1.34	x	110.22	x	0.46	x	0.8	=	37.67	(76)
East	0.9x	0.77	x	2.09	x	110.22	x	0.46	x	0.8	=	58.75	(76)
East	0.9x	0.77	x	1.34	x	94.68	x	0.46	x	0.8	=	32.35	(76)
East	0.9x	0.77	x	1.34	x	94.68	x	0.46	x	0.8	=	32.35	(76)
East	0.9x	0.77	x	2.09	x	94.68	x	0.46	x	0.8	=	50.46	(76)
East	0.9x	0.77	x	1.34	x	73.59	x	0.46	x	0.8	=	25.15	(76)

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East	0.9x	0.77	x	1.34	x	73.59	x	0.46	x	0.8	=	25.15	(76)
East	0.9x	0.77	x	2.09	x	73.59	x	0.46	x	0.8	=	39.22	(76)
East	0.9x	0.77	x	1.34	x	45.59	x	0.46	x	0.8	=	15.58	(76)
East	0.9x	0.77	x	1.34	x	45.59	x	0.46	x	0.8	=	15.58	(76)
East	0.9x	0.77	x	2.09	x	45.59	x	0.46	x	0.8	=	24.3	(76)
East	0.9x	0.77	x	1.34	x	24.49	x	0.46	x	0.8	=	8.37	(76)
East	0.9x	0.77	x	1.34	x	24.49	x	0.46	x	0.8	=	8.37	(76)
East	0.9x	0.77	x	2.09	x	24.49	x	0.46	x	0.8	=	13.05	(76)
East	0.9x	0.77	x	1.34	x	16.15	x	0.46	x	0.8	=	5.52	(76)
East	0.9x	0.77	x	1.34	x	16.15	x	0.46	x	0.8	=	5.52	(76)
East	0.9x	0.77	x	2.09	x	16.15	x	0.46	x	0.8	=	8.61	(76)
Southeast	0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast	0.9x	0.77	x	1.34	x	36.79	x	0.46	x	0.8	=	12.57	(77)
Southeast	0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)
Southeast	0.9x	0.77	x	1.34	x	62.67	x	0.46	x	0.8	=	21.42	(77)
Southeast	0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast	0.9x	0.77	x	1.34	x	85.75	x	0.46	x	0.8	=	29.3	(77)
Southeast	0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast	0.9x	0.77	x	1.34	x	106.25	x	0.46	x	0.8	=	36.31	(77)
Southeast	0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)
Southeast	0.9x	0.77	x	1.34	x	119.01	x	0.46	x	0.8	=	40.67	(77)
Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97	(77)
Southeast	0.9x	0.77	x	1.34	x	118.15	x	0.46	x	0.8	=	40.38	(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71	(77)
Southeast	0.9x	0.77	x	1.34	x	113.91	x	0.46	x	0.8	=	38.93	(77)
Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64	(77)
Southeast	0.9x	0.77	x	1.34	x	104.39	x	0.46	x	0.8	=	35.67	(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49	(77)
Southeast	0.9x	0.77	x	1.34	x	92.85	x	0.46	x	0.8	=	31.73	(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92	(77)
Southeast	0.9x	0.77	x	1.34	x	69.27	x	0.46	x	0.8	=	23.67	(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49	(77)
Southeast	0.9x	0.77	x	1.34	x	44.07	x	0.46	x	0.8	=	15.06	(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78	(77)
Southeast	0.9x	0.77	x	1.34	x	31.49	x	0.46	x	0.8	=	10.76	(77)
South	0.9x	0.77	x	6.28	x	46.75	x	0.46	x	0.8	=	74.88	(78)
South	0.9x	0.77	x	6.28	x	76.57	x	0.46	x	0.8	=	122.63	(78)
South	0.9x	0.77	x	6.28	x	97.53	x	0.46	x	0.8	=	156.21	(78)
South	0.9x	0.77	x	6.28	x	110.23	x	0.46	x	0.8	=	176.55	(78)
South	0.9x	0.77	x	6.28	x	114.87	x	0.46	x	0.8	=	183.97	(78)
South	0.9x	0.77	x	6.28	x	110.55	x	0.46	x	0.8	=	177.05	(78)

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South	0.9x	0.77	x	6.28	x	108.01	x	0.46	x	0.8	=	172.99	(78)
South	0.9x	0.77	x	6.28	x	104.89	x	0.46	x	0.8	=	167.99	(78)
South	0.9x	0.77	x	6.28	x	101.89	x	0.46	x	0.8	=	163.18	(78)
South	0.9x	0.77	x	6.28	x	82.59	x	0.46	x	0.8	=	132.27	(78)
South	0.9x	0.77	x	6.28	x	55.42	x	0.46	x	0.8	=	88.75	(78)
South	0.9x	0.77	x	6.28	x	40.4	x	0.46	x	0.8	=	64.7	(78)

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

(83)m=	145.49	251.96	355.39	457.56	527.78	530.56	508.78	455.46	390.66	281.38	175.02	124.01	(83)

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

(84)m=	609.9	714.22	802.78	880.87	926.45	905.6	868.52	821.47	769.09	684.11	605.71	575.84	(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	0.93	0.8	0.61	0.44	0.49	0.74	0.95	0.99	1	(86)

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

(87)m=	20.06	20.22	20.46	20.73	20.91	20.99	21	21	20.96	20.72	20.34	20.03	(87)

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

(88)m=	20.12	20.12	20.12	20.13	20.14	20.15	20.15	20.15	20.14	20.14	20.13	20.13	(88)

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

(89)m=	1	0.99	0.97	0.91	0.75	0.53	0.36	0.4	0.67	0.93	0.99	1	(89)

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

(90)m=	18.86	19.1	19.43	19.82	20.05	20.14	20.15	20.15	20.11	19.81	19.27	18.83	(90)

fLA = Living area ÷ (4) = 0.37 (91)

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

(92)m=	19.31	19.52	19.81	20.16	20.37	20.45	20.46	20.46	20.43	20.15	19.67	19.28	(92)

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

(93)m=	19.31	19.52	19.81	20.16	20.37	20.45	20.46	20.46	20.43	20.15	19.67	19.28	(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	0.77	0.56	0.39	0.43	0.69	0.93	0.99	1	(94)

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

(95)m=	606.85	705.32	776.56	798.12	712.19	506.63	338.58	354.53	533.7	637.13	598.47	573.71	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1370.78	1331.27	1208.88	1007.03	773.53	514.18	339.31	355.84	559.14	851.59	1127.72	1360.86	(97)

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

(98)m=	568.37	420.63	321.65	150.41	45.63	0	0	0	0	159.56	381.06	585.64	

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2632.95	(98)
Space heating requirement in kWh/m²/year		27.7	(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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2632.95	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2896.25	(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		2193.62	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2412.99	(310a)
Electricity used for heat distribution	0.01 × [(307a)...(307e) + (310a)...(310e)] =	53.09	(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		195.66	(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) =	195.66	(331)
Energy for lighting (calculated in Appendix L)		390.54	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5895.44	(338)

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	=	1274.22	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	27.55	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1301.77	(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) =			1301.77	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	101.55	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	202.69	(379)
Total CO2, kg/year	sum of (376)…(382) =			1606.01	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.9	(384)
EI rating (section 14)				84.63	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 2 - Apt 3

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.49	(1a) x	2.7	(2a) =	136.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.49	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.32	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Floor			3.66	x	0.13	=	0.4758			(28)
Walls Type1	50.65	16.75	33.9	x	0.18	=	6.1			(29)
Walls Type2	16.79	1.89	14.9	x	0.17	=	2.5			(29)
Total area of elements, m²			71.11							(31)
Party wall			8.96	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.52 (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 9.1 (36)

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

Total fabric heat loss (33) + (36) = 34.62 (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=	13.56	13.41	13.27	12.55	12.41	11.69	11.69	11.55	11.98	12.41	12.69	12.98	(38)

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

(39)m=	48.17	48.03	47.89	47.17	47.03	46.31	46.31	46.16	46.59	47.03	47.31	47.6	

Average = Sum(39)$_{1...12}$ /12= 47.13 (39)

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

(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.91	0.92	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (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 1.7 (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 74.68 (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=	82.15	79.16	76.18	73.19	70.2	67.21	67.21	70.2	73.19	76.18	79.16	82.15	

Total = Sum(44)$_{1...12}$ = 896.19 (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=	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.4	85.41	99.53	108.65	117.98	

Total = Sum(45)$_{1...12}$ = 1175.05 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	

Output from water heater (annual)$_{1...12}$ | 1825.89 | (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=	84.73	75.37	80.78	74.67	74.8	69.19	68.68	72.28	71.19	77.32	78.92	83.45	(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=	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(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=	148.51	150.05	146.16	137.9	127.46	117.65	111.1	109.56	113.44	121.71	132.15	141.95	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains (Table 5)

(72)m=	113.88	112.16	108.58	103.71	100.54	96.09	92.31	97.16	98.88	103.92	109.61	112.17	(72)

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

(73)m=	324.2	322.53	312.87	297.41	281.98	266.88	256.91	261.7	269.5	285.13	303.09	316.29	(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)	
North	0.9x 0.77	x	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x 0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)

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North	0.9x	0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x	0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x	0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)
North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Southwest	0.9x	0.77	x	2.09	x	36.79		0.46	x	0.8	=	19.61	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79		0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	2.09	x	62.67		0.46	x	0.8	=	33.4	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67		0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	2.09	x	85.75		0.46	x	0.8	=	45.71	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75		0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	2.09	x	106.25		0.46	x	0.8	=	56.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25		0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	2.09	x	119.01		0.46	x	0.8	=	63.43	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01		0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	2.09	x	118.15		0.46	x	0.8	=	62.97	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15		0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	2.09	x	113.91		0.46	x	0.8	=	60.71	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91		0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	2.09	x	104.39		0.46	x	0.8	=	55.64	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39		0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	2.09	x	92.85		0.46	x	0.8	=	49.49	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85		0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	2.09	x	69.27		0.46	x	0.8	=	36.92	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27		0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	2.09	x	44.07		0.46	x	0.8	=	23.49	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	2.09	x	31.49		0.46	x	0.8	=	16.78	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)
West	0.9x	0.77	x	6.28	x	19.64	x	0.46	x	0.8	=	31.45	(80)
West	0.9x	0.77	x	6.28	x	38.42	x	0.46	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	6.28	x	63.27	x	0.46	x	0.8	=	101.34	(80)
West	0.9x	0.77	x	6.28	x	92.28	x	0.46	x	0.8	=	147.79	(80)
West	0.9x	0.77	x	6.28	x	113.09	x	0.46	x	0.8	=	181.12	(80)
West	0.9x	0.77	x	6.28	x	115.77	x	0.46	x	0.8	=	185.41	(80)
West	0.9x	0.77	x	6.28	x	110.22	x	0.46	x	0.8	=	176.52	(80)

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West	0.9x	0.77	x	6.28	x	94.68	x	0.46	x	0.8	=	151.63	(80)
West	0.9x	0.77	x	6.28	x	73.59	x	0.46	x	0.8	=	117.86	(80)
West	0.9x	0.77	x	6.28	x	45.59	x	0.46	x	0.8	=	73.01	(80)
West	0.9x	0.77	x	6.28	x	24.49	x	0.46	x	0.8	=	39.22	(80)
West	0.9x	0.77	x	6.28	x	16.15	x	0.46	x	0.8	=	25.87	(80)

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

(83)m=	101.74	183.62	275.57	377.23	451.56	460.1	438.75	382.12	310.93	209.8	123.82	85.77	(83)

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

(84)m=	425.94	506.15	588.44	674.64	733.55	726.99	695.66	643.82	580.43	494.93	426.91	402.06	(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	0.97	0.92	0.78	0.58	0.41	0.29	0.33	0.55	0.85	0.97	0.99	(86)

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

(87)m=	20.26	20.45	20.7	20.91	20.98	21	21	21	20.99	20.87	20.53	20.22	(87)

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

(88)m=	20.12	20.12	20.13	20.14	20.14	20.15	20.15	20.16	20.15	20.14	20.14	20.13	(88)

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

(89)m=	0.99	0.96	0.89	0.74	0.53	0.35	0.24	0.27	0.48	0.81	0.96	0.99	(89)

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

(90)m=	19.15	19.43	19.77	20.04	20.13	20.15	20.15	20.16	20.14	20.01	19.55	19.11	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.68	19.92	20.21	20.45	20.53	20.55	20.55	20.55	20.54	20.41	20.01	19.64	(92)

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

(93)m=	19.68	19.92	20.21	20.45	20.53	20.55	20.55	20.55	20.54	20.41	20.01	19.64	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.9	0.75	0.56	0.38	0.26	0.3	0.51	0.82	0.96	0.99	(94)

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

(95)m=	418.68	485.43	527.87	506.96	409.19	275.15	183.03	191.7	297.49	408.3	410.24	396.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	740.74	721.2	656.49	544.93	415.34	275.64	183.07	191.79	300.27	461.53	611.02	734.78	(97)

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

(98)m=	239.62	158.44	95.69	27.34	4.58	0	0	0	0	39.6	144.56	251.44	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 961.27 (98)

Space heating requirement in kWh/m²/year 19.04 (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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		961.27	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1057.4	(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		1825.89	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2008.48	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	30.66	(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		103.95	(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) =	103.95	(331)
Energy for lighting (calculated in Appendix L)		233.81	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3403.63	(338)

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	=	735.81	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.91	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	751.72	(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)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			751.72	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	53.95	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.35	(379)
Total CO2, kg/year	sum of (376)…(382) =			927.02	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.36	(384)
EI rating (section 14)				86.99	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 2 - Apt 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.58	(1a) x	2.7	(2a) =	190.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		190.57	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 4			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Walls Type1	46.14	16.75	29.39	x	0.18	=	5.29			(29)
Walls Type2	18.71	1.89	16.82	x	0.17	=	2.82			(29)
Total area of elements, m²			64.85							(31)
Party wall			25.6	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.56 (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 7.76 (36)

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

Total fabric heat loss (33) + (36) = 32.31 (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=	18.95	18.75	18.55	17.55	17.34	16.34	16.34	16.14	16.74	17.34	17.75	18.15	(38)

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

(39)m=	51.26	51.06	50.86	49.86	49.66	48.66	48.66	48.45	49.06	49.66	50.06	50.46	

Average = Sum(39)$_{1...12}$ /12= 49.81 (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=	0.73	0.72	0.72	0.71	0.7	0.69	0.69	0.69	0.7	0.7	0.71	0.71	

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 2.26 (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 87.88 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	96.67	93.15	89.64	86.12	82.61	79.09	79.09	82.61	86.12	89.64	93.15	96.67	

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

Total = Sum(44)$_{1...12}$ = 1054.54 (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=	143.35	125.38	129.38	112.79	108.23	93.39	86.54	99.31	100.5	117.12	127.84	138.83	

Total = Sum(45)$_{1...12}$ = 1382.66 (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=	21.5	18.81	19.41	16.92	16.23	14.01	12.98	14.9	15.07	17.57	19.18	20.82	(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)

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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=	198.63	175.3	184.65	166.29	163.51	146.89	141.82	154.59	153.99	172.39	181.34	194.11	(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=	198.63	175.3	184.65	166.29	163.51	146.89	141.82	154.59	153.99	172.39	181.34	194.11	

Output from water heater (annual)$_{1...12}$ 2033.5 (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=	91.89	81.63	87.24	80.3	80.21	73.85	73	77.24	76.21	83.16	85.3	90.38	(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=	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	(66)

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

(67)m=	17.71	15.73	12.79	9.68	7.24	6.11	6.6	8.58	11.52	14.63	17.07	18.2	(67)

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

(68)m=	198.65	200.71	195.51	184.46	170.5	157.38	148.61	146.55	151.74	162.8	176.76	189.88	(68)

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

(69)m=	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	(71)

Water heating gains (Table 5)

(72)m=	123.5	121.47	117.26	111.53	107.81	102.57	98.11	103.82	105.85	111.78	118.48	121.48	(72)

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

(73)m=	396.76	394.81	382.47	362.57	342.44	322.96	310.23	315.86	326.01	346.11	369.21	386.47	(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)	
Southeast 0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast 0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)
Southeast 0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast 0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast 0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)

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Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97	(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71	(77)
Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64	(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49	(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92	(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49	(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78	(77)
South	0.9x	0.77	x	6.28	x	46.75	x	0.46	x	0.8	=	74.88	(78)
South	0.9x	0.77	x	6.28	x	76.57	x	0.46	x	0.8	=	122.63	(78)
South	0.9x	0.77	x	6.28	x	97.53	x	0.46	x	0.8	=	156.21	(78)
South	0.9x	0.77	x	6.28	x	110.23	x	0.46	x	0.8	=	176.55	(78)
South	0.9x	0.77	x	6.28	x	114.87	x	0.46	x	0.8	=	183.97	(78)
South	0.9x	0.77	x	6.28	x	110.55	x	0.46	x	0.8	=	177.05	(78)
South	0.9x	0.77	x	6.28	x	108.01	x	0.46	x	0.8	=	172.99	(78)
South	0.9x	0.77	x	6.28	x	104.89	x	0.46	x	0.8	=	167.99	(78)
South	0.9x	0.77	x	6.28	x	101.89	x	0.46	x	0.8	=	163.18	(78)
South	0.9x	0.77	x	6.28	x	82.59	x	0.46	x	0.8	=	132.27	(78)
South	0.9x	0.77	x	6.28	x	55.42	x	0.46	x	0.8	=	88.75	(78)
South	0.9x	0.77	x	6.28	x	40.4	x	0.46	x	0.8	=	64.7	(78)
Southwest	0.9x	0.77	x	4.19	x	36.79	x	0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79	x	0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67	x	0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67	x	0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75	x	0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75	x	0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25	x	0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25	x	0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01	x	0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01	x	0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15	x	0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15	x	0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91	x	0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91	x	0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39	x	0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39	x	0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85	x	0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85	x	0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27	x	0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27	x	0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07	x	0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07	x	0.46	x	0.8	=	47.09	(79)

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Southwest 0.9x	0.77	x	4.19	x	31.49	0.46	x	0.8	=	33.65	(79)
Southwest 0.9x	0.77	x	4.19	x	31.49	0.46	x	0.8	=	33.65	(79)

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

(83)m=	173.12	289.97	385.17	460.25	501.74	492.52	477.14	446.73	411.1	317.22	206.43	148.78	(83)

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

(84)m=	569.88	684.78	767.64	822.82	844.19	815.48	787.37	762.58	737.11	663.33	575.64	535.24	(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=	0.98	0.94	0.86	0.71	0.54	0.38	0.27	0.29	0.46	0.75	0.95	0.99	(86)

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

(87)m=	20.57	20.75	20.89	20.98	21	21	21	21	21	20.97	20.78	20.54	(87)

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

(88)m=	20.32	20.32	20.32	20.34	20.34	20.35	20.35	20.35	20.35	20.34	20.33	20.33	(88)

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

(89)m=	0.98	0.93	0.84	0.68	0.51	0.34	0.23	0.25	0.42	0.71	0.93	0.98	(89)

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

(90)m=	19.76	20.01	20.2	20.31	20.34	20.35	20.35	20.35	20.34	20.31	20.07	19.72	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	20.1	20.31	20.48	20.59	20.61	20.62	20.62	20.62	20.62	20.58	20.36	20.06	(92)

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

(93)m=	20.1	20.31	20.48	20.59	20.61	20.62	20.62	20.62	20.62	20.58	20.36	20.06	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.93	0.85	0.69	0.52	0.36	0.25	0.27	0.43	0.72	0.94	0.98	(94)

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

(95)m=	556.52	638.68	648.72	569.39	440.78	292.75	195.52	204.47	319.3	480.75	538.5	526.17	(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=	809.74	786.96	711.25	582.61	442.36	292.82	195.52	204.48	319.6	495.76	663.97	800.21	(97)

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

(98)m=	188.39	99.65	46.53	9.52	1.17	0	0	0	0	11.17	90.34	203.88	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 650.65 (98)

Space heating requirement in kWh/m²/year 9.22 (99)

9b. Energy requirements – Community heating scheme

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

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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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		650.65	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	715.71	(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		2033.5	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2236.85	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	29.53	(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		145.31	(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) =	145.31	(331)
Energy for lighting (calculated in Appendix L)		312.76	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3410.63	(338)

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	=	708.62	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.32	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	723.94	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				723.94	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	75.41	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	162.32	(379)
Total CO2, kg/year	sum of (376)…(382) =			961.67	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.63	(384)
EI rating (section 14)				88.85	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 2 - Apt 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.96	(1a) x	2.7	(2a) =	140.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		140.29	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 2			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Walls Type1	44.06	14.65	29.41	x	0.18	=	5.29			(29)
Walls Type2	4.02	1.89	2.13	x	0.17	=	0.36			(29)
Walls Type3	11.88	0	11.88	x	0.15	=	1.84			(29)
Total area of elements, m²			59.97							(31)
Party wall			16.5	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.11 (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 7.62 (36)

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

Total fabric heat loss (33) + (36) = 29.73 (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=	13.95	13.8	13.65	12.92	12.77	12.03	12.03	11.88	12.33	12.77	13.06	13.36	(38)

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

(39)m=	43.68	43.53	43.39	42.65	42.5	41.76	41.76	41.62	42.06	42.5	42.8	43.09	

Average = Sum(39)$_{1...12}$ /12= 42.61 (39)

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

(40)m=	0.84	0.84	0.84	0.82	0.82	0.8	0.8	0.8	0.81	0.82	0.82	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 75.71 (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=	83.28	80.26	77.23	74.2	71.17	68.14	68.14	71.17	74.2	77.23	80.26	83.28	

Total = Sum(44)$_{1...12}$ = 908.55 (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=	123.51	108.02	111.47	97.18	93.25	80.46	74.56	85.56	86.58	100.9	110.14	119.61	

Total = Sum(45)$_{1...12}$ = 1191.25 (45)

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

(46)m=	18.53	16.2	16.72	14.58	13.99	12.07	11.18	12.83	12.99	15.14	16.52	17.94	(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=	178.78	157.95	166.74	150.67	148.52	133.96	129.84	140.84	140.08	156.18	163.64	174.89	(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=	178.78	157.95	166.74	150.67	148.52	133.96	129.84	140.84	140.08	156.18	163.64	174.89	

Output from water heater (annual)$_{1...12}$ | 1842.09 | (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=	85.29	75.86	81.28	75.11	75.23	69.55	69.01	72.67	71.58	77.77	79.42	83.99	(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=	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	(66)

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

(67)m=	13.58	12.06	9.81	7.43	5.55	4.69	5.06	6.58	8.83	11.22	13.09	13.96	(67)

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

(68)m=	152.32	153.9	149.92	141.44	130.74	120.68	113.95	112.37	116.36	124.84	135.54	145.6	(68)

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

(69)m=	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	(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=	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	(71)

Water heating gains (Table 5)

(72)m=	114.63	112.88	109.25	104.32	101.11	96.6	92.76	97.68	99.42	104.53	110.3	112.89	(72)

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

(73)m=	329.75	328.07	318.2	302.4	286.62	271.18	261	265.85	273.83	289.81	308.15	321.67	(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	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x 0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)

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North	0.9x	0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x	0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x	0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)
North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Northeast	0.9x	0.77	x	6.28	x	11.28	x	0.46	x	0.8	=	18.07	(75)
Northeast	0.9x	0.77	x	6.28	x	22.97	x	0.46	x	0.8	=	36.78	(75)
Northeast	0.9x	0.77	x	6.28	x	41.38	x	0.46	x	0.8	=	66.27	(75)
Northeast	0.9x	0.77	x	6.28	x	67.96	x	0.46	x	0.8	=	108.83	(75)
Northeast	0.9x	0.77	x	6.28	x	91.35	x	0.46	x	0.8	=	146.3	(75)
Northeast	0.9x	0.77	x	6.28	x	97.38	x	0.46	x	0.8	=	155.97	(75)
Northeast	0.9x	0.77	x	6.28	x	91.1	x	0.46	x	0.8	=	145.9	(75)
Northeast	0.9x	0.77	x	6.28	x	72.63	x	0.46	x	0.8	=	116.32	(75)
Northeast	0.9x	0.77	x	6.28	x	50.42	x	0.46	x	0.8	=	80.75	(75)
Northeast	0.9x	0.77	x	6.28	x	28.07	x	0.46	x	0.8	=	44.95	(75)
Northeast	0.9x	0.77	x	6.28	x	14.2	x	0.46	x	0.8	=	22.74	(75)
Northeast	0.9x	0.77	x	6.28	x	9.21	x	0.46	x	0.8	=	14.76	(75)
East	0.9x	0.77	x	2.09	x	19.64	x	0.46	x	0.8	=	10.47	(76)
East	0.9x	0.77	x	2.09	x	38.42	x	0.46	x	0.8	=	20.48	(76)
East	0.9x	0.77	x	2.09	x	63.27	x	0.46	x	0.8	=	33.72	(76)
East	0.9x	0.77	x	2.09	x	92.28	x	0.46	x	0.8	=	49.19	(76)
East	0.9x	0.77	x	2.09	x	113.09	x	0.46	x	0.8	=	60.28	(76)
East	0.9x	0.77	x	2.09	x	115.77	x	0.46	x	0.8	=	61.71	(76)
East	0.9x	0.77	x	2.09	x	110.22	x	0.46	x	0.8	=	58.75	(76)
East	0.9x	0.77	x	2.09	x	94.68	x	0.46	x	0.8	=	50.46	(76)
East	0.9x	0.77	x	2.09	x	73.59	x	0.46	x	0.8	=	39.22	(76)
East	0.9x	0.77	x	2.09	x	45.59	x	0.46	x	0.8	=	24.3	(76)
East	0.9x	0.77	x	2.09	x	24.49	x	0.46	x	0.8	=	13.05	(76)
East	0.9x	0.77	x	2.09	x	16.15	x	0.46	x	0.8	=	8.61	(76)
Southeast	0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast	0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)
Southeast	0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast	0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast	0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)
Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97	(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71	(77)

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Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64	(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49	(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92	(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49	(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78	(77)

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

(83)m=	59.51	112.38	182.6	273.92	349.84	366.11	345.16	285.73	213.83	132.02	73.3	49.62	(83)

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

(84)m=	389.27	440.45	500.8	576.32	636.46	637.29	606.16	551.58	487.66	421.82	381.45	371.29	(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	0.94	0.82	0.61	0.42	0.3	0.35	0.59	0.89	0.98	0.99	(86)

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

(87)m=	20.34	20.49	20.7	20.91	20.99	21	21	21	20.99	20.87	20.58	20.32	(87)

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

(88)m=	20.22	20.22	20.22	20.24	20.24	20.25	20.25	20.25	20.25	20.24	20.23	20.23	(88)

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

(89)m=	0.99	0.98	0.93	0.78	0.56	0.37	0.25	0.29	0.53	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=	19.35	19.56	19.86	20.14	20.23	20.25	20.25	20.25	20.24	20.1	19.7	19.32	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.81	19.99	20.25	20.5	20.58	20.6	20.6	20.6	20.59	20.46	20.1	19.78	(92)

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

(93)m=	19.81	19.99	20.25	20.5	20.58	20.6	20.6	20.6	20.59	20.46	20.1	19.78	(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	0.93	0.79	0.59	0.39	0.28	0.32	0.55	0.87	0.97	0.99	(94)

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

(95)m=	384.69	429.19	465.88	457.78	372.55	250.14	166.9	174.65	270.43	365.49	371.02	367.89	(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=	677.42	656.73	596.47	494.68	377.36	250.42	166.92	174.7	272.89	418.95	556.48	671.49	(97)

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

(98)m=	217.79	152.91	97.16	26.57	3.58	0	0	0	0	39.77	133.53	225.88	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 897.19 (98)

Space heating requirement in kWh/m²/year 17.27 (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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		897.19	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	986.91	(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		1842.09	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2026.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	30.13	(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		106.97	(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) =	106.97	(331)
Energy for lighting (calculated in Appendix L)		239.82	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3360	(338)

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	=	723.17	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.64	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	738.81	(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)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			738.81	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	55.52	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	124.47	(379)
Total CO2, kg/year	sum of (376)…(382) =			918.79	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.68	(384)
EI rating (section 14)				87.3	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 3 - Apt 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.49	(1a) x	2.7	(2a) =	136.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.49	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.32	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Walls Type1	50.65	16.75	33.9	x	0.18	=	6.1			(29)
Walls Type2	16.79	1.89	14.9	x	0.17	=	2.5			(29)
Total area of elements, m²			67.45							(31)
Party wall			17.93	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.05 (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 8.14 (36)

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

Total fabric heat loss (33) + (36) = 33.19 (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=	13.56	13.41	13.27	12.55	12.41	11.69	11.69	11.55	11.98	12.41	12.69	12.98	(38)

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

(39)m=	46.74	46.6	46.46	45.74	45.59	44.88	44.88	44.73	45.16	45.59	45.88	46.17	

Average = Sum(39)$_{1...12}$ /12= 45.7 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.89	0.9	0.91	0.91

Average = Sum(40)$_{1...12}$ /12= 0.91 (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 1.7 (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 74.68 (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=	82.15	79.16	76.18	73.19	70.2	67.21	67.21	70.2	73.19	76.18	79.16	82.15

Total = Sum(44)$_{1...12}$ = 896.19 (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=	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.4	85.41	99.53	108.65	117.98

Total = Sum(45)$_{1...12}$ = 1175.05 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7

(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	

Output from water heater (annual)$_{1...12}$ 1825.89 (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=	84.73	75.37	80.78	74.67	74.8	69.19	68.68	72.28	71.19	77.32	78.92	83.45	(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=	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(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=	148.51	150.05	146.16	137.9	127.46	117.65	111.1	109.56	113.44	121.71	132.15	141.95	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains (Table 5)

(72)m=	113.88	112.16	108.58	103.71	100.54	96.09	92.31	97.16	98.88	103.92	109.61	112.17	(72)

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

(73)m=	324.2	322.53	312.87	297.41	281.98	266.88	256.91	261.7	269.5	285.13	303.09	316.29	(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)	
North	0.9x 0.77	x	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x 0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)
North	0.9x 0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x 0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x 0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)

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North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Southwest	0.9x	0.77	x	2.09	x	36.79		0.46	x	0.8	=	19.61	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79		0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	2.09	x	62.67		0.46	x	0.8	=	33.4	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67		0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	2.09	x	85.75		0.46	x	0.8	=	45.71	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75		0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	2.09	x	106.25		0.46	x	0.8	=	56.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25		0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	2.09	x	119.01		0.46	x	0.8	=	63.43	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01		0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	2.09	x	118.15		0.46	x	0.8	=	62.97	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15		0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	2.09	x	113.91		0.46	x	0.8	=	60.71	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91		0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	2.09	x	104.39		0.46	x	0.8	=	55.64	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39		0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	2.09	x	92.85		0.46	x	0.8	=	49.49	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85		0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	2.09	x	69.27		0.46	x	0.8	=	36.92	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27		0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	2.09	x	44.07		0.46	x	0.8	=	23.49	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	2.09	x	31.49		0.46	x	0.8	=	16.78	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)
West	0.9x	0.77	x	6.28	x	19.64	x	0.46	x	0.8	=	31.45	(80)
West	0.9x	0.77	x	6.28	x	38.42	x	0.46	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	6.28	x	63.27	x	0.46	x	0.8	=	101.34	(80)
West	0.9x	0.77	x	6.28	x	92.28	x	0.46	x	0.8	=	147.79	(80)
West	0.9x	0.77	x	6.28	x	113.09	x	0.46	x	0.8	=	181.12	(80)
West	0.9x	0.77	x	6.28	x	115.77	x	0.46	x	0.8	=	185.41	(80)
West	0.9x	0.77	x	6.28	x	110.22	x	0.46	x	0.8	=	176.52	(80)
West	0.9x	0.77	x	6.28	x	94.68	x	0.46	x	0.8	=	151.63	(80)
West	0.9x	0.77	x	6.28	x	73.59	x	0.46	x	0.8	=	117.86	(80)
West	0.9x	0.77	x	6.28	x	45.59	x	0.46	x	0.8	=	73.01	(80)

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West	0.9x	0.77	x	6.28	x	24.49	x	0.46	x	0.8	=	39.22	(80)
West	0.9x	0.77	x	6.28	x	16.15	x	0.46	x	0.8	=	25.87	(80)

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

(83)m=	101.74	183.62	275.57	377.23	451.56	460.1	438.75	382.12	310.93	209.8	123.82	85.77	(83)

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

(84)m=	425.94	506.15	588.44	674.64	733.55	726.99	695.66	643.82	580.43	494.93	426.91	402.06	(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	0.97	0.91	0.76	0.57	0.39	0.28	0.32	0.53	0.84	0.97	0.99	(86)

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

(87)m=	20.3	20.49	20.73	20.92	20.99	21	21	21	20.99	20.89	20.56	20.27	(87)

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

(88)m=	20.15	20.15	20.15	20.16	20.16	20.18	20.18	20.18	20.17	20.16	20.16	20.16	(88)

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

(89)m=	0.98	0.96	0.89	0.72	0.52	0.34	0.23	0.26	0.47	0.8	0.96	0.99	(89)

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

(90)m=	19.23	19.51	19.83	20.08	20.15	20.18	20.18	20.18	20.17	20.05	19.62	19.19	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.74	19.97	20.26	20.48	20.55	20.57	20.57	20.57	20.56	20.45	20.07	19.7	(92)

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

(93)m=	19.74	19.97	20.26	20.48	20.55	20.57	20.57	20.57	20.56	20.45	20.07	19.7	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.89	0.74	0.54	0.37	0.26	0.29	0.5	0.81	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	418.38	484.27	524.09	498.07	398.72	267.36	177.96	186.36	289.61	403.11	409.28	396.62	(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=	721.62	702.44	639.09	529.7	403.44	267.71	177.99	186.42	291.7	448.91	594.93	715.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	225.61	146.61	85.56	22.77	3.52	0	0	0	0	34.08	133.67	237.29	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 889.1 (98)

Space heating requirement in kWh/m²/year 17.61 (99)

9b. Energy requirements – Community heating scheme

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

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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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		889.1	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	978.01	(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		1825.89	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2008.48	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	29.86	(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		103.95	(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) =	103.95	(331)
Energy for lighting (calculated in Appendix L)		233.81	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3324.25	(338)

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	=	716.76	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.5	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	732.26	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				732.26	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	53.95	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.35	(379)
Total CO2, kg/year	sum of (376)…(382) =			907.55	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.97	(384)
EI rating (section 14)				87.26	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 8 - Apt 21

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.49	(1a) x	2.7	(2a) =	136.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.49	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.32	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Walls Type1	50.65	16.75	33.9	x	0.18	=	6.1			(29)
Walls Type2	16.79	1.89	14.9	x	0.17	=	2.49			(29)
Roof	50.49	0	50.49	x	0.12	=	6.06			(30)
Total area of elements, m²			117.94							(31)
Party wall			17.93	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.09 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 454.41 (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 9.19 (36)

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

Total fabric heat loss (33) + (36) = 40.28 (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=	13.56	13.41	13.27	12.55	12.41	11.69	11.69	11.55	11.98	12.41	12.69	12.98	(38)

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

(39)m=	53.83	53.69	53.55	52.83	52.69	51.97	51.97	51.83	52.26	52.69	52.97	53.26	

Average = Sum(39)$_{1...12}$ /12= 52.8 (39)

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

(40)m=	1.07	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.05 (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 1.7 (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 74.68 (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=	82.15	79.16	76.18	73.19	70.2	67.21	67.21	70.2	73.19	76.18	79.16	82.15	

Total = Sum(44)$_{1...12}$ = 896.19 (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=	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.4	85.41	99.53	108.65	117.98	

Total = Sum(45)$_{1...12}$ = 1175.05 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	

Output from water heater (annual)$_{1...12}$ | 1825.89 | (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=	84.73	75.37	80.78	74.67	74.8	69.19	68.68	72.28	71.19	77.32	78.92	83.45	(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=	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(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=	148.51	150.05	146.16	137.9	127.46	117.65	111.1	109.56	113.44	121.71	132.15	141.95	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains (Table 5)

(72)m=	113.88	112.16	108.58	103.71	100.54	96.09	92.31	97.16	98.88	103.92	109.61	112.17	(72)

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

(73)m=	324.2	322.53	312.87	297.41	281.98	266.88	256.91	261.7	269.5	285.13	303.09	316.29	(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)	
North	0.9x 0.77	x	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x 0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)

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North	0.9x	0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x	0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x	0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)
North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Southwest	0.9x	0.77	x	2.09	x	36.79		0.46	x	0.8	=	19.61	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79		0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	2.09	x	62.67		0.46	x	0.8	=	33.4	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67		0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	2.09	x	85.75		0.46	x	0.8	=	45.71	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75		0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	2.09	x	106.25		0.46	x	0.8	=	56.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25		0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	2.09	x	119.01		0.46	x	0.8	=	63.43	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01		0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	2.09	x	118.15		0.46	x	0.8	=	62.97	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15		0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	2.09	x	113.91		0.46	x	0.8	=	60.71	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91		0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	2.09	x	104.39		0.46	x	0.8	=	55.64	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39		0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	2.09	x	92.85		0.46	x	0.8	=	49.49	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85		0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	2.09	x	69.27		0.46	x	0.8	=	36.92	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27		0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	2.09	x	44.07		0.46	x	0.8	=	23.49	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	2.09	x	31.49		0.46	x	0.8	=	16.78	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)
West	0.9x	0.77	x	6.28	x	19.64	x	0.46	x	0.8	=	31.45	(80)
West	0.9x	0.77	x	6.28	x	38.42	x	0.46	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	6.28	x	63.27	x	0.46	x	0.8	=	101.34	(80)
West	0.9x	0.77	x	6.28	x	92.28	x	0.46	x	0.8	=	147.79	(80)
West	0.9x	0.77	x	6.28	x	113.09	x	0.46	x	0.8	=	181.12	(80)
West	0.9x	0.77	x	6.28	x	115.77	x	0.46	x	0.8	=	185.41	(80)
West	0.9x	0.77	x	6.28	x	110.22	x	0.46	x	0.8	=	176.52	(80)

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West	0.9x	0.77	x	6.28	x	94.68	x	0.46	x	0.8	=	151.63	(80)
West	0.9x	0.77	x	6.28	x	73.59	x	0.46	x	0.8	=	117.86	(80)
West	0.9x	0.77	x	6.28	x	45.59	x	0.46	x	0.8	=	73.01	(80)
West	0.9x	0.77	x	6.28	x	24.49	x	0.46	x	0.8	=	39.22	(80)
West	0.9x	0.77	x	6.28	x	16.15	x	0.46	x	0.8	=	25.87	(80)

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

(83)m=	101.74	183.62	275.57	377.23	451.56	460.1	438.75	382.12	310.93	209.8	123.82	85.77	(83)

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

(84)m=	425.94	506.15	588.44	674.64	733.55	726.99	695.66	643.82	580.43	494.93	426.91	402.06	(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	0.93	0.82	0.64	0.45	0.33	0.37	0.6	0.88	0.98	0.99	(86)

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

(87)m=	20.1	20.3	20.57	20.84	20.96	21	21	21	20.98	20.79	20.4	20.06	(87)

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

(88)m=	20.03	20.03	20.03	20.04	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04	(88)

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

(89)m=	0.99	0.97	0.92	0.78	0.58	0.39	0.26	0.29	0.53	0.85	0.97	0.99	(89)

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

(90)m=	18.85	19.14	19.52	19.87	20.02	20.06	20.06	20.06	20.04	19.83	19.29	18.8	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.44	19.69	20.02	20.33	20.46	20.5	20.5	20.5	20.48	20.28	19.81	19.4	(92)

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

(93)m=	19.44	19.69	20.02	20.33	20.46	20.5	20.5	20.5	20.48	20.28	19.81	19.4	(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	0.92	0.79	0.61	0.42	0.29	0.33	0.56	0.86	0.97	0.99	(94)

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

(95)m=	419.49	488.68	538.95	535.68	447.18	305.09	202.7	212.4	326.6	424.25	412.89	397.35	(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=	815.05	793.97	723.78	603.85	461.73	306.64	202.86	212.71	333.65	510.21	673.39	809.47	(97)

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

(98)m=	294.3	205.16	137.52	49.08	10.83	0	0	0	0	63.96	187.56	306.62	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 1255.01 (98)

Space heating requirement in kWh/m²/year 24.86 (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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1255.01	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1380.51	(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		1825.89	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2008.48	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.89	(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		103.95	(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) =	103.95	(331)
Energy for lighting (calculated in Appendix L)		233.81	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3726.75	(338)

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	=	813.36	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	17.59	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	830.95	(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)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			830.95	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	53.95	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.35	(379)
Total CO2, kg/year	sum of (376)…(382) =			1006.24	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			19.93	(384)
EI rating (section 14)				85.88	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 8 - Apt 22

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.58	(1a) x	2.7	(2a) =	190.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		190.57	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 4			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Walls Type1	46.14	16.75	29.39	x	0.18	=	5.29			(29)
Walls Type2	18.71	1.89	16.82	x	0.17	=	2.81			(29)
Roof	70.58	0	70.58	x	0.12	=	8.47			(30)
Total area of elements, m²			135.43							(31)
Party wall			25.6	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.01 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 635.22 (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 10.27 (36)

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

Total fabric heat loss (33) + (36) = 43.28 (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=	18.95	18.75	18.55	17.55	17.34	16.34	16.34	16.14	16.74	17.34	17.75	18.15	(38)

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

(39)m=	62.23	62.03	61.83	60.83	60.63	59.63	59.63	59.43	60.03	60.63	61.03	61.43	

Average = Sum(39)$_{1...12}$ /12= 60.78 (39)

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

(40)m=	0.88	0.88	0.88	0.86	0.86	0.84	0.84	0.84	0.85	0.86	0.86	0.87	

Average = Sum(40)$_{1...12}$ /12= 0.86 (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 2.26 (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 87.88 (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=	96.67	93.15	89.64	86.12	82.61	79.09	79.09	82.61	86.12	89.64	93.15	96.67	

Total = Sum(44)$_{1...12}$ = 1054.54 (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=	143.35	125.38	129.38	112.79	108.23	93.39	86.54	99.31	100.5	117.12	127.84	138.83	

Total = Sum(45)$_{1...12}$ = 1382.66 (45)

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

(46)m=	21.5	18.81	19.41	16.92	16.23	14.01	12.98	14.9	15.07	17.57	19.18	20.82	(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=	198.63	175.3	184.65	166.29	163.51	146.89	141.82	154.59	153.99	172.39	181.34	194.11	(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=	198.63	175.3	184.65	166.29	163.51	146.89	141.82	154.59	153.99	172.39	181.34	194.11	

Output from water heater (annual)$_{1...12}$ | 2033.5 | (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=	91.89	81.63	87.24	80.3	80.21	73.85	73	77.24	76.21	83.16	85.3	90.38	(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=	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	(66)

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

(67)m=	17.71	15.73	12.79	9.68	7.24	6.11	6.6	8.58	11.52	14.63	17.07	18.2	(67)

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

(68)m=	198.65	200.71	195.51	184.46	170.5	157.38	148.61	146.55	151.74	162.8	176.76	189.88	(68)

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

(69)m=	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	(71)

Water heating gains (Table 5)

(72)m=	123.5	121.47	117.26	111.53	107.81	102.57	98.11	103.82	105.85	111.78	118.48	121.48	(72)

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

(73)m=	396.76	394.81	382.47	362.57	342.44	322.96	310.23	315.86	326.01	346.11	369.21	386.47	(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)	
Southeast 0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast 0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)

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Southeast	0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast	0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast	0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)
Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97	(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71	(77)
Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64	(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49	(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92	(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49	(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78	(77)
South	0.9x	0.77	x	6.28	x	46.75	x	0.46	x	0.8	=	74.88	(78)
South	0.9x	0.77	x	6.28	x	76.57	x	0.46	x	0.8	=	122.63	(78)
South	0.9x	0.77	x	6.28	x	97.53	x	0.46	x	0.8	=	156.21	(78)
South	0.9x	0.77	x	6.28	x	110.23	x	0.46	x	0.8	=	176.55	(78)
South	0.9x	0.77	x	6.28	x	114.87	x	0.46	x	0.8	=	183.97	(78)
South	0.9x	0.77	x	6.28	x	110.55	x	0.46	x	0.8	=	177.05	(78)
South	0.9x	0.77	x	6.28	x	108.01	x	0.46	x	0.8	=	172.99	(78)
South	0.9x	0.77	x	6.28	x	104.89	x	0.46	x	0.8	=	167.99	(78)
South	0.9x	0.77	x	6.28	x	101.89	x	0.46	x	0.8	=	163.18	(78)
South	0.9x	0.77	x	6.28	x	82.59	x	0.46	x	0.8	=	132.27	(78)
South	0.9x	0.77	x	6.28	x	55.42	x	0.46	x	0.8	=	88.75	(78)
South	0.9x	0.77	x	6.28	x	40.4	x	0.46	x	0.8	=	64.7	(78)
Southwest	0.9x	0.77	x	4.19	x	36.79	x	0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79	x	0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67	x	0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67	x	0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75	x	0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75	x	0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25	x	0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25	x	0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01	x	0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01	x	0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15	x	0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15	x	0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91	x	0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91	x	0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39	x	0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39	x	0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85	x	0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85	x	0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27	x	0.46	x	0.8	=	74.02	(79)

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Southwest	0.9x	0.77	x	4.19	x	69.27		0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	173.12	289.97	385.17	460.25	501.74	492.52	477.14	446.73	411.1	317.22	206.43	148.78	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	569.88	684.78	767.64	822.82	844.19	815.48	787.37	762.58	737.11	663.33	575.64	535.24	(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	0.97	0.92	0.81	0.65	0.47	0.33	0.36	0.56	0.84	0.97	0.99	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	20.33	20.53	20.73	20.9	20.98	21	21	21	20.99	20.9	20.59	20.3	(87)

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=	20.18	20.19	20.19	20.2	20.2	20.21	20.21	20.22	20.21	20.2	20.2	20.19	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.96	0.9	0.78	0.6	0.41	0.27	0.3	0.49	0.8	0.96	0.99	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	19.31	19.59	19.87	20.1	20.18	20.21	20.21	20.22	20.21	20.1	19.69	19.26	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.73	19.98	20.23	20.43	20.51	20.54	20.54	20.54	20.53	20.43	20.06	19.69	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.73	19.98	20.23	20.43	20.51	20.54	20.54	20.54	20.53	20.43	20.06	19.69	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.79	0.62	0.43	0.3	0.32	0.52	0.81	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	560.8	655.79	692.44	647.34	523.36	353.12	234.79	245.92	383.16	540.11	552.64	528.98	(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=	960.4	935.3	848.74	701.46	534.28	354.02	234.85	246.03	386.03	595.94	791.22	951.58	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	297.31	187.84	116.29	38.96	8.12	0	0	0	0	41.54	171.78	314.42	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1176.25 (98)

Space heating requirement in kWh/m²/year 16.67 (99)

DER WorkSheet: New dwelling design stage

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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1176.25	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1293.88	(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		2033.5	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2236.85	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.31	(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		145.31	(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) =	145.31	(331)
Energy for lighting (calculated in Appendix L)		312.76	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3988.79	(338)

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	=	847.38	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.32	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	865.7	(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)

DER WorkSheet: New dwelling design stage

Total CO2 associated with space and water heating	(373) + (374) + (375) =			865.7	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	75.41	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	162.32	(379)
Total CO2, kg/year	sum of (376)…(382) =			1103.43	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.63	(384)
EI rating (section 14)				87.21	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 8 - Apt 23

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.96	(1a) x	2.7	(2a) =	140.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		140.29	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 2			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Walls Type1	44.06	14.65	29.41	x	0.18	=	5.29			(29)
Walls Type2	4.02	1.89	2.13	x	0.17	=	0.36			(29)
Walls Type3	11.88	0	11.88	x	0.15	=	1.84			(29)
Roof	51.96	0	51.96	x	0.12	=	6.24			(30)
Total area of elements, m²			111.93							(31)
Party wall			16.5	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 467.64 (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 9.31 (36)

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

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

DER WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	13.95	13.8	13.65	12.92	12.77	12.03	12.03	11.88	12.33	12.77	13.06	13.36	(38)

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

(39)m=	51.6	51.46	51.31	50.57	50.42	49.69	49.69	49.54	49.98	50.42	50.72	51.01	

Average = Sum(39)$_{1...12}$ /12= 50.53 (39)

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

(40)m=	0.99	0.99	0.99	0.97	0.97	0.96	0.96	0.95	0.96	0.97	0.98	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (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 75.71 (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=	83.28	80.26	77.23	74.2	71.17	68.14	68.14	71.17	74.2	77.23	80.26	83.28	

Total = Sum(44)$_{1...12}$ = 908.55 (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=	123.51	108.02	111.47	97.18	93.25	80.46	74.56	85.56	86.58	100.9	110.14	119.61	

Total = Sum(45)$_{1...12}$ = 1191.25 (45)

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

(46)m=	18.53	16.2	16.72	14.58	13.99	12.07	11.18	12.83	12.99	15.14	16.52	17.94	(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)

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

(57)m=	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=	178.78	157.95	166.74	150.67	148.52	133.96	129.84	140.84	140.08	156.18	163.64	174.89	(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=	178.78	157.95	166.74	150.67	148.52	133.96	129.84	140.84	140.08	156.18	163.64	174.89	

Output from water heater (annual)$_{1...12}$ — 1842.09 — (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=	85.29	75.86	81.28	75.11	75.23	69.55	69.01	72.67	71.58	77.77	79.42	83.99	(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=	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	(66)

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

(67)m=	13.58	12.06	9.81	7.43	5.55	4.69	5.06	6.58	8.83	11.22	13.09	13.96	(67)

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

(68)m=	152.32	153.9	149.92	141.44	130.74	120.68	113.95	112.37	116.36	124.84	135.54	145.6	(68)

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

(69)m=	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	(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=	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	(71)

Water heating gains (Table 5)

(72)m=	114.63	112.88	109.25	104.32	101.11	96.6	92.76	97.68	99.42	104.53	110.3	112.89	(72)

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

(73)m=	329.75	328.07	318.2	302.4	286.62	271.18	261	265.85	273.83	289.81	308.15	321.67	(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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North	0.9x	0.77	x	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x	0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)
North	0.9x	0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x	0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x	0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)
North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Northeast	0.9x	0.77	x	6.28	x	11.28	x	0.46	x	0.8	=	18.07	(75)
Northeast	0.9x	0.77	x	6.28	x	22.97	x	0.46	x	0.8	=	36.78	(75)
Northeast	0.9x	0.77	x	6.28	x	41.38	x	0.46	x	0.8	=	66.27	(75)
Northeast	0.9x	0.77	x	6.28	x	67.96	x	0.46	x	0.8	=	108.83	(75)
Northeast	0.9x	0.77	x	6.28	x	91.35	x	0.46	x	0.8	=	146.3	(75)
Northeast	0.9x	0.77	x	6.28	x	97.38	x	0.46	x	0.8	=	155.97	(75)
Northeast	0.9x	0.77	x	6.28	x	91.1	x	0.46	x	0.8	=	145.9	(75)
Northeast	0.9x	0.77	x	6.28	x	72.63	x	0.46	x	0.8	=	116.32	(75)
Northeast	0.9x	0.77	x	6.28	x	50.42	x	0.46	x	0.8	=	80.75	(75)
Northeast	0.9x	0.77	x	6.28	x	28.07	x	0.46	x	0.8	=	44.95	(75)
Northeast	0.9x	0.77	x	6.28	x	14.2	x	0.46	x	0.8	=	22.74	(75)
Northeast	0.9x	0.77	x	6.28	x	9.21	x	0.46	x	0.8	=	14.76	(75)
East	0.9x	0.77	x	2.09	x	19.64	x	0.46	x	0.8	=	10.47	(76)
East	0.9x	0.77	x	2.09	x	38.42	x	0.46	x	0.8	=	20.48	(76)
East	0.9x	0.77	x	2.09	x	63.27	x	0.46	x	0.8	=	33.72	(76)
East	0.9x	0.77	x	2.09	x	92.28	x	0.46	x	0.8	=	49.19	(76)
East	0.9x	0.77	x	2.09	x	113.09	x	0.46	x	0.8	=	60.28	(76)
East	0.9x	0.77	x	2.09	x	115.77	x	0.46	x	0.8	=	61.71	(76)
East	0.9x	0.77	x	2.09	x	110.22	x	0.46	x	0.8	=	58.75	(76)
East	0.9x	0.77	x	2.09	x	94.68	x	0.46	x	0.8	=	50.46	(76)
East	0.9x	0.77	x	2.09	x	73.59	x	0.46	x	0.8	=	39.22	(76)
East	0.9x	0.77	x	2.09	x	45.59	x	0.46	x	0.8	=	24.3	(76)
East	0.9x	0.77	x	2.09	x	24.49	x	0.46	x	0.8	=	13.05	(76)
East	0.9x	0.77	x	2.09	x	16.15	x	0.46	x	0.8	=	8.61	(76)
Southeast	0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast	0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)
Southeast	0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast	0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast	0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)

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Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97		(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71		(77)
Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64		(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49		(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92		(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49		(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78		(77)

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

(83)m=	59.51	112.38	182.6	273.92	349.84	366.11	345.16	285.73	213.83	132.02	73.3	49.62	(83)

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

(84)m=	389.27	440.45	500.8	576.32	636.46	637.29	606.16	551.58	487.66	421.82	381.45	371.29	(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	0.96	0.88	0.7	0.49	0.36	0.41	0.68	0.93	0.99	1	(86)

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

(87)m=	20.12	20.27	20.51	20.8	20.95	20.99	21	21	20.97	20.75	20.39	20.09	(87)

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

(88)m=	20.09	20.09	20.09	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.1	20.1	(88)

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

(89)m=	0.99	0.98	0.95	0.84	0.64	0.43	0.29	0.33	0.6	0.9	0.98	0.99	(89)

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

(90)m=	18.92	19.14	19.49	19.89	20.07	20.12	20.12	20.12	20.1	19.84	19.32	18.89	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.47	19.66	19.96	20.31	20.48	20.52	20.53	20.53	20.5	20.26	19.81	19.45	(92)

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

(93)m=	19.47	19.66	19.96	20.31	20.48	20.52	20.53	20.53	20.5	20.26	19.81	19.45	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.85	0.67	0.46	0.32	0.37	0.64	0.91	0.98	0.99	(94)

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

(95)m=	385.49	431.82	475.78	491.31	424.5	292.53	194.91	204.06	309.85	382.22	373.58	368.44	(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=	783.02	759.56	690.8	576.98	442.62	294.27	195.08	204.45	319.91	487.05	644.88	777.75	(97)

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

(98)m=	295.76	220.24	159.97	61.69	13.48	0	0	0	0	77.99	195.34	304.53	

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1329	(98)
Space heating requirement in kWh/m²/year		25.58	(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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1329	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1461.9	(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		1842.09	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2026.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)...(307e) + (310a)...(310e)] =	34.88	(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		106.97	(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) =	106.97	(331)
Energy for lighting (calculated in Appendix L)		239.82	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3835	(338)

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	=	837.17	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.1	(372)

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Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	855.27	(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) =			855.27	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	55.52	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	124.47	(379)
Total CO2, kg/year	sum of (376)…(382) =			1035.26	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			19.92	(384)
EI rating (section 14)				85.69	(385)

Appendix C – “Be Green” SAP Output Documents

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 1 - Apt 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80.71	(1a) x	2.7	(2a) =	217.92	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		217.92	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 2			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 3			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 4			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 5			2.09	x1/[1/(0.9)+ 0.04]		=	1.82			(27)
Windows Type 6			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 7			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 8			6.28	x1/[1/(0.9)+ 0.04]		=	5.46			(27)
Windows Type 9			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 10			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Floor Type 1			14.57	x	0.065	=	0.9470499			(28)
Floor Type 2			33.19	x	0.13	=	4.3147			(28)
Floor Type 3			32.95	x	0.13	=	4.2835			(28)
Walls Type1	80.38	19.09	61.29	x	0.18	=	11.03			(29)
Walls Type2	29.57	1.89	27.68	x	0.17	=	4.62			(29)
Total area of elements, m²			190.65							(31)
Party wall			18.31	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.67 (33)

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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 21.73 (36)

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

Total fabric heat loss (33) + (36) = 65.4 (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=	21.67	21.44	21.21	20.06	19.83	18.69	18.69	18.46	19.15	19.83	20.29	20.75	(38)

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

(39)m=	87.07	86.84	86.61	85.47	85.24	84.09	84.09	83.86	84.55	85.24	85.7	86.16	

Average = Sum(39)$_{1...12}$ /12= 85.41 (39)

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

(40)m=	1.08	1.08	1.07	1.06	1.06	1.04	1.04	1.04	1.05	1.06	1.06	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 2.48 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.01 (43)

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

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

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

(44)m=	102.31	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.31	

Total = Sum(44)$_{1...12}$ = 1116.12 (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=	151.72	132.7	136.93	119.38	114.55	98.85	91.6	105.11	106.36	123.96	135.31	146.94	

Total = Sum(45)$_{1...12}$ = 1463.4 (45)

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

(46)m=	22.76	19.9	20.54	17.91	17.18	14.83	13.74	15.77	15.95	18.59	20.3	22.04	(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:

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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=	207	182.63	192.21	172.88	169.83	152.34	146.87	160.39	159.86	179.23	188.8	202.21	(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=	207	182.63	192.21	172.88	169.83	152.34	146.87	160.39	159.86	179.23	188.8	202.21	

Output from water heater (annual)$_{1...12}$ 2114.24 (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=	94.67	84.06	89.75	82.49	82.31	75.66	74.68	79.17	78.16	85.44	87.79	93.08	(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=	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	123.81	(66)

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

(67)m=	19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24	(67)

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

(68)m=	220.92	223.21	217.43	205.14	189.61	175.02	165.27	162.98	168.76	181.06	196.58	211.17	(68)

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

(69)m=	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	-99.05	(71)

Water heating gains (Table 5)

(72)m=	127.24	125.1	120.63	114.57	110.63	105.09	100.37	106.41	108.56	114.83	121.92	125.1	(72)

DER WorkSheet: New dwelling design stage

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

(73)m=	428	425.94	412.44	390.62	368.44	347.05	333.13	339.08	350.27	372.3	397.63	416.66	(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	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North 0.9x	0.77	x	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North 0.9x	0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North 0.9x	0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North 0.9x	0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North 0.9x	0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North 0.9x	0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North 0.9x	0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North 0.9x	0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North 0.9x	0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North 0.9x	0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North 0.9x	0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North 0.9x	0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North 0.9x	0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North 0.9x	0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North 0.9x	0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North 0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North 0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North 0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North 0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North 0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North 0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North 0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
North 0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	2.09	x	36.79		0.46	x	0.8	=	19.61	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	36.79		0.46	x	0.8	=	12.57	(79)
Southwest 0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest 0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest 0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)

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Southwest	0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest	0.9x	0.77	x	2.09	x	62.67		0.46	x	0.8	=	33.4	(79)
Southwest	0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest	0.9x	0.77	x	1.34	x	62.67		0.46	x	0.8	=	21.42	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	2.09	x	85.75		0.46	x	0.8	=	45.71	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	85.75		0.46	x	0.8	=	29.3	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	2.09	x	106.25		0.46	x	0.8	=	56.63	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	106.25		0.46	x	0.8	=	36.31	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	2.09	x	119.01		0.46	x	0.8	=	63.43	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	119.01		0.46	x	0.8	=	40.67	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	2.09	x	118.15		0.46	x	0.8	=	62.97	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	118.15		0.46	x	0.8	=	40.38	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	2.09	x	113.91		0.46	x	0.8	=	60.71	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	113.91		0.46	x	0.8	=	38.93	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)

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Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	2.09	x	104.39		0.46	x	0.8	=	55.64	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	1.34	x	104.39		0.46	x	0.8	=	35.67	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	2.09	x	92.85		0.46	x	0.8	=	49.49	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	92.85		0.46	x	0.8	=	31.73	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	2.09	x	69.27		0.46	x	0.8	=	36.92	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	69.27		0.46	x	0.8	=	23.67	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	2.09	x	44.07		0.46	x	0.8	=	23.49	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	44.07		0.46	x	0.8	=	15.06	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	2.09	x	31.49		0.46	x	0.8	=	16.78	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
Southwest	0.9x	0.77	x	1.34	x	31.49		0.46	x	0.8	=	10.76	(79)
West	0.9x	0.77	x	6.28	x	19.64	x	0.46	x	0.8	=	31.45	(80)
West	0.9x	0.77	x	6.28	x	38.42	x	0.46	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	6.28	x	63.27	x	0.46	x	0.8	=	101.34	(80)
West	0.9x	0.77	x	6.28	x	92.28	x	0.46	x	0.8	=	147.79	(80)
West	0.9x	0.77	x	6.28	x	113.09	x	0.46	x	0.8	=	181.12	(80)
West	0.9x	0.77	x	6.28	x	115.77	x	0.46	x	0.8	=	185.41	(80)
West	0.9x	0.77	x	6.28	x	110.22	x	0.46	x	0.8	=	176.52	(80)
West	0.9x	0.77	x	6.28	x	94.68	x	0.46	x	0.8	=	151.63	(80)

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West	0.9x	0.77	x	6.28	x	73.59	x	0.46	x	0.8	=	117.86	(80)
West	0.9x	0.77	x	6.28	x	45.59	x	0.46	x	0.8	=	73.01	(80)
West	0.9x	0.77	x	6.28	x	24.49	x	0.46	x	0.8	=	39.22	(80)
West	0.9x	0.77	x	6.28	x	16.15	x	0.46	x	0.8	=	25.87	(80)

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

(83)m=	133.78	237.33	346.47	460.19	539.64	545.31	521.83	461.8	386.11	268.49	162.04	113.27	(83)

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

(84)m=	561.78	663.27	758.9	850.81	908.08	892.35	854.96	800.88	736.38	640.79	559.67	529.93	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.43	0.48	0.73	0.94	0.99	1	(86)

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

(87)m=	19.95	20.13	20.39	20.7	20.9	20.98	21	21	20.95	20.67	20.25	19.91	(87)

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

(88)m=	20.02	20.02	20.02	20.03	20.04	20.05	20.05	20.05	20.04	20.04	20.03	20.03	(88)

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

(89)m=	0.99	0.99	0.96	0.89	0.73	0.51	0.34	0.38	0.65	0.92	0.99	1	(89)

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

(90)m=	18.62	18.88	19.26	19.69	19.95	20.04	20.05	20.05	20.01	19.67	19.07	18.58	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	19.08	19.32	19.65	20.04	20.28	20.37	20.38	20.38	20.33	20.02	19.48	19.05	(92)

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

(93)m=	19.08	19.32	19.65	20.04	20.28	20.37	20.38	20.38	20.33	20.02	19.48	19.05	(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=	0.99	0.98	0.96	0.89	0.74	0.53	0.37	0.41	0.68	0.92	0.98	0.99	(94)

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

(95)m=	557.82	652.33	727.22	754.18	672.02	476.83	316.84	332.05	499.38	590.36	550.94	527.11	(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=	1287.09	1251.89	1139.29	952.25	731.27	485	317.76	333.69	527.08	802.54	1060.92	1279.05	(97)

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

(98)m=	542.58	402.91	306.58	142.61	44.08	0	0	0	0	157.86	367.18	559.45	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2523.25 (98)

Space heating requirement in kWh/m²/year 31.26 (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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2523.25	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2775.58	(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		2114.24	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2325.67	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	51.01	(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		166.16	(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) =	166.16	(331)
Energy for lighting (calculated in Appendix L)		347.82	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-423.17	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5192.05	(338)

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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1059.02	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.48	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1085.49	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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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) =			1085.49	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	86.24	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	180.52	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-219.63	(380)
Total CO2, kg/year	sum of (376)…(382) =			1132.62	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.03	(384)
EI rating (section 14)				87.93	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 1 - Apt 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	95.04	(1a) x	2.7	(2a) =	256.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	95.04	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		256.61	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 2			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 3			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 4			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 5			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 6			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Windows Type 7			2.09	x1/[1/(0.9)+ 0.04]		=	1.82			(27)
Windows Type 8			2.09	x1/[1/(0.9)+ 0.04]		=	1.82			(27)
Windows Type 9			6.28	x1/[1/(0.9)+ 0.04]		=	5.46			(27)
Windows Type 10			1.34	x1/[1/(0.9)+ 0.04]		=	1.16			(27)
Floor Type 1			30.54	x	0.13	=	3.9702			(28)
Floor Type 2			35.35	x	0.13	=	4.5955			(28)
Floor Type 3			29.15	x	0.13	=	3.7895			(28)
Walls Type1	73.22	19.84	53.38	x	0.18	=	9.61			(29)
Walls Type2	11.07	1.89	9.18	x	0.17	=	1.53			(29)
Walls Type3	11.88	0	11.88	x	0.15	=	1.84			(29)
Roof	5.68	0	5.68	x	0.12	=	0.68			(30)
Total area of elements, m²			196.89							(31)

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Party wall	18.31	x	0	=	0	(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	45.15 (33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	51.12 (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 — 20.68 (36)

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

Total fabric heat loss — (33) + (36) = — 65.82 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.52	25.25	24.98	23.63	23.36	22.01	22.01	21.74	22.55	23.36	23.9	24.44	(38)

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

(39)m=	91.34	91.07	90.8	89.45	89.18	87.83	87.83	87.56	88.37	89.18	89.72	90.26	

Average = Sum(39)$_{1...12}$ /12= 89.38 (39)

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

(40)m=	0.96	0.96	0.96	0.94	0.94	0.92	0.92	0.92	0.93	0.94	0.94	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.94 (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 — 2.69 (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 — 98.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	107.86	103.94	100.02	96.09	92.17	88.25	88.25	92.17	96.09	100.02	103.94	107.86	

Total = Sum(44)$_{1...12}$ = 1176.66 (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=	159.95	139.9	144.36	125.86	120.76	104.21	96.57	110.81	112.13	130.68	142.65	154.91	

Total = Sum(45)$_{1...12}$ = 1542.78 (45)

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

(46)m=	23.99	20.98	21.65	18.88	18.11	15.63	14.48	16.62	16.82	19.6	21.4	23.24	(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)

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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=	215.23	189.82	199.64	179.35	176.04	157.7	151.84	166.09	165.63	185.96	196.14	210.18	(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=	215.23	189.82	199.64	179.35	176.04	157.7	151.84	166.09	165.63	185.96	196.14	210.18	

Output from water heater (annual)$_{1...12}$: 2193.62 (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=	97.41	86.46	92.22	84.64	84.38	77.44	76.33	81.07	80.08	87.67	90.23	95.73	(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=	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	134.43	(66)

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

(67)m=	22.11	19.64	15.97	12.09	9.04	7.63	8.25	10.72	14.39	18.27	21.32	22.73	(67)

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

(68)m=	248.05	250.62	244.14	230.33	212.9	196.52	185.57	183	189.48	203.29	220.72	237.11	(68)

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

(69)m=	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	36.44	(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=	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	-107.54	(71)

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Water heating gains (Table 5)

(72)m=	130.92	128.66	123.95	117.56	113.41	107.56	102.59	108.96	111.22	117.84	125.31	128.67	(72)

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

(73)m=	464.42	462.25	447.39	423.31	398.68	375.04	359.74	366	378.42	402.73	430.69	451.83	(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	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North	0.9x 0.77	x	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North	0.9x 0.77	x	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North	0.9x 0.77	x	1.34	x	10.63	x	0.46	x	0.8	=	3.63	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North	0.9x 0.77	x	1.34	x	20.32	x	0.46	x	0.8	=	6.94	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North	0.9x 0.77	x	1.34	x	34.53	x	0.46	x	0.8	=	11.8	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North	0.9x 0.77	x	1.34	x	55.46	x	0.46	x	0.8	=	18.95	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North	0.9x 0.77	x	1.34	x	74.72	x	0.46	x	0.8	=	25.53	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North	0.9x 0.77	x	1.34	x	79.99	x	0.46	x	0.8	=	27.33	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North	0.9x 0.77	x	1.34	x	74.68	x	0.46	x	0.8	=	25.52	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)
North	0.9x 0.77	x	1.34	x	59.25	x	0.46	x	0.8	=	20.25	(74)

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North	0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North	0.9x	0.77	x	1.34	x	41.52	x	0.46	x	0.8	=	14.19	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North	0.9x	0.77	x	1.34	x	24.19	x	0.46	x	0.8	=	8.27	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North	0.9x	0.77	x	1.34	x	13.12	x	0.46	x	0.8	=	4.48	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
North	0.9x	0.77	x	1.34	x	8.86	x	0.46	x	0.8	=	3.03	(74)
East	0.9x	0.77	x	1.34	x	19.64	x	0.46	x	0.8	=	6.71	(76)
East	0.9x	0.77	x	1.34	x	19.64	x	0.46	x	0.8	=	6.71	(76)
East	0.9x	0.77	x	2.09	x	19.64	x	0.46	x	0.8	=	10.47	(76)
East	0.9x	0.77	x	1.34	x	38.42	x	0.46	x	0.8	=	13.13	(76)
East	0.9x	0.77	x	1.34	x	38.42	x	0.46	x	0.8	=	13.13	(76)
East	0.9x	0.77	x	2.09	x	38.42	x	0.46	x	0.8	=	20.48	(76)
East	0.9x	0.77	x	1.34	x	63.27	x	0.46	x	0.8	=	21.62	(76)
East	0.9x	0.77	x	1.34	x	63.27	x	0.46	x	0.8	=	21.62	(76)
East	0.9x	0.77	x	2.09	x	63.27	x	0.46	x	0.8	=	33.72	(76)
East	0.9x	0.77	x	1.34	x	92.28	x	0.46	x	0.8	=	31.54	(76)
East	0.9x	0.77	x	1.34	x	92.28	x	0.46	x	0.8	=	31.54	(76)
East	0.9x	0.77	x	2.09	x	92.28	x	0.46	x	0.8	=	49.19	(76)
East	0.9x	0.77	x	1.34	x	113.09	x	0.46	x	0.8	=	38.65	(76)
East	0.9x	0.77	x	1.34	x	113.09	x	0.46	x	0.8	=	38.65	(76)
East	0.9x	0.77	x	2.09	x	113.09	x	0.46	x	0.8	=	60.28	(76)
East	0.9x	0.77	x	1.34	x	115.77	x	0.46	x	0.8	=	39.56	(76)
East	0.9x	0.77	x	1.34	x	115.77	x	0.46	x	0.8	=	39.56	(76)
East	0.9x	0.77	x	2.09	x	115.77	x	0.46	x	0.8	=	61.71	(76)
East	0.9x	0.77	x	1.34	x	110.22	x	0.46	x	0.8	=	37.67	(76)
East	0.9x	0.77	x	1.34	x	110.22	x	0.46	x	0.8	=	37.67	(76)
East	0.9x	0.77	x	2.09	x	110.22	x	0.46	x	0.8	=	58.75	(76)
East	0.9x	0.77	x	1.34	x	94.68	x	0.46	x	0.8	=	32.35	(76)
East	0.9x	0.77	x	1.34	x	94.68	x	0.46	x	0.8	=	32.35	(76)
East	0.9x	0.77	x	2.09	x	94.68	x	0.46	x	0.8	=	50.46	(76)
East	0.9x	0.77	x	1.34	x	73.59	x	0.46	x	0.8	=	25.15	(76)

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East	0.9x	0.77	x	1.34	x	73.59	x	0.46	x	0.8	=	25.15	(76)
East	0.9x	0.77	x	2.09	x	73.59	x	0.46	x	0.8	=	39.22	(76)
East	0.9x	0.77	x	1.34	x	45.59	x	0.46	x	0.8	=	15.58	(76)
East	0.9x	0.77	x	1.34	x	45.59	x	0.46	x	0.8	=	15.58	(76)
East	0.9x	0.77	x	2.09	x	45.59	x	0.46	x	0.8	=	24.3	(76)
East	0.9x	0.77	x	1.34	x	24.49	x	0.46	x	0.8	=	8.37	(76)
East	0.9x	0.77	x	1.34	x	24.49	x	0.46	x	0.8	=	8.37	(76)
East	0.9x	0.77	x	2.09	x	24.49	x	0.46	x	0.8	=	13.05	(76)
East	0.9x	0.77	x	1.34	x	16.15	x	0.46	x	0.8	=	5.52	(76)
East	0.9x	0.77	x	1.34	x	16.15	x	0.46	x	0.8	=	5.52	(76)
East	0.9x	0.77	x	2.09	x	16.15	x	0.46	x	0.8	=	8.61	(76)
Southeast	0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast	0.9x	0.77	x	1.34	x	36.79	x	0.46	x	0.8	=	12.57	(77)
Southeast	0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)
Southeast	0.9x	0.77	x	1.34	x	62.67	x	0.46	x	0.8	=	21.42	(77)
Southeast	0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast	0.9x	0.77	x	1.34	x	85.75	x	0.46	x	0.8	=	29.3	(77)
Southeast	0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast	0.9x	0.77	x	1.34	x	106.25	x	0.46	x	0.8	=	36.31	(77)
Southeast	0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)
Southeast	0.9x	0.77	x	1.34	x	119.01	x	0.46	x	0.8	=	40.67	(77)
Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97	(77)
Southeast	0.9x	0.77	x	1.34	x	118.15	x	0.46	x	0.8	=	40.38	(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71	(77)
Southeast	0.9x	0.77	x	1.34	x	113.91	x	0.46	x	0.8	=	38.93	(77)
Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64	(77)
Southeast	0.9x	0.77	x	1.34	x	104.39	x	0.46	x	0.8	=	35.67	(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49	(77)
Southeast	0.9x	0.77	x	1.34	x	92.85	x	0.46	x	0.8	=	31.73	(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92	(77)
Southeast	0.9x	0.77	x	1.34	x	69.27	x	0.46	x	0.8	=	23.67	(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49	(77)
Southeast	0.9x	0.77	x	1.34	x	44.07	x	0.46	x	0.8	=	15.06	(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78	(77)
Southeast	0.9x	0.77	x	1.34	x	31.49	x	0.46	x	0.8	=	10.76	(77)
South	0.9x	0.77	x	6.28	x	46.75	x	0.46	x	0.8	=	74.88	(78)
South	0.9x	0.77	x	6.28	x	76.57	x	0.46	x	0.8	=	122.63	(78)
South	0.9x	0.77	x	6.28	x	97.53	x	0.46	x	0.8	=	156.21	(78)
South	0.9x	0.77	x	6.28	x	110.23	x	0.46	x	0.8	=	176.55	(78)
South	0.9x	0.77	x	6.28	x	114.87	x	0.46	x	0.8	=	183.97	(78)
South	0.9x	0.77	x	6.28	x	110.55	x	0.46	x	0.8	=	177.05	(78)

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South	0.9x	0.77	x	6.28	x	108.01	x	0.46	x	0.8	=	172.99	(78)
South	0.9x	0.77	x	6.28	x	104.89	x	0.46	x	0.8	=	167.99	(78)
South	0.9x	0.77	x	6.28	x	101.89	x	0.46	x	0.8	=	163.18	(78)
South	0.9x	0.77	x	6.28	x	82.59	x	0.46	x	0.8	=	132.27	(78)
South	0.9x	0.77	x	6.28	x	55.42	x	0.46	x	0.8	=	88.75	(78)
South	0.9x	0.77	x	6.28	x	40.4	x	0.46	x	0.8	=	64.7	(78)

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

(83)m=	145.49	251.96	355.39	457.56	527.78	530.56	508.78	455.46	390.66	281.38	175.02	124.01	(83)

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

(84)m=	609.9	714.22	802.78	880.87	926.45	905.6	868.52	821.47	769.09	684.11	605.71	575.84	(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	0.93	0.8	0.61	0.44	0.49	0.74	0.95	0.99	1	(86)

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

(87)m=	20.06	20.22	20.46	20.73	20.91	20.99	21	21	20.96	20.72	20.34	20.03	(87)

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

(88)m=	20.12	20.12	20.12	20.13	20.14	20.15	20.15	20.15	20.14	20.14	20.13	20.13	(88)

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

(89)m=	1	0.99	0.97	0.91	0.75	0.53	0.36	0.4	0.67	0.93	0.99	1	(89)

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

(90)m=	18.86	19.1	19.43	19.82	20.05	20.14	20.15	20.15	20.11	19.81	19.27	18.83	(90)

fLA = Living area ÷ (4) = 0.37 (91)

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

(92)m=	19.31	19.52	19.81	20.16	20.37	20.45	20.46	20.46	20.43	20.15	19.67	19.28	(92)

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

(93)m=	19.31	19.52	19.81	20.16	20.37	20.45	20.46	20.46	20.43	20.15	19.67	19.28	(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	0.77	0.56	0.39	0.43	0.69	0.93	0.99	1	(94)

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

(95)m=	606.85	705.32	776.56	798.12	712.19	506.63	338.58	354.53	533.7	637.13	598.47	573.71	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1370.78	1331.27	1208.88	1007.03	773.53	514.18	339.31	355.84	559.14	851.59	1127.72	1360.86	(97)

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

(98)m=	568.37	420.63	321.65	150.41	45.63	0	0	0	0	159.56	381.06	585.64	

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2632.95	(98)
Space heating requirement in kWh/m²/year		27.7	(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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2632.95	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2896.25	(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		2193.62	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2412.99	(310a)
Electricity used for heat distribution	0.01 × [(307a)...(307e) + (310a)...(310e)] =	53.09	(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		195.66	(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) =	195.66	(331)
Energy for lighting (calculated in Appendix L)		390.54	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-500.9	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5394.54	(338)

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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1102.2	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	27.55	(372)

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Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1129.75	(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) =			1129.75	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	101.55	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	202.69	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-259.97	(380)
Total CO2, kg/year	sum of (376)…(382) =			1174.02	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			12.35	(384)
EI rating (section 14)				88.77	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 2 - Apt 3

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.49	(1a) x	2.7	(2a) =	136.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.49	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.32	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Floor			3.66	x	0.13	=	0.4758			(28)
Walls Type1	50.65	16.75	33.9	x	0.18	=	6.1			(29)
Walls Type2	16.79	1.89	14.9	x	0.17	=	2.5			(29)
Total area of elements, m²			71.11							(31)
Party wall			8.96	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.52 (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 9.1 (36)

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

Total fabric heat loss (33) + (36) = 34.62 (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=	13.56	13.41	13.27	12.55	12.41	11.69	11.69	11.55	11.98	12.41	12.69	12.98	(38)

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

(39)m=	48.17	48.03	47.89	47.17	47.03	46.31	46.31	46.16	46.59	47.03	47.31	47.6	

Average = Sum(39)$_{1...12}$ /12= 47.13 (39)

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

(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.91	0.92	0.93	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.93 (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 1.7 (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 74.68 (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=	82.15	79.16	76.18	73.19	70.2	67.21	67.21	70.2	73.19	76.18	79.16	82.15	

Total = Sum(44)$_{1...12}$ = 896.19 (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=	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.4	85.41	99.53	108.65	117.98	

Total = Sum(45)$_{1...12}$ = 1175.05 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	

Output from water heater (annual)$_{1...12}$ | 1825.89 | (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=	84.73	75.37	80.78	74.67	74.8	69.19	68.68	72.28	71.19	77.32	78.92	83.45	(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=	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(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=	148.51	150.05	146.16	137.9	127.46	117.65	111.1	109.56	113.44	121.71	132.15	141.95	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains (Table 5)

(72)m=	113.88	112.16	108.58	103.71	100.54	96.09	92.31	97.16	98.88	103.92	109.61	112.17	(72)

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

(73)m=	324.2	322.53	312.87	297.41	281.98	266.88	256.91	261.7	269.5	285.13	303.09	316.29	(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)	
North	0.9x 0.77	x	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x 0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)

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North	0.9x	0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x	0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x	0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)
North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Southwest	0.9x	0.77	x	2.09	x	36.79		0.46	x	0.8	=	19.61	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79		0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	2.09	x	62.67		0.46	x	0.8	=	33.4	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67		0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	2.09	x	85.75		0.46	x	0.8	=	45.71	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75		0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	2.09	x	106.25		0.46	x	0.8	=	56.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25		0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	2.09	x	119.01		0.46	x	0.8	=	63.43	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01		0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	2.09	x	118.15		0.46	x	0.8	=	62.97	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15		0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	2.09	x	113.91		0.46	x	0.8	=	60.71	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91		0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	2.09	x	104.39		0.46	x	0.8	=	55.64	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39		0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	2.09	x	92.85		0.46	x	0.8	=	49.49	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85		0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	2.09	x	69.27		0.46	x	0.8	=	36.92	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27		0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	2.09	x	44.07		0.46	x	0.8	=	23.49	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	2.09	x	31.49		0.46	x	0.8	=	16.78	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)
West	0.9x	0.77	x	6.28	x	19.64	x	0.46	x	0.8	=	31.45	(80)
West	0.9x	0.77	x	6.28	x	38.42	x	0.46	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	6.28	x	63.27	x	0.46	x	0.8	=	101.34	(80)
West	0.9x	0.77	x	6.28	x	92.28	x	0.46	x	0.8	=	147.79	(80)
West	0.9x	0.77	x	6.28	x	113.09	x	0.46	x	0.8	=	181.12	(80)
West	0.9x	0.77	x	6.28	x	115.77	x	0.46	x	0.8	=	185.41	(80)
West	0.9x	0.77	x	6.28	x	110.22	x	0.46	x	0.8	=	176.52	(80)

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West	0.9x	0.77	x	6.28	x	94.68	x	0.46	x	0.8	=	151.63	(80)
West	0.9x	0.77	x	6.28	x	73.59	x	0.46	x	0.8	=	117.86	(80)
West	0.9x	0.77	x	6.28	x	45.59	x	0.46	x	0.8	=	73.01	(80)
West	0.9x	0.77	x	6.28	x	24.49	x	0.46	x	0.8	=	39.22	(80)
West	0.9x	0.77	x	6.28	x	16.15	x	0.46	x	0.8	=	25.87	(80)

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

(83)m=	101.74	183.62	275.57	377.23	451.56	460.1	438.75	382.12	310.93	209.8	123.82	85.77	(83)

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

(84)m=	425.94	506.15	588.44	674.64	733.55	726.99	695.66	643.82	580.43	494.93	426.91	402.06	(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	0.97	0.92	0.78	0.58	0.41	0.29	0.33	0.55	0.85	0.97	0.99	(86)

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

(87)m=	20.26	20.45	20.7	20.91	20.98	21	21	21	20.99	20.87	20.53	20.22	(87)

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

(88)m=	20.12	20.12	20.13	20.14	20.14	20.15	20.15	20.16	20.15	20.14	20.14	20.13	(88)

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

(89)m=	0.99	0.96	0.89	0.74	0.53	0.35	0.24	0.27	0.48	0.81	0.96	0.99	(89)

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

(90)m=	19.15	19.43	19.77	20.04	20.13	20.15	20.15	20.16	20.14	20.01	19.55	19.11	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.68	19.92	20.21	20.45	20.53	20.55	20.55	20.55	20.54	20.41	20.01	19.64	(92)

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

(93)m=	19.68	19.92	20.21	20.45	20.53	20.55	20.55	20.55	20.54	20.41	20.01	19.64	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.9	0.75	0.56	0.38	0.26	0.3	0.51	0.82	0.96	0.99	(94)

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

(95)m=	418.68	485.43	527.87	506.96	409.19	275.15	183.03	191.7	297.49	408.3	410.24	396.83	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	740.74	721.2	656.49	544.93	415.34	275.64	183.07	191.79	300.27	461.53	611.02	734.78	(97)

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

(98)m=	239.62	158.44	95.69	27.34	4.58	0	0	0	0	39.6	144.56	251.44	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 961.27 (98)

Space heating requirement in kWh/m²/year 19.04 (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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		961.27	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1057.4	(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		1825.89	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2008.48	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	30.66	(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		103.95	(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) =	103.95	(331)
Energy for lighting (calculated in Appendix L)		233.81	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-267.72	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3135.91	(338)

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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	636.48	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.91	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	652.39	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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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) =			652.39	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	53.95	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.35	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-138.95	(380)
Total CO2, kg/year	sum of (376)…(382) =			688.74	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.64	(384)
EI rating (section 14)				90.34	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 2 - Apt 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.58	(1a) x	2.7	(2a) =	190.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		190.57	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 4			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Walls Type1	46.14	16.75	29.39	x	0.18	=	5.29			(29)
Walls Type2	18.71	1.89	16.82	x	0.17	=	2.82			(29)
Total area of elements, m²			64.85							(31)
Party wall			25.6	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.56 (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 7.76 (36)

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

Total fabric heat loss (33) + (36) = 32.31 (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=	18.95	18.75	18.55	17.55	17.34	16.34	16.34	16.14	16.74	17.34	17.75	18.15	(38)

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

(39)m=	51.26	51.06	50.86	49.86	49.66	48.66	48.66	48.45	49.06	49.66	50.06	50.46	

Average = Sum(39)$_{1...12}$ /12= 49.81 (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=	0.73	0.72	0.72	0.71	0.7	0.69	0.69	0.69	0.7	0.7	0.71	0.71	

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 2.26 (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 87.88 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	96.67	93.15	89.64	86.12	82.61	79.09	79.09	82.61	86.12	89.64	93.15	96.67	

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

Total = Sum(44)$_{1...12}$ = 1054.54 (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=	143.35	125.38	129.38	112.79	108.23	93.39	86.54	99.31	100.5	117.12	127.84	138.83	

Total = Sum(45)$_{1...12}$ = 1382.66 (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=	21.5	18.81	19.41	16.92	16.23	14.01	12.98	14.9	15.07	17.57	19.18	20.82	(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)

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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=	198.63	175.3	184.65	166.29	163.51	146.89	141.82	154.59	153.99	172.39	181.34	194.11	(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=	198.63	175.3	184.65	166.29	163.51	146.89	141.82	154.59	153.99	172.39	181.34	194.11	

Output from water heater (annual)$_{1...12}$ 2033.5 (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=	91.89	81.63	87.24	80.3	80.21	73.85	73	77.24	76.21	83.16	85.3	90.38	(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=	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	(66)

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

(67)m=	17.71	15.73	12.79	9.68	7.24	6.11	6.6	8.58	11.52	14.63	17.07	18.2	(67)

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

(68)m=	198.65	200.71	195.51	184.46	170.5	157.38	148.61	146.55	151.74	162.8	176.76	189.88	(68)

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

(69)m=	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	(71)

Water heating gains (Table 5)

(72)m=	123.5	121.47	117.26	111.53	107.81	102.57	98.11	103.82	105.85	111.78	118.48	121.48	(72)

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

(73)m=	396.76	394.81	382.47	362.57	342.44	322.96	310.23	315.86	326.01	346.11	369.21	386.47	(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)	
Southeast 0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast 0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)
Southeast 0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast 0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast 0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)

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Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97	(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71	(77)
Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64	(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49	(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92	(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49	(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78	(77)
South	0.9x	0.77	x	6.28	x	46.75	x	0.46	x	0.8	=	74.88	(78)
South	0.9x	0.77	x	6.28	x	76.57	x	0.46	x	0.8	=	122.63	(78)
South	0.9x	0.77	x	6.28	x	97.53	x	0.46	x	0.8	=	156.21	(78)
South	0.9x	0.77	x	6.28	x	110.23	x	0.46	x	0.8	=	176.55	(78)
South	0.9x	0.77	x	6.28	x	114.87	x	0.46	x	0.8	=	183.97	(78)
South	0.9x	0.77	x	6.28	x	110.55	x	0.46	x	0.8	=	177.05	(78)
South	0.9x	0.77	x	6.28	x	108.01	x	0.46	x	0.8	=	172.99	(78)
South	0.9x	0.77	x	6.28	x	104.89	x	0.46	x	0.8	=	167.99	(78)
South	0.9x	0.77	x	6.28	x	101.89	x	0.46	x	0.8	=	163.18	(78)
South	0.9x	0.77	x	6.28	x	82.59	x	0.46	x	0.8	=	132.27	(78)
South	0.9x	0.77	x	6.28	x	55.42	x	0.46	x	0.8	=	88.75	(78)
South	0.9x	0.77	x	6.28	x	40.4	x	0.46	x	0.8	=	64.7	(78)
Southwest	0.9x	0.77	x	4.19	x	36.79	x	0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79	x	0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67	x	0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67	x	0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75	x	0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75	x	0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25	x	0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25	x	0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01	x	0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01	x	0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15	x	0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15	x	0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91	x	0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91	x	0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39	x	0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39	x	0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85	x	0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85	x	0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27	x	0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27	x	0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07	x	0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07	x	0.46	x	0.8	=	47.09	(79)

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Southwest 0.9x	0.77	x	4.19	x	31.49	0.46	x	0.8	=	33.65	(79)
Southwest 0.9x	0.77	x	4.19	x	31.49	0.46	x	0.8	=	33.65	(79)

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

(83)m=	173.12	289.97	385.17	460.25	501.74	492.52	477.14	446.73	411.1	317.22	206.43	148.78	(83)

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

(84)m=	569.88	684.78	767.64	822.82	844.19	815.48	787.37	762.58	737.11	663.33	575.64	535.24	(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=	0.98	0.94	0.86	0.71	0.54	0.38	0.27	0.29	0.46	0.75	0.95	0.99	(86)

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

(87)m=	20.57	20.75	20.89	20.98	21	21	21	21	21	20.97	20.78	20.54	(87)

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

(88)m=	20.32	20.32	20.32	20.34	20.34	20.35	20.35	20.35	20.35	20.34	20.33	20.33	(88)

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

(89)m=	0.98	0.93	0.84	0.68	0.51	0.34	0.23	0.25	0.42	0.71	0.93	0.98	(89)

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

(90)m=	19.76	20.01	20.2	20.31	20.34	20.35	20.35	20.35	20.34	20.31	20.07	19.72	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	20.1	20.31	20.48	20.59	20.61	20.62	20.62	20.62	20.62	20.58	20.36	20.06	(92)

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

(93)m=	20.1	20.31	20.48	20.59	20.61	20.62	20.62	20.62	20.62	20.58	20.36	20.06	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.93	0.85	0.69	0.52	0.36	0.25	0.27	0.43	0.72	0.94	0.98	(94)

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

(95)m=	556.52	638.68	648.72	569.39	440.78	292.75	195.52	204.47	319.3	480.75	538.5	526.17	(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=	809.74	786.96	711.25	582.61	442.36	292.82	195.52	204.48	319.6	495.76	663.97	800.21	(97)

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

(98)m=	188.39	99.65	46.53	9.52	1.17	0	0	0	0	11.17	90.34	203.88	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 650.65 (98)

Space heating requirement in kWh/m²/year 9.22 (99)

9b. Energy requirements – Community heating scheme

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

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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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		650.65	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	715.71	(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		2033.5	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2236.85	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	29.53	(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		145.31	(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) =	145.31	(331)
Energy for lighting (calculated in Appendix L)		312.76	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-371.36	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3039.27	(338)

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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	612.95	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.32	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	628.28	(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)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			628.28	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	75.41	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	162.32	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-192.73	(380)
Total CO2, kg/year	sum of (376)…(382) =			673.28	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			9.54	(384)
EI rating (section 14)				92.19	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 2 - Apt 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.96	(1a) x	2.7	(2a) =	140.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		140.29	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 2			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Walls Type1	44.06	14.65	29.41	x	0.18	=	5.29			(29)
Walls Type2	4.02	1.89	2.13	x	0.17	=	0.36			(29)
Walls Type3	11.88	0	11.88	x	0.15	=	1.84			(29)
Total area of elements, m²			59.97							(31)
Party wall			16.5	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.11 (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 7.62 (36)

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

Total fabric heat loss (33) + (36) = 29.73 (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=	13.95	13.8	13.65	12.92	12.77	12.03	12.03	11.88	12.33	12.77	13.06	13.36	(38)

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

(39)m=	43.68	43.53	43.39	42.65	42.5	41.76	41.76	41.62	42.06	42.5	42.8	43.09	

Average = Sum(39)$_{1...12}$ /12= 42.61 (39)

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

(40)m=	0.84	0.84	0.84	0.82	0.82	0.8	0.8	0.8	0.81	0.82	0.82	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 75.71 (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=	83.28	80.26	77.23	74.2	71.17	68.14	68.14	71.17	74.2	77.23	80.26	83.28	

Total = Sum(44)$_{1...12}$ = 908.55 (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=	123.51	108.02	111.47	97.18	93.25	80.46	74.56	85.56	86.58	100.9	110.14	119.61	

Total = Sum(45)$_{1...12}$ = 1191.25 (45)

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

(46)m=	18.53	16.2	16.72	14.58	13.99	12.07	11.18	12.83	12.99	15.14	16.52	17.94	(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=	178.78	157.95	166.74	150.67	148.52	133.96	129.84	140.84	140.08	156.18	163.64	174.89	(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=	178.78	157.95	166.74	150.67	148.52	133.96	129.84	140.84	140.08	156.18	163.64	174.89	

Output from water heater (annual)$_{1...12}$ | 1842.09 | (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=	85.29	75.86	81.28	75.11	75.23	69.55	69.01	72.67	71.58	77.77	79.42	83.99	(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=	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	(66)

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

(67)m=	13.58	12.06	9.81	7.43	5.55	4.69	5.06	6.58	8.83	11.22	13.09	13.96	(67)

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

(68)m=	152.32	153.9	149.92	141.44	130.74	120.68	113.95	112.37	116.36	124.84	135.54	145.6	(68)

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

(69)m=	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	(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=	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	(71)

Water heating gains (Table 5)

(72)m=	114.63	112.88	109.25	104.32	101.11	96.6	92.76	97.68	99.42	104.53	110.3	112.89	(72)

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

(73)m=	329.75	328.07	318.2	302.4	286.62	271.18	261	265.85	273.83	289.81	308.15	321.67	(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	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x 0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)

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North	0.9x	0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x	0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x	0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)
North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Northeast	0.9x	0.77	x	6.28	x	11.28	x	0.46	x	0.8	=	18.07	(75)
Northeast	0.9x	0.77	x	6.28	x	22.97	x	0.46	x	0.8	=	36.78	(75)
Northeast	0.9x	0.77	x	6.28	x	41.38	x	0.46	x	0.8	=	66.27	(75)
Northeast	0.9x	0.77	x	6.28	x	67.96	x	0.46	x	0.8	=	108.83	(75)
Northeast	0.9x	0.77	x	6.28	x	91.35	x	0.46	x	0.8	=	146.3	(75)
Northeast	0.9x	0.77	x	6.28	x	97.38	x	0.46	x	0.8	=	155.97	(75)
Northeast	0.9x	0.77	x	6.28	x	91.1	x	0.46	x	0.8	=	145.9	(75)
Northeast	0.9x	0.77	x	6.28	x	72.63	x	0.46	x	0.8	=	116.32	(75)
Northeast	0.9x	0.77	x	6.28	x	50.42	x	0.46	x	0.8	=	80.75	(75)
Northeast	0.9x	0.77	x	6.28	x	28.07	x	0.46	x	0.8	=	44.95	(75)
Northeast	0.9x	0.77	x	6.28	x	14.2	x	0.46	x	0.8	=	22.74	(75)
Northeast	0.9x	0.77	x	6.28	x	9.21	x	0.46	x	0.8	=	14.76	(75)
East	0.9x	0.77	x	2.09	x	19.64	x	0.46	x	0.8	=	10.47	(76)
East	0.9x	0.77	x	2.09	x	38.42	x	0.46	x	0.8	=	20.48	(76)
East	0.9x	0.77	x	2.09	x	63.27	x	0.46	x	0.8	=	33.72	(76)
East	0.9x	0.77	x	2.09	x	92.28	x	0.46	x	0.8	=	49.19	(76)
East	0.9x	0.77	x	2.09	x	113.09	x	0.46	x	0.8	=	60.28	(76)
East	0.9x	0.77	x	2.09	x	115.77	x	0.46	x	0.8	=	61.71	(76)
East	0.9x	0.77	x	2.09	x	110.22	x	0.46	x	0.8	=	58.75	(76)
East	0.9x	0.77	x	2.09	x	94.68	x	0.46	x	0.8	=	50.46	(76)
East	0.9x	0.77	x	2.09	x	73.59	x	0.46	x	0.8	=	39.22	(76)
East	0.9x	0.77	x	2.09	x	45.59	x	0.46	x	0.8	=	24.3	(76)
East	0.9x	0.77	x	2.09	x	24.49	x	0.46	x	0.8	=	13.05	(76)
East	0.9x	0.77	x	2.09	x	16.15	x	0.46	x	0.8	=	8.61	(76)
Southeast	0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast	0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)
Southeast	0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast	0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast	0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)
Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97	(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71	(77)

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Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64	(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49	(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92	(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49	(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78	(77)

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

(83)m=	59.51	112.38	182.6	273.92	349.84	366.11	345.16	285.73	213.83	132.02	73.3	49.62	(83)

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

(84)m=	389.27	440.45	500.8	576.32	636.46	637.29	606.16	551.58	487.66	421.82	381.45	371.29	(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	0.94	0.82	0.61	0.42	0.3	0.35	0.59	0.89	0.98	0.99	(86)

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

(87)m=	20.34	20.49	20.7	20.91	20.99	21	21	21	20.99	20.87	20.58	20.32	(87)

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

(88)m=	20.22	20.22	20.22	20.24	20.24	20.25	20.25	20.25	20.25	20.24	20.23	20.23	(88)

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

(89)m=	0.99	0.98	0.93	0.78	0.56	0.37	0.25	0.29	0.53	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=	19.35	19.56	19.86	20.14	20.23	20.25	20.25	20.25	20.24	20.1	19.7	19.32	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.81	19.99	20.25	20.5	20.58	20.6	20.6	20.6	20.59	20.46	20.1	19.78	(92)

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

(93)m=	19.81	19.99	20.25	20.5	20.58	20.6	20.6	20.6	20.59	20.46	20.1	19.78	(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	0.93	0.79	0.59	0.39	0.28	0.32	0.55	0.87	0.97	0.99	(94)

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

(95)m=	384.69	429.19	465.88	457.78	372.55	250.14	166.9	174.65	270.43	365.49	371.02	367.89	(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=	677.42	656.73	596.47	494.68	377.36	250.42	166.92	174.7	272.89	418.95	556.48	671.49	(97)

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

(98)m=	217.79	152.91	97.16	26.57	3.58	0	0	0	0	39.77	133.53	225.88	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 897.19 (98)

Space heating requirement in kWh/m²/year 17.27 (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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		897.19	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	986.91	(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		1842.09	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2026.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	30.13	(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		106.97	(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) =	106.97	(331)
Energy for lighting (calculated in Appendix L)		239.82	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-267.72	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3092.28	(338)

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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	625.54	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.64	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	641.18	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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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) =			641.18	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	55.52	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	124.47	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-138.95	(380)
Total CO2, kg/year	sum of (376)…(382) =			682.22	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.13	(384)
EI rating (section 14)				90.57	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 3 - Apt 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.49	(1a) x	2.7	(2a) =	136.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.49	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.32	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Walls Type1	50.65	16.75	33.9	x	0.18	=	6.1			(29)
Walls Type2	16.79	1.89	14.9	x	0.17	=	2.5			(29)
Total area of elements, m²			67.45							(31)
Party wall			17.93	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.05 (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 8.14 (36)

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

Total fabric heat loss (33) + (36) = 33.19 (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=	13.56	13.41	13.27	12.55	12.41	11.69	11.69	11.55	11.98	12.41	12.69	12.98	(38)

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

(39)m=	46.74	46.6	46.46	45.74	45.59	44.88	44.88	44.73	45.16	45.59	45.88	46.17	

Average = Sum(39)$_{1...12}$ /12= 45.7 (39)

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

(40)m=	0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.89	0.9	0.91	0.91

Average = Sum(40)$_{1...12}$ /12= 0.91 (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 1.7 (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 74.68 (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=	82.15	79.16	76.18	73.19	70.2	67.21	67.21	70.2	73.19	76.18	79.16	82.15

Total = Sum(44)$_{1...12}$ = 896.19 (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=	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.4	85.41	99.53	108.65	117.98

Total = Sum(45)$_{1...12}$ = 1175.05 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7

(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	

Output from water heater (annual)$_{1...12}$ 1825.89 (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=	84.73	75.37	80.78	74.67	74.8	69.19	68.68	72.28	71.19	77.32	78.92	83.45	(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=	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(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=	148.51	150.05	146.16	137.9	127.46	117.65	111.1	109.56	113.44	121.71	132.15	141.95	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains (Table 5)

(72)m=	113.88	112.16	108.58	103.71	100.54	96.09	92.31	97.16	98.88	103.92	109.61	112.17	(72)

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

(73)m=	324.2	322.53	312.87	297.41	281.98	266.88	256.91	261.7	269.5	285.13	303.09	316.29	(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)	
North	0.9x 0.77	x	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x 0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)
North	0.9x 0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x 0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x 0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)

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North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Southwest	0.9x	0.77	x	2.09	x	36.79		0.46	x	0.8	=	19.61	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79		0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	2.09	x	62.67		0.46	x	0.8	=	33.4	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67		0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	2.09	x	85.75		0.46	x	0.8	=	45.71	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75		0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	2.09	x	106.25		0.46	x	0.8	=	56.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25		0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	2.09	x	119.01		0.46	x	0.8	=	63.43	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01		0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	2.09	x	118.15		0.46	x	0.8	=	62.97	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15		0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	2.09	x	113.91		0.46	x	0.8	=	60.71	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91		0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	2.09	x	104.39		0.46	x	0.8	=	55.64	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39		0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	2.09	x	92.85		0.46	x	0.8	=	49.49	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85		0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	2.09	x	69.27		0.46	x	0.8	=	36.92	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27		0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	2.09	x	44.07		0.46	x	0.8	=	23.49	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	2.09	x	31.49		0.46	x	0.8	=	16.78	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)
West	0.9x	0.77	x	6.28	x	19.64	x	0.46	x	0.8	=	31.45	(80)
West	0.9x	0.77	x	6.28	x	38.42	x	0.46	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	6.28	x	63.27	x	0.46	x	0.8	=	101.34	(80)
West	0.9x	0.77	x	6.28	x	92.28	x	0.46	x	0.8	=	147.79	(80)
West	0.9x	0.77	x	6.28	x	113.09	x	0.46	x	0.8	=	181.12	(80)
West	0.9x	0.77	x	6.28	x	115.77	x	0.46	x	0.8	=	185.41	(80)
West	0.9x	0.77	x	6.28	x	110.22	x	0.46	x	0.8	=	176.52	(80)
West	0.9x	0.77	x	6.28	x	94.68	x	0.46	x	0.8	=	151.63	(80)
West	0.9x	0.77	x	6.28	x	73.59	x	0.46	x	0.8	=	117.86	(80)
West	0.9x	0.77	x	6.28	x	45.59	x	0.46	x	0.8	=	73.01	(80)

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West	0.9x	0.77	x	6.28	x	24.49	x	0.46	x	0.8	=	39.22	(80)
West	0.9x	0.77	x	6.28	x	16.15	x	0.46	x	0.8	=	25.87	(80)

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

(83)m=	101.74	183.62	275.57	377.23	451.56	460.1	438.75	382.12	310.93	209.8	123.82	85.77	(83)

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

(84)m=	425.94	506.15	588.44	674.64	733.55	726.99	695.66	643.82	580.43	494.93	426.91	402.06	(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	0.97	0.91	0.76	0.57	0.39	0.28	0.32	0.53	0.84	0.97	0.99	(86)

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

(87)m=	20.3	20.49	20.73	20.92	20.99	21	21	21	20.99	20.89	20.56	20.27	(87)

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

(88)m=	20.15	20.15	20.15	20.16	20.16	20.18	20.18	20.18	20.17	20.16	20.16	20.16	(88)

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

(89)m=	0.98	0.96	0.89	0.72	0.52	0.34	0.23	0.26	0.47	0.8	0.96	0.99	(89)

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

(90)m=	19.23	19.51	19.83	20.08	20.15	20.18	20.18	20.18	20.17	20.05	19.62	19.19	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.74	19.97	20.26	20.48	20.55	20.57	20.57	20.57	20.56	20.45	20.07	19.7	(92)

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

(93)m=	19.74	19.97	20.26	20.48	20.55	20.57	20.57	20.57	20.56	20.45	20.07	19.7	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.89	0.74	0.54	0.37	0.26	0.29	0.5	0.81	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	418.38	484.27	524.09	498.07	398.72	267.36	177.96	186.36	289.61	403.11	409.28	396.62	(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=	721.62	702.44	639.09	529.7	403.44	267.71	177.99	186.42	291.7	448.91	594.93	715.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	225.61	146.61	85.56	22.77	3.52	0	0	0	0	34.08	133.67	237.29	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 889.1 (98)

Space heating requirement in kWh/m²/year 17.61 (99)

9b. Energy requirements – Community heating scheme

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

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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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		889.1	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	978.01	(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		1825.89	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2008.48	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	29.86	(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		103.95	(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) =	103.95	(331)
Energy for lighting (calculated in Appendix L)		233.81	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-267.72	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3056.52	(338)

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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	619.99	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	15.5	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	635.49	(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)

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Total CO2 associated with space and water heating	(373) + (374) + (375) =			635.49	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	53.95	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.35	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-138.95	(380)
Total CO2, kg/year	sum of (376)…(382) =			671.84	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.31	(384)
EI rating (section 14)				90.57	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 8 - Apt 21

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.49	(1a) x	2.7	(2a) =	136.32	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.49	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		136.32	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Walls Type1	50.65	16.75	33.9	x	0.18	=	6.1			(29)
Walls Type2	16.79	1.89	14.9	x	0.17	=	2.49			(29)
Roof	50.49	0	50.49	x	0.12	=	6.06			(30)
Total area of elements, m²			117.94							(31)
Party wall			17.93	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.09 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 454.41 (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 9.19 (36)

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

Total fabric heat loss (33) + (36) = 40.28 (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=	13.56	13.41	13.27	12.55	12.41	11.69	11.69	11.55	11.98	12.41	12.69	12.98	(38)

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

(39)m=	53.83	53.69	53.55	52.83	52.69	51.97	51.97	51.83	52.26	52.69	52.97	53.26	

Average = Sum(39)$_{1...12}$ /12= 52.8 (39)

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

(40)m=	1.07	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.05 (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 1.7 (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 74.68 (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=	82.15	79.16	76.18	73.19	70.2	67.21	67.21	70.2	73.19	76.18	79.16	82.15	

Total = Sum(44)$_{1...12}$ = 896.19 (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=	121.83	106.55	109.95	95.86	91.98	79.37	73.55	84.4	85.41	99.53	108.65	117.98	

Total = Sum(45)$_{1...12}$ = 1175.05 (45)

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

(46)m=	18.27	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	(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=	177.1	156.48	165.23	149.35	147.25	132.86	128.82	139.67	138.9	154.81	162.14	173.26	

Output from water heater (annual)$_{1...12}$ | 1825.89 | (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=	84.73	75.37	80.78	74.67	74.8	69.19	68.68	72.28	71.19	77.32	78.92	83.45	(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=	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	85.23	(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=	148.51	150.05	146.16	137.9	127.46	117.65	111.1	109.56	113.44	121.71	132.15	141.95	(68)

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

(69)m=	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	(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=	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	-68.18	(71)

Water heating gains (Table 5)

(72)m=	113.88	112.16	108.58	103.71	100.54	96.09	92.31	97.16	98.88	103.92	109.61	112.17	(72)

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

(73)m=	324.2	322.53	312.87	297.41	281.98	266.88	256.91	261.7	269.5	285.13	303.09	316.29	(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)	
North	0.9x 0.77	x	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x 0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)

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North	0.9x	0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x	0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x	0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)
North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Southwest	0.9x	0.77	x	2.09	x	36.79		0.46	x	0.8	=	19.61	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79		0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	2.09	x	62.67		0.46	x	0.8	=	33.4	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67		0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	2.09	x	85.75		0.46	x	0.8	=	45.71	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75		0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	2.09	x	106.25		0.46	x	0.8	=	56.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25		0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	2.09	x	119.01		0.46	x	0.8	=	63.43	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01		0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	2.09	x	118.15		0.46	x	0.8	=	62.97	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15		0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	2.09	x	113.91		0.46	x	0.8	=	60.71	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91		0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	2.09	x	104.39		0.46	x	0.8	=	55.64	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39		0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	2.09	x	92.85		0.46	x	0.8	=	49.49	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85		0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	2.09	x	69.27		0.46	x	0.8	=	36.92	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27		0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	2.09	x	44.07		0.46	x	0.8	=	23.49	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	2.09	x	31.49		0.46	x	0.8	=	16.78	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)
West	0.9x	0.77	x	6.28	x	19.64	x	0.46	x	0.8	=	31.45	(80)
West	0.9x	0.77	x	6.28	x	38.42	x	0.46	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	6.28	x	63.27	x	0.46	x	0.8	=	101.34	(80)
West	0.9x	0.77	x	6.28	x	92.28	x	0.46	x	0.8	=	147.79	(80)
West	0.9x	0.77	x	6.28	x	113.09	x	0.46	x	0.8	=	181.12	(80)
West	0.9x	0.77	x	6.28	x	115.77	x	0.46	x	0.8	=	185.41	(80)
West	0.9x	0.77	x	6.28	x	110.22	x	0.46	x	0.8	=	176.52	(80)

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West	0.9x	0.77	x	6.28	x	94.68	x	0.46	x	0.8	=	151.63	(80)
West	0.9x	0.77	x	6.28	x	73.59	x	0.46	x	0.8	=	117.86	(80)
West	0.9x	0.77	x	6.28	x	45.59	x	0.46	x	0.8	=	73.01	(80)
West	0.9x	0.77	x	6.28	x	24.49	x	0.46	x	0.8	=	39.22	(80)
West	0.9x	0.77	x	6.28	x	16.15	x	0.46	x	0.8	=	25.87	(80)

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

(83)m=	101.74	183.62	275.57	377.23	451.56	460.1	438.75	382.12	310.93	209.8	123.82	85.77	(83)

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

(84)m=	425.94	506.15	588.44	674.64	733.55	726.99	695.66	643.82	580.43	494.93	426.91	402.06	(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	0.93	0.82	0.64	0.45	0.33	0.37	0.6	0.88	0.98	0.99	(86)

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

(87)m=	20.1	20.3	20.57	20.84	20.96	21	21	21	20.98	20.79	20.4	20.06	(87)

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

(88)m=	20.03	20.03	20.03	20.04	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04	(88)

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

(89)m=	0.99	0.97	0.92	0.78	0.58	0.39	0.26	0.29	0.53	0.85	0.97	0.99	(89)

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

(90)m=	18.85	19.14	19.52	19.87	20.02	20.06	20.06	20.06	20.04	19.83	19.29	18.8	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.44	19.69	20.02	20.33	20.46	20.5	20.5	20.5	20.48	20.28	19.81	19.4	(92)

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

(93)m=	19.44	19.69	20.02	20.33	20.46	20.5	20.5	20.5	20.48	20.28	19.81	19.4	(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	0.92	0.79	0.61	0.42	0.29	0.33	0.56	0.86	0.97	0.99	(94)

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

(95)m=	419.49	488.68	538.95	535.68	447.18	305.09	202.7	212.4	326.6	424.25	412.89	397.35	(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=	815.05	793.97	723.78	603.85	461.73	306.64	202.86	212.71	333.65	510.21	673.39	809.47	(97)

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

(98)m=	294.3	205.16	137.52	49.08	10.83	0	0	0	0	63.96	187.56	306.62	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 1255.01 (98)

Space heating requirement in kWh/m²/year 24.86 (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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1255.01	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1380.51	(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		1825.89	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2008.48	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.89	(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		103.95	(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) =	103.95	(331)
Energy for lighting (calculated in Appendix L)		233.81	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-267.72	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3459.03	(338)

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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	703.55	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	17.59	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	721.14	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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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) =			721.14	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	53.95	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.35	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-138.95	(380)
Total CO2, kg/year	sum of (376)…(382) =			757.49	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15	(384)
EI rating (section 14)				89.37	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 8 - Apt 22

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.58	(1a) x	2.7	(2a) =	190.57	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		190.57	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 2			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 3			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 4			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Walls Type1	46.14	16.75	29.39	x	0.18	=	5.29			(29)
Walls Type2	18.71	1.89	16.82	x	0.17	=	2.81			(29)
Roof	70.58	0	70.58	x	0.12	=	8.47			(30)
Total area of elements, m²			135.43							(31)
Party wall			25.6	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.01 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 635.22 (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 10.27 (36)

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

Total fabric heat loss (33) + (36) = 43.28 (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=	18.95	18.75	18.55	17.55	17.34	16.34	16.34	16.14	16.74	17.34	17.75	18.15	(38)

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

(39)m=	62.23	62.03	61.83	60.83	60.63	59.63	59.63	59.43	60.03	60.63	61.03	61.43	

Average = Sum(39)$_{1...12}$ /12= 60.78 (39)

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

(40)m=	0.88	0.88	0.88	0.86	0.86	0.84	0.84	0.84	0.85	0.86	0.86	0.87	

Average = Sum(40)$_{1...12}$ /12= 0.86 (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 2.26 (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 87.88 (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=	96.67	93.15	89.64	86.12	82.61	79.09	79.09	82.61	86.12	89.64	93.15	96.67	

Total = Sum(44)$_{1...12}$ = 1054.54 (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=	143.35	125.38	129.38	112.79	108.23	93.39	86.54	99.31	100.5	117.12	127.84	138.83	

Total = Sum(45)$_{1...12}$ = 1382.66 (45)

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

(46)m=	21.5	18.81	19.41	16.92	16.23	14.01	12.98	14.9	15.07	17.57	19.18	20.82	(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=	198.63	175.3	184.65	166.29	163.51	146.89	141.82	154.59	153.99	172.39	181.34	194.11	(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=	198.63	175.3	184.65	166.29	163.51	146.89	141.82	154.59	153.99	172.39	181.34	194.11	

Output from water heater (annual)$_{1...12}$ | 2033.5 | (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=	91.89	81.63	87.24	80.3	80.21	73.85	73	77.24	76.21	83.16	85.3	90.38	(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=	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	113.01	(66)

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

(67)m=	17.71	15.73	12.79	9.68	7.24	6.11	6.6	8.58	11.52	14.63	17.07	18.2	(67)

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

(68)m=	198.65	200.71	195.51	184.46	170.5	157.38	148.61	146.55	151.74	162.8	176.76	189.88	(68)

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

(69)m=	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	34.3	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	-90.4	(71)

Water heating gains (Table 5)

(72)m=	123.5	121.47	117.26	111.53	107.81	102.57	98.11	103.82	105.85	111.78	118.48	121.48	(72)

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

(73)m=	396.76	394.81	382.47	362.57	342.44	322.96	310.23	315.86	326.01	346.11	369.21	386.47	(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)	
Southeast 0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast 0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)

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Southeast	0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast	0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast	0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)
Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97	(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71	(77)
Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64	(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49	(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92	(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49	(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78	(77)
South	0.9x	0.77	x	6.28	x	46.75	x	0.46	x	0.8	=	74.88	(78)
South	0.9x	0.77	x	6.28	x	76.57	x	0.46	x	0.8	=	122.63	(78)
South	0.9x	0.77	x	6.28	x	97.53	x	0.46	x	0.8	=	156.21	(78)
South	0.9x	0.77	x	6.28	x	110.23	x	0.46	x	0.8	=	176.55	(78)
South	0.9x	0.77	x	6.28	x	114.87	x	0.46	x	0.8	=	183.97	(78)
South	0.9x	0.77	x	6.28	x	110.55	x	0.46	x	0.8	=	177.05	(78)
South	0.9x	0.77	x	6.28	x	108.01	x	0.46	x	0.8	=	172.99	(78)
South	0.9x	0.77	x	6.28	x	104.89	x	0.46	x	0.8	=	167.99	(78)
South	0.9x	0.77	x	6.28	x	101.89	x	0.46	x	0.8	=	163.18	(78)
South	0.9x	0.77	x	6.28	x	82.59	x	0.46	x	0.8	=	132.27	(78)
South	0.9x	0.77	x	6.28	x	55.42	x	0.46	x	0.8	=	88.75	(78)
South	0.9x	0.77	x	6.28	x	40.4	x	0.46	x	0.8	=	64.7	(78)
Southwest	0.9x	0.77	x	4.19	x	36.79	x	0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	4.19	x	36.79	x	0.46	x	0.8	=	39.32	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67	x	0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	4.19	x	62.67	x	0.46	x	0.8	=	66.97	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75	x	0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	4.19	x	85.75	x	0.46	x	0.8	=	91.63	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25	x	0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	4.19	x	106.25	x	0.46	x	0.8	=	113.54	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01	x	0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	4.19	x	119.01	x	0.46	x	0.8	=	127.17	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15	x	0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	4.19	x	118.15	x	0.46	x	0.8	=	126.25	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91	x	0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	4.19	x	113.91	x	0.46	x	0.8	=	121.72	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39	x	0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	4.19	x	104.39	x	0.46	x	0.8	=	111.55	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85	x	0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	4.19	x	92.85	x	0.46	x	0.8	=	99.22	(79)
Southwest	0.9x	0.77	x	4.19	x	69.27	x	0.46	x	0.8	=	74.02	(79)

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Southwest	0.9x	0.77	x	4.19	x	69.27		0.46	x	0.8	=	74.02	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	4.19	x	44.07		0.46	x	0.8	=	47.09	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)
Southwest	0.9x	0.77	x	4.19	x	31.49		0.46	x	0.8	=	33.65	(79)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	173.12	289.97	385.17	460.25	501.74	492.52	477.14	446.73	411.1	317.22	206.43	148.78	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	569.88	684.78	767.64	822.82	844.19	815.48	787.37	762.58	737.11	663.33	575.64	535.24	(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	0.97	0.92	0.81	0.65	0.47	0.33	0.36	0.56	0.84	0.97	0.99	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	20.33	20.53	20.73	20.9	20.98	21	21	21	20.99	20.9	20.59	20.3	(87)

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=	20.18	20.19	20.19	20.2	20.2	20.21	20.21	20.22	20.21	20.2	20.2	20.19	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.96	0.9	0.78	0.6	0.41	0.27	0.3	0.49	0.8	0.96	0.99	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	19.31	19.59	19.87	20.1	20.18	20.21	20.21	20.22	20.21	20.1	19.69	19.26	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.73	19.98	20.23	20.43	20.51	20.54	20.54	20.54	20.53	20.43	20.06	19.69	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.73	19.98	20.23	20.43	20.51	20.54	20.54	20.54	20.53	20.43	20.06	19.69	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.79	0.62	0.43	0.3	0.32	0.52	0.81	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	560.8	655.79	692.44	647.34	523.36	353.12	234.79	245.92	383.16	540.11	552.64	528.98	(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=	960.4	935.3	848.74	701.46	534.28	354.02	234.85	246.03	386.03	595.94	791.22	951.58	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	297.31	187.84	116.29	38.96	8.12	0	0	0	0	41.54	171.78	314.42	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 1176.25 (98)

Space heating requirement in kWh/m²/year 16.67 (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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1176.25	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1293.88	(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		2033.5	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2236.85	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.31	(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		145.31	(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) =	145.31	(331)
Energy for lighting (calculated in Appendix L)		312.76	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-371.36	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3617.44	(338)

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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	732.98	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.32	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	751.3	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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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) =			751.3	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	75.41	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	162.32	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-192.73	(380)
Total CO2, kg/year	sum of (376)…(382) =			796.3	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.28	(384)
EI rating (section 14)				90.77	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.41

Property Address: Level 8 - Apt 23

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.96	(1a) x	2.7	(2a) =	140.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		140.29	(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) = 72.25 (23c)

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

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(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=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			4.19	x	1/[1/(0.9)+ 0.04]	=	3.64			(27)
Windows Type 2			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Windows Type 3			6.28	x	1/[1/(0.9)+ 0.04]	=	5.46			(27)
Windows Type 4			2.09	x	1/[1/(0.9)+ 0.04]	=	1.82			(27)
Walls Type1	44.06	14.65	29.41	x	0.18	=	5.29			(29)
Walls Type2	4.02	1.89	2.13	x	0.17	=	0.36			(29)
Walls Type3	11.88	0	11.88	x	0.15	=	1.84			(29)
Roof	51.96	0	51.96	x	0.12	=	6.24			(30)
Total area of elements, m²			111.93							(31)
Party wall			16.5	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 467.64 (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 9.31 (36)

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

Total fabric heat loss (33) + (36) = 37.65 (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=	13.95	13.8	13.65	12.92	12.77	12.03	12.03	11.88	12.33	12.77	13.06	13.36	(38)

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

(39)m=	51.6	51.46	51.31	50.57	50.42	49.69	49.69	49.54	49.98	50.42	50.72	51.01	

Average = Sum(39)$_{1...12}$ /12= 50.53 (39)

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

(40)m=	0.99	0.99	0.99	0.97	0.97	0.96	0.96	0.95	0.96	0.97	0.98	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (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 75.71 (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=	83.28	80.26	77.23	74.2	71.17	68.14	68.14	71.17	74.2	77.23	80.26	83.28	

Total = Sum(44)$_{1...12}$ = 908.55 (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=	123.51	108.02	111.47	97.18	93.25	80.46	74.56	85.56	86.58	100.9	110.14	119.61	

Total = Sum(45)$_{1...12}$ = 1191.25 (45)

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

(46)m=	18.53	16.2	16.72	14.58	13.99	12.07	11.18	12.83	12.99	15.14	16.52	17.94	(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)

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

(57)m=	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=	178.78	157.95	166.74	150.67	148.52	133.96	129.84	140.84	140.08	156.18	163.64	174.89	(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=	178.78	157.95	166.74	150.67	148.52	133.96	129.84	140.84	140.08	156.18	163.64	174.89	

Output from water heater (annual)$_{1...12}$ — 1842.09 — (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=	85.29	75.86	81.28	75.11	75.23	69.55	69.01	72.67	71.58	77.77	79.42	83.99	(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=	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	87.39	(66)

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

(67)m=	13.58	12.06	9.81	7.43	5.55	4.69	5.06	6.58	8.83	11.22	13.09	13.96	(67)

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

(68)m=	152.32	153.9	149.92	141.44	130.74	120.68	113.95	112.37	116.36	124.84	135.54	145.6	(68)

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

(69)m=	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	31.74	(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=	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	-69.92	(71)

Water heating gains (Table 5)

(72)m=	114.63	112.88	109.25	104.32	101.11	96.6	92.76	97.68	99.42	104.53	110.3	112.89	(72)

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

(73)m=	329.75	328.07	318.2	302.4	286.62	271.18	261	265.85	273.83	289.81	308.15	321.67	(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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North	0.9x	0.77	x	4.19	x	10.63	x	0.46	x	0.8	=	11.36	(74)
North	0.9x	0.77	x	4.19	x	20.32	x	0.46	x	0.8	=	21.71	(74)
North	0.9x	0.77	x	4.19	x	34.53	x	0.46	x	0.8	=	36.9	(74)
North	0.9x	0.77	x	4.19	x	55.46	x	0.46	x	0.8	=	59.27	(74)
North	0.9x	0.77	x	4.19	x	74.72	x	0.46	x	0.8	=	79.84	(74)
North	0.9x	0.77	x	4.19	x	79.99	x	0.46	x	0.8	=	85.47	(74)
North	0.9x	0.77	x	4.19	x	74.68	x	0.46	x	0.8	=	79.8	(74)
North	0.9x	0.77	x	4.19	x	59.25	x	0.46	x	0.8	=	63.31	(74)
North	0.9x	0.77	x	4.19	x	41.52	x	0.46	x	0.8	=	44.36	(74)
North	0.9x	0.77	x	4.19	x	24.19	x	0.46	x	0.8	=	25.85	(74)
North	0.9x	0.77	x	4.19	x	13.12	x	0.46	x	0.8	=	14.02	(74)
North	0.9x	0.77	x	4.19	x	8.86	x	0.46	x	0.8	=	9.47	(74)
Northeast	0.9x	0.77	x	6.28	x	11.28	x	0.46	x	0.8	=	18.07	(75)
Northeast	0.9x	0.77	x	6.28	x	22.97	x	0.46	x	0.8	=	36.78	(75)
Northeast	0.9x	0.77	x	6.28	x	41.38	x	0.46	x	0.8	=	66.27	(75)
Northeast	0.9x	0.77	x	6.28	x	67.96	x	0.46	x	0.8	=	108.83	(75)
Northeast	0.9x	0.77	x	6.28	x	91.35	x	0.46	x	0.8	=	146.3	(75)
Northeast	0.9x	0.77	x	6.28	x	97.38	x	0.46	x	0.8	=	155.97	(75)
Northeast	0.9x	0.77	x	6.28	x	91.1	x	0.46	x	0.8	=	145.9	(75)
Northeast	0.9x	0.77	x	6.28	x	72.63	x	0.46	x	0.8	=	116.32	(75)
Northeast	0.9x	0.77	x	6.28	x	50.42	x	0.46	x	0.8	=	80.75	(75)
Northeast	0.9x	0.77	x	6.28	x	28.07	x	0.46	x	0.8	=	44.95	(75)
Northeast	0.9x	0.77	x	6.28	x	14.2	x	0.46	x	0.8	=	22.74	(75)
Northeast	0.9x	0.77	x	6.28	x	9.21	x	0.46	x	0.8	=	14.76	(75)
East	0.9x	0.77	x	2.09	x	19.64	x	0.46	x	0.8	=	10.47	(76)
East	0.9x	0.77	x	2.09	x	38.42	x	0.46	x	0.8	=	20.48	(76)
East	0.9x	0.77	x	2.09	x	63.27	x	0.46	x	0.8	=	33.72	(76)
East	0.9x	0.77	x	2.09	x	92.28	x	0.46	x	0.8	=	49.19	(76)
East	0.9x	0.77	x	2.09	x	113.09	x	0.46	x	0.8	=	60.28	(76)
East	0.9x	0.77	x	2.09	x	115.77	x	0.46	x	0.8	=	61.71	(76)
East	0.9x	0.77	x	2.09	x	110.22	x	0.46	x	0.8	=	58.75	(76)
East	0.9x	0.77	x	2.09	x	94.68	x	0.46	x	0.8	=	50.46	(76)
East	0.9x	0.77	x	2.09	x	73.59	x	0.46	x	0.8	=	39.22	(76)
East	0.9x	0.77	x	2.09	x	45.59	x	0.46	x	0.8	=	24.3	(76)
East	0.9x	0.77	x	2.09	x	24.49	x	0.46	x	0.8	=	13.05	(76)
East	0.9x	0.77	x	2.09	x	16.15	x	0.46	x	0.8	=	8.61	(76)
Southeast	0.9x	0.77	x	2.09	x	36.79	x	0.46	x	0.8	=	19.61	(77)
Southeast	0.9x	0.77	x	2.09	x	62.67	x	0.46	x	0.8	=	33.4	(77)
Southeast	0.9x	0.77	x	2.09	x	85.75	x	0.46	x	0.8	=	45.71	(77)
Southeast	0.9x	0.77	x	2.09	x	106.25	x	0.46	x	0.8	=	56.63	(77)
Southeast	0.9x	0.77	x	2.09	x	119.01	x	0.46	x	0.8	=	63.43	(77)

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Southeast	0.9x	0.77	x	2.09	x	118.15	x	0.46	x	0.8	=	62.97		(77)
Southeast	0.9x	0.77	x	2.09	x	113.91	x	0.46	x	0.8	=	60.71		(77)
Southeast	0.9x	0.77	x	2.09	x	104.39	x	0.46	x	0.8	=	55.64		(77)
Southeast	0.9x	0.77	x	2.09	x	92.85	x	0.46	x	0.8	=	49.49		(77)
Southeast	0.9x	0.77	x	2.09	x	69.27	x	0.46	x	0.8	=	36.92		(77)
Southeast	0.9x	0.77	x	2.09	x	44.07	x	0.46	x	0.8	=	23.49		(77)
Southeast	0.9x	0.77	x	2.09	x	31.49	x	0.46	x	0.8	=	16.78		(77)

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

(83)m=	59.51	112.38	182.6	273.92	349.84	366.11	345.16	285.73	213.83	132.02	73.3	49.62	(83)

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

(84)m=	389.27	440.45	500.8	576.32	636.46	637.29	606.16	551.58	487.66	421.82	381.45	371.29	(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	0.96	0.88	0.7	0.49	0.36	0.41	0.68	0.93	0.99	1	(86)

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

(87)m=	20.12	20.27	20.51	20.8	20.95	20.99	21	21	20.97	20.75	20.39	20.09	(87)

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

(88)m=	20.09	20.09	20.09	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.1	20.1	(88)

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

(89)m=	0.99	0.98	0.95	0.84	0.64	0.43	0.29	0.33	0.6	0.9	0.98	0.99	(89)

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

(90)m=	18.92	19.14	19.49	19.89	20.07	20.12	20.12	20.12	20.1	19.84	19.32	18.89	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.47	19.66	19.96	20.31	20.48	20.52	20.53	20.53	20.5	20.26	19.81	19.45	(92)

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

(93)m=	19.47	19.66	19.96	20.31	20.48	20.52	20.53	20.53	20.5	20.26	19.81	19.45	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.85	0.67	0.46	0.32	0.37	0.64	0.91	0.98	0.99	(94)

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

(95)m=	385.49	431.82	475.78	491.31	424.5	292.53	194.91	204.06	309.85	382.22	373.58	368.44	(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=	783.02	759.56	690.8	576.98	442.62	294.27	195.08	204.45	319.91	487.05	644.88	777.75	(97)

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

(98)m=	295.76	220.24	159.97	61.69	13.48	0	0	0	0	77.99	195.34	304.53	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1329	(98)
Space heating requirement in kWh/m²/year		25.58	(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		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1329	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1461.9	(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		1842.09	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2026.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)...(307e) + (310a)...(310e)] =	34.88	(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		106.97	(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) =	106.97	(331)
Energy for lighting (calculated in Appendix L)		239.82	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-267.72	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3567.27	(338)

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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	724.15	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.1	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	742.25	(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) =			742.25	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	55.52	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	124.47	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-138.95	(380)
Total CO2, kg/year	sum of (376)…(382) =			783.29	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.07	(384)
EI rating (section 14)				89.17	(385)

Appendix D – Discounted Renewable Technologies and Reasons for Exclusion from Development

With the reference to Item 6.1 Green Technologies, the following describes the renewable technologies that have been discounted in respect of the proposed development and why:

Domestic Hot Water Heating

Solar thermal or solar hot water (SHW) systems use a collector which is generally mounted on the roof, and typically contains a water glycol mixture which is heated by the sun. The heated liquid is then passed through a coil in a hot water storage cylinder. The water in the cylinder is then further heated (if required) by a boiler or electric immersion heater. The free energy obtained from the sun can be used to offset the amount of energy required for providing domestic hot water, and will reduce both running costs (due to the fuel being displaced electricity, natural gas, Liquefied Petroleum Gas (LPG) or oil) and the associated CO2 emissions.

These systems are not good enough to provide space heating in the UK due to the climate but are among the most cost- effective renewable energy systems that can be installed to assist with domestic hot water demand.

Solar water heating could be installed by utilizing either evacuated tube type panels or flat plate collectors mounted on the roof of the building.

Reasons for Excluding this Technology for this Site

SHW only contributes to the water heating demand of the building and has reduced effectiveness during the winter months. Consequently, they do not supply sufficient carbon reduction. This technology is not considered suitable for this project and is not investigated further.

SHW only contributes to the water heating demand of the building and has reduced effectiveness during the winter months. Consequently, they do not supply sufficient carbon reduction. This technology is not considered suitable for this project and is not investigated further.

Biomass Boilers

Biomass heating is the combustion of a biomass fuel such as wood in a boiler to supply space heating and hot water. Biomass is biological in origin and when from sustainable sources is regarded as a renewable. The most common fuel is wood, supplied in three forms, logs, chips and compressed wood pellets.

Any biomass heating system requires the following main components:

- Fuel storage;
- One or more boilers;
- One or more heat accumulators;
- A chimney stack or flue;
- A heat meter.

Sufficient fuel must be stored on-site to maintain operations in between deliveries. The amount will depend on circumstances but is typically no less than a week of operation at full load.

The store must keep the fuel dry. Wet fuel will cause the boiler to malfunction.

The design of the store will depend on the fuel selected; logs can be kept in a simple shed, chips in a storage bay and pellets in an enclosed hopper. Typical solutions are silos similar to animal feed storage or partitioned sections in an enclosed barn, outhouse or commodity store. Access is needed for deliveries and some is needed to convey the fuel to the boiler on demand.

There are two main types of boiler – continuously fuelled and batch fuelled. Continuously fuelled boilers use wood chip or pellet fuels and can be made fully automatic. The space requirement for biomass plant, equipment and associated fuel storage is significant and given the footprint of the building and its central location the site has limited off-street loading and delivery areas. Biomass requires frequent and regular deliveries of fuel which would impact on local transportation due to site servicing constraints and would therefore not be suitable for this redevelopment.

Reasons for Excluding this Technology for this Site

There are many discussions at this time with regards to the suitability of biomass within the central locations due to the Clean Air Act Requirements and the viability of clean biomass systems has not yet been proven.

Storage limitations dictate whether it is physically feasible to include within the development's renewable energy strategy; a large dry space for storing the fuel would be required to hold several months' worth of fuel. In addition, a fuel supplier would need to be within reasonable vicinity; otherwise the emissions associated with delivery will significantly reduce the on-site carbon savings.

Biomass boilers do not operate in the same way as gas and oil boilers. They have a more limited operating range and cannot respond as rapidly to changes in demand. Short operating

cycles are not recommended. The use of a hot water tank or accumulator in the system to balance the output of the boiler and the demand of the heating system is highly recommended. The necessary volume depends on the type of boiler and the character of the heating system. Pellet boilers have a good operating range and a relatively small tank would be used. Log boilers have little range and a large tank that can absorb the energy contained within one or more charges of wood is necessary.

Biomass boilers are combustion appliances and are subject to regulation on placing height and the quantity of pollutant emissions. This should be discussed with the Environmental Health Officer of the Local Authority.

Therefore, the inclusion of biomass has not been deemed appropriate and is not considered further.

Ground Source Heat Pumps

Ground source heat pumps can be used to provide heating and or cooling to the building. Whilst ground source does rely on fossil fuels (indirectly) to provide the energy source, they are considered renewable given their high coefficient of performance and hence reduced fossil fuel reliance.

This can be one of four methods:

i. Closed horizontal loops, generally comprising a number of flow and return horizontal coiled loops sometimes called 'slinkies'.

ii. Closed vertical loops, generally comprising a number of flow and return vertical loops to approximately 100m.

iii. Open loop, generally comprising of an abstraction and rejection well.

iv. Abstraction only open loop, comprising of an abstraction well with water rejected to either the local sewer systems or river/water course.

Reasons for Excluding this Technology for this Site

In order to provide the anticipated heating and cooling bore holes would be required with sufficient distance needed between them. With the site having limited external areas, ground source heat pumps are deemed not suitable for this project and have not been considered further.

Wind Turbines

This section covers both large scale and micro wind solutions. Large scale wind generation systems have capacities over 100kW and are usually used to power larger developments such as, larger scale housing, industrial estates and hotels with many rooms. These systems cannot be roof mounted due to their size and weight.

Reasons for Excluding this Technology for this Site

Due to the large capital cost and surroundings, large scale wind turbine systems are not considered viable at this project.

It is difficult to obtain predictable or large amounts of wind energy in central locations, as they require non-turbulent, horizontal air streams to be most effective. Surrounding buildings, trees, etc. can cause significant issues with regards to micro and large-scale installations unless the rotors are positioned at a considerable height.

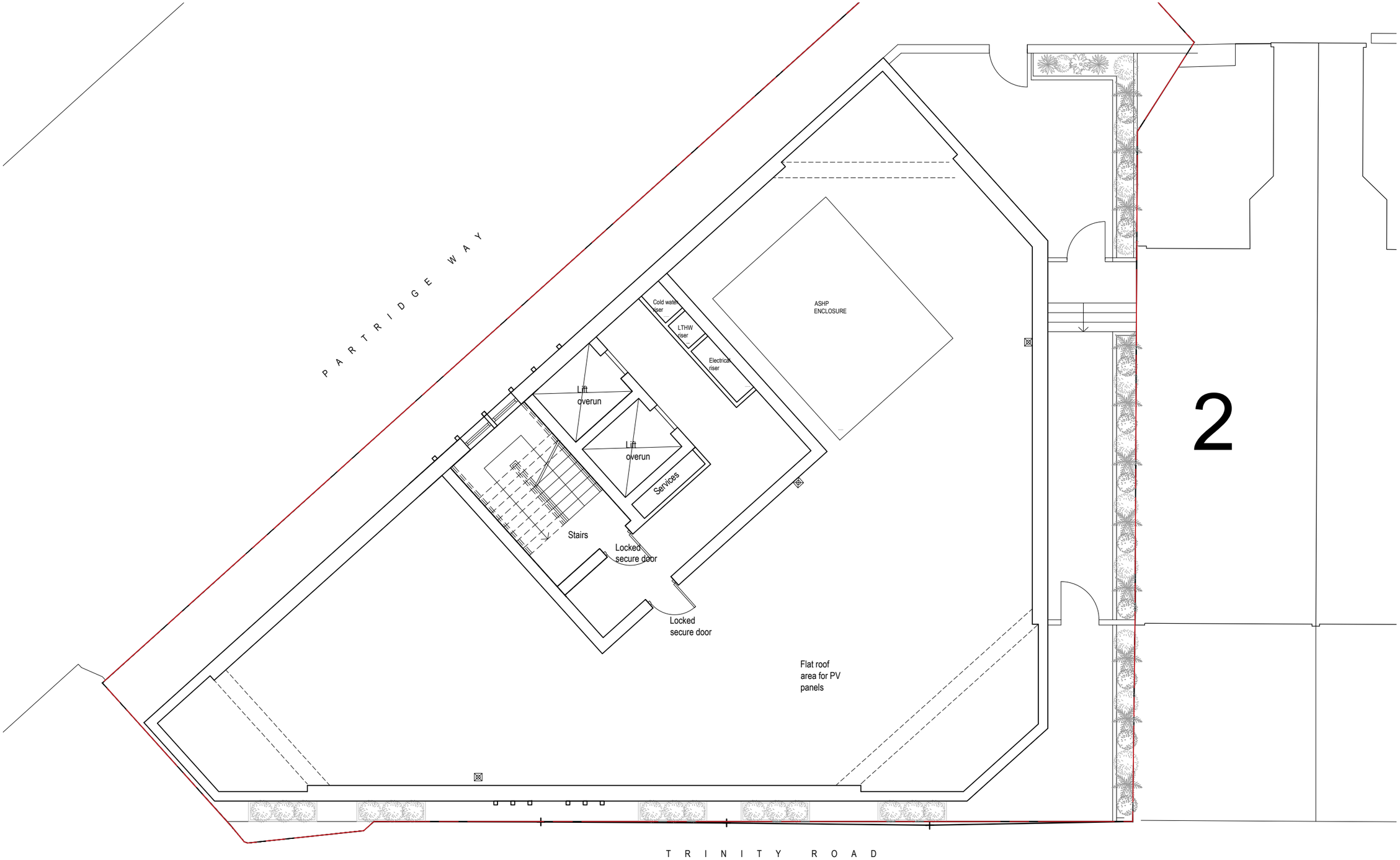
Micro wind turbine technology has been found to be extremely difficult to achieve a contribution economically. A significant number of units would be required to provide any reasonable energy savings which would have serious visual impact implications.

Tall buildings give their own specific problems in that the building act as a spoiler, pushing wind upwards and over the turbine, reducing effectiveness considerably.

Additional considerations with large and micro wind solutions are the potential issues from stroboscopic light, topple distance, noise, impact on wildlife and structural enhancements which all raise major concerns given the building central London location.

Given the building location and its close proximity to nearby buildings, achieving an acceptable solution that will provide sufficient renewable contribution as well as overcome the installation impacts is unlikely and therefore has not been considered for this project.

Appendix E – Ninth Floor Plan - ASHP Location



01/106 PROPOSED NINTH FLOOR PLAN

1:100

CONTRACTORS ARE NOT TO SCALE OFF THIS DRAWING
ALL DIMENSIONS MUST BE CHECKED ON SITE
INFORM THE ARCHITECT OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION
PLOT SIZE: A3

NOTES:
SCALE: 1:100 @ A3
0 1 2

REV	DATE	DESCRIPTION	DRN	CHK
A04	14.01.2021	AMENDED TO PLANNERS AND CONSULTANTS COMMS	VL	CP
A03	27.11.2020	AMENDED TO CONSULTANTS COMMENTS	VL	CP
A02	25.11.2020	AMENDED TO CONSULTANTS COMMENTS	VL	CP
A01	18.09.2020	ISSUED FOR PUBLIC ENGAGEMENT	VL	CP

REVISION HISTORY

PROJECT:
PARTRIDGE WAY
HARINGEY

CLIENT:
HARINGEY COUNCIL

DRAWING NO:
0226 - 106

DRAWING TITLE:
PROPOSED
NINTH FLOOR PLAN

SCALE @ A3: 1:100

REV:
A04

UNIT
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Appendix F – GLA’s Carbon Emission Reporting Spreadsheet

The applicant should complete all the light blue cells including information on the modelled units, the area per unit, the number of units, the baseline energy consumption figures, the TER and the TFEE.

SAP 2012 CO2 PERFORMANCE

SAP10 CO2 PERFORMANCE

DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

DEMAND

Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m^2)	Number of units	Total area represented by model (m^2)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - TER WORKSHEET							REGULATED CO2 EMISSIONS PER UNIT (kgCO2 p.a.)						REGULATED CO2 EMISSIONS PER UNIT							Fabric Energy Efficiency (FEE)
				Calculated TER 2012 (kgCO2 / m2)	TER Worksheet TER 2012 (kgCO2 / m2)	Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	2012 CO2 emissions (kgCO2 p.a.)	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated TER SAP10 (kgCO2 / m2)	Target Fabric Energy Efficiency (TFEE) (kWh/m²)
	TER Worksheet (Row 4)				TER Worksheet (Row 273)	TER Worksheet (Row 211)		TER Worksheet (Row 219)		TER Worksheet (Row 232)	TER Worksheet (Row 231)	N / A														
Apt 1 - level 1	80.71	1	80.71	20.2	20.2	4161.98	Natural Gas	2373.86	Natural Gas	347.75	75		899	513	180	39		1,631	874	499	81	17		1,471	18.2	64.5
Apt 2 - level 1	95.04	1	95.04	18.3	18.3	4469.03	Natural Gas	2465.95	Natural Gas	391.78	75		965	533	203	39		1,740	938	518	91	17		1,565	16.5	58.3
Apt 3 - level 2	50.49	1	50.49	20.1	20.1	1895.87	Natural Gas	2060.65	Natural Gas	234.28	75		410	445	122	39		1,015	398	433	55	17		903	17.9	50.8
Apt 4 - level 2	70.58	6	423.48	15.6	15.6	1856.96	Natural Gas	2318.78	Natural Gas	312.75	75		401	501	162	39		1,103	390	487	73	17		967	13.7	37.1
Apt 5 - level 2	51.96	6	311.76	19.7	19.7	1891.90	Natural Gas	2080.38	Natural Gas	240.23	75		409	449	125	39		1,022	397	437	56	17		908	17.5	49.4
Apt 6 - level 3	50.49	5	252.45	19.8	19.8	1810.62	Natural Gas	2062.90	Natural Gas	234.28	75		391	446	122	39		997	380	433	55	17		886	17.5	49
Apt 21 - level 8	50.49	1	50.49	21.5	21.5	2239.52	Natural Gas	2052.57	Natural Gas	234.28	75		484	443	122	39		1,088	470	431	55	17		973	19.3	58.3
Apt 22 - level 8	70.58	1	70.58	17.4	17.4	2461.22	Natural Gas	2303.07	Natural Gas	312.75	75		532	497	162	39		1,230	517	484	73	17		1,091	15.5	46.4
Apt 23 - level 8	51.96	1	51.96	21.5	21.6	2356.70	Natural Gas	2069.68	Natural Gas	240.23	75		509	447	125	39		1,120	495	435	56	17		1,003	19.3	59.2
Sum	1,387	23	1,387	18.4	-	49,131	N/A	50,035	N/A	6,250	1,725	0	10,612	10,808	3,244	895	0	25,559	10,317	10,507	1,456	402	0	22,683	16.4	47.65

The applicant should complete all the light blue cells including information on the 'be lean' energy consumption figures, the 'be lean' DER, the DFEE and the regulated energy demand of the 'be lean' scenario.

SAP 2012 CO2 PERFORMANCE

SAP10 CO2 PERFORMANCE

DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

DOMESTIC ENERGY DEMAND DATA

Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE LEAN' SAP DER WORKSHEET							REGULATED CO2 EMISSIONS PER UNIT (kgCO2 p.a.)						REGULATED CO2 EMISSIONS PER UNIT							Fabric Energy Efficiency (FEE)	REGULATED ENERGY DEMAND PER UNIT PER ANNUM (kWh p.a.)				
				Calculated DER 2012 (kgCO2 / m2)	DER Worksheet DER 2012 (kgCO2 / m2)	Space Heating	Fuel type Space Heating	Domestic Hot Water	Fuel type Domestic Hot Water	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Lighting	Auxiliary	Cooling	2012 CO2 emissions (kgCO2 p.a.)	Space Heating CO2 emissions (kgCO2 p.a.)	Domestic Hot Water CO2 emissions (kgCO2 p.a.)	Lighting CO2 emissions (kgCO2 p.a.)	Auxiliary CO2 emissions (kgCO2 p.a.)	Cooling CO2 emissions (kgCO2 p.a.)	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated DER SAP10 (kgCO2 / m2)	Dwelling Fabric Energy Efficiency (DFEE) (kWh/m²)	Space Heating (kWh p.a.)	Domestic Hot Water (kWh p.a.)	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)
					DER Sheet (Row 384)	DER Sheet [(Row 307a) ÷ (Row 367a x 0.01)]	Select fuel type	DER Sheet [(Row 310a) ÷ (Row 367a x 0.01)]	Select fuel type	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315																			
Apt 1 - level 1	80.71	1	80.71	20.1	20.1	3555.177778	Natural Gas	2584.077778	Natural Gas	347.82	219.86	0	768	558	181	114	0	1,621	747	543	81	51	0	1,422	17.6	54.36	3,555	2,584	348	220	0
Apt 2 - level 1	95.04	1	95.04	18.1	18.1	3726.033333	Natural Gas	2681.1	Natural Gas	390.54	252	0	805	579	203	131	0	1,717	782	563	91	59	0	1,495	15.7	49.91	3,726	2,681	391	252	0
Apt 3 - level 2	50.49	1	50.49	20.1	20.1	1565.2	Natural Gas	2231.644444	Natural Gas	233.81	137.3	0	338	482	121	71	0	1,013	329	469	54	32	0	884	17.5	46.19	1,565	2,232	234	137	0
Apt 4 - level 2	70.58	6	423.48	14.7	14.7	1143.844444	Natural Gas	2485.388889	Natural Gas	312.76	177.27	0	247	537	162	92	0	1,038	240	522	73	41	0	876	12.4	31.85	6,863	14,912	1,877	1,064	0
Apt 5 - level 2	51.96	6	311.76	19.2	19.2	1452.411111	Natural Gas	2251.444444	Natural Gas	239.82	139.58	0	314	486	124	72	0	997	305	473	56	33	0	866	16.7	43.75	8,714	13,509	1,439	837	0
Apt 6 - level 3	50.49	5	252.45	19.7	19.7	1473.1	Natural Gas	2231.644444	Natural Gas	233.81	136.48	0	318	482	121	71	0	992	309	469	54	32	0	864	17.1	44.64	7,366	11,158	1,169	682	0
Apt 21 - level 8	50.49	1	50.49	21.7	21.7	1934.366667	Natural Gas	2231.644444	Natural Gas	233.81	140.61	0	418	482	121	73	0	1,094	406	469	54	33	0	962	19.1	52.31	1,934	2,232	234	141	0
Apt 22 - level 8	70.58	1	70.58	16.9	16.9	1829.255556	Natural Gas	2485.388889	Natural Gas	312.76	183.37	0	395	537	162	95	0	1,189	384	522	73	43	0	1,022	14.5	40.45	1,829	2,485	313	183	0
Apt 23 - level 8	51.96	1	51.96	21.5	21.5	1990.977778	Natural Gas	2251.444444	Natural Gas	239.82	144.41	0	430	486	124	75	0	1,116	418	473	56	34	0	980	18.9	52.38	1,991	2,251	240	144	0
Sum	1,387	23	1,387	18.0	-	37,544	N/A	54,045	N/A	6,243	3,661	0	8,110	11,674	3,240	1,900	0	24,923	7,884	11,349	1,455	853	0	21,541	15.5	41.87	144,894	240,782	27,497	15,896	0

The applicant should complete all the light blue cells including information on the 'be clean' energy consumption figures and the 'be clean' DER.

DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS

				VALIDATION CHECK		REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE CLEAN' SAP DER WORKSHEET										REGULATED CO2 EMISSIONS PER UNIT (kgCO2 p.a.)								REGULATED CO2 EMISSIONS PER UNIT (kgCO2 p.a.)								
Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Number of units	Total area represented by model (m²)	Calculated DER 2012 (kgCO2 / m2)	DER Worksheet DER 2012 (kgCO2 / m2)	Space Heating (Heat Source 1)	Fuel type Space Heating	Domestic Hot Water (Heat Source 1)	Fuel type Domestic Hot Water	Space and Domestic Hot Water from CHP	Fuel type CHP	Total Electricity generated by CHP (-)	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Space Heating and DHW from CHP	Electricity generated by CHP	Lighting	Auxiliary	Cooling	2012 CO2 emissions (kgCO2 p.a.)	Space Heating	Domestic Hot Water	Space Heating and DHW from CHP	Electricity generated by CHP	Lighting	Auxiliary	Cooling	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated DER SAP10 (kgCO2 / m2)
					DER Sheet (Row 384)	DER Sheet [Row 307b ÷ (Row 367b x 0.01)]	Select fuel type	DER Sheet [Row 310b ÷ (Row 367b x 0.01)]	Select fuel type	DER Sheet [(Row 307a + 310a) ÷ (Row 362 x 0.01)]	Select fuel type	DER Sheet [(Row 307a + 310a) × (Row 361 ÷ 362)]	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315			if applicable	if applicable								if applicable	if applicable				
Apt 1 - level 1	80.71	1	80.71	20.1	20.1	3555.177778	Natural Gas	2584.077778	Natural Gas	0	Natural Gas	0	347.82	219.86	0	768	558	0	0	181	114	0	1,621	747	543	0	0	81	51	0	1,422	17.6
Apt 2 - level 1	95.04	1	95.04	18.1	18.1	3726.033333	Natural Gas	2681.1	Natural Gas	0	Natural Gas	0	390.54	252	0	805	579	0	0	203	131	0	1,717	782	563	0	0	91	59	0	1,495	15.7
Apt 3 - level 2	50.49	1	50.49	20.1	20.1	1565.2	Natural Gas	2231.644444	Natural Gas	0	Natural Gas	0	233.81	137.3	0	338	482	0	0	121	71	0	1,013	329	469	0	0	54	32	0	884	17.5
Apt 4 - level 2	70.58	6	423.48	14.7	14.7	1143.844444	Natural Gas	2485.388889	Natural Gas	0	Natural Gas	0	312.76	177.27	0	247	537	0	0	162	92	0	1,038	240	522	0	0	73	41	0	876	12.4
Apt 5 - level 2	51.96	6	311.76	19.2	19.2	1452.411111	Natural Gas	2251.444444	Natural Gas	0	Natural Gas	0	239.82	139.58	0	314	486	0	0	124	72	0	997	305	473	0	0	56	33	0	866	16.7
Apt 6 - level 3	50.49	5	252.45	19.7	19.7	1473.1	Natural Gas	2231.644444	Natural Gas	0	Natural Gas	0	233.81	136.48	0	318	482	0	0	121	71	0	992	309	469	0	0	54	32	0	864	17.1
Apt 21 - level 8	50.49	1	50.49	21.7	21.7	1934.366667	Natural Gas	2231.644444	Natural Gas	0	Natural Gas	0	233.81	140.61	0	418	482	0	0	121	73	0	1,094	406	469	0	0	54	33	0	962	19.1
Apt 22 - level 8	70.58	1	70.58	16.9	16.9	1829.255556	Natural Gas	2485.388889	Natural Gas	0	Natural Gas	0	312.76	183.37	0	395	537	0	0	162	95	0	1,189	384	522	0	0	73	43	0	1,022	14.5
Apt 23 - level 8	51.96	1	51.96	21.5	21.5	1990.977778	Natural Gas	2251.444444	Natural Gas	0	Natural Gas	0	239.82	144.41	0	430	486	0	0	124	75	0	1,116	418	473	0	0	56	34	0	980	18.9
Sum	1,387	23	1,387	18.0	-	37,544	N/A	54,045	N/A	0	N/A	0	6,243	3,661	0	8,110	11,674	0	0	3,240	1,900	0	24,923	7,884	11,349	0	0	1,455	853	0	21,541	15.5

The applicant should complete all the light blue cells including information on the 'be green' energy consumption figures and the 'be green' DER.

SAP 2012 CO2 PERFORMANCE

SAP10 CO2 PERFORMANCE

DOMESTIC ENERGY CONSUMPTION AND CO2 ANALYSIS

Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area (m²)	Number of units	Total area represented by model (m²)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION PER UNIT (kWh p.a.) - 'BE GREEN' SAP DER WORKSHEET													REGULATED CO2 EMISSIONS PER UNIT (kgCO2 p.a.)								REGULATED CO2 EMISSIONS PER UNIT									
				Calculated DER 2012 (kgCO2 / m2)	DER Worksheet DER 2012 (kgCO2 / m2)	Space Heating (Heat Source 1)	Fuel type Space Heating	Domestic Hot Water (Heat Source 1)	Fuel type Domestic Hot Water	Space Heating (Heat source 2) if applicable	Fuel type Space Heating	Domestic Hot Water (Heat source 2) if applicable	Fuel type Domestic Hot Water	Space and Domestic Hot Water from CHP if applicable	Fuel type CHP if applicable	Total Electricity generated by CHP (-) if applicable	Electricity generated by renewable (-) if applicable	Lighting	Auxiliary	Cooling	Space Heating	Domestic Hot Water	Space Heating and DHW from CHP if applicable	Electricity generated by CHP if applicable	Electricity generated by renewable if applicable	Lighting	Auxiliary	Cooling	2012 CO2 emissions (kgCO2 p.a.)	Space Heating	Domestic Hot Water	Space Heating and DHW from CHP if applicable	Electricity generated by CHP if applicable	Electricity generated by renewable if applicable	Lighting	Auxiliary	Cooling	SAP10 CO2 emissions (kgCO2 p.a.)	Calculated DER SAP10 (kgCO2 / m2)
					DER Sheet (Row 384)	DER Sheet [Row 307b + (Row 367b x 0.01)]	Select fuel type	DER Sheet [Row 310b + (Row 367b x 0.01)]	Select fuel type	DER Sheet [Row 307c + (Row 367c x 0.01)]	Select fuel type	DER Sheet [Row 310c + (Row 367c x 0.01)]	Select fuel type	DER Sheet [(Row 307a + 310a) + (Row 362 x 0.01)]	Select fuel type	DER Sheet [(Row 307a + 310a) x (Row 361 ÷ 362)]	DER Sheet Row 380	DER Sheet Row 332	DER Sheet (Row 313 + 331)	DER Sheet Row 315																					
Apt 1 - level 1	80.71	1	80.71	16.3	16.3	1279.864	Grid Electricity	930.268	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-241.81	347.82	219.86	0	664	483	0	0	-125	181	114	0	1,316	298	217	0	0	-56	81	51	0	591	7.3
Apt 2 - level 1	95.04	1	95.04	14.5	14.6	1341.372	Grid Electricity	965.196	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-284.99	390.54	252	0	696	501	0	0	-148	203	131	0	1,383	313	225	0	0	-66	91	59	0	621	6.5
Apt 3 - level 2	50.49	1	50.49	16.4	16.4	563.472	Grid Electricity	803.392	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-146.82	233.81	137.3	0	292	417	0	0	-76	121	71	0	826	131	187	0	0	-34	54	32	0	371	7.3
Apt 4 - level 2	70.58	6	423.48	11.7	11.7	411.784	Grid Electricity	894.74	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-207.27	312.76	177.27	0	214	464	0	0	-108	162	92	0	825	96	208	0	0	-48	73	41	0	370	5.2
Apt 5 - level 2	51.96	6	311.76	15.6	15.6	522.868	Grid Electricity	810.52	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-155.45	239.82	139.58	0	271	421	0	0	-81	124	72	0	808	122	189	0	0	-36	56	33	0	363	7.0
Apt 6 - level 3	50.49	5	252.45	16.0	16.0	530.316	Grid Electricity	803.392	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-146.82	233.81	136.48	0	275	417	0	0	-76	121	71	0	808	124	187	0	0	-34	54	32	0	363	7.2
Apt 21 - level 8	50.49	1	50.49	17.8	17.8	696.372	Grid Electricity	803.392	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-146.82	233.81	140.61	0	361	417	0	0	-76	121	73	0	897	162	187	0	0	-34	54	33	0	402	8.0
Apt 22 - level 8	70.58	1	70.58	13.5	13.6	658.532	Grid Electricity	894.74	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-207.27	312.76	183.37	0	342	464	0	0	-108	162	95	0	956	153	208	0	0	-48	73	43	0	429	6.1
Apt 23 - level 8	51.96	1	51.96	17.5	17.5	716.752	Grid Electricity	810.52	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-155.45	239.82	144.41	0	372	421	0	0	-81	124	75	0	911	167	189	0	0	-36	56	34	0	409	7.9
					14.0	1110.232	Grid Electricity	930.268	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-219.63	347.82	217.17	0	575	483	0	0	-114	181	113	0	1,238	259	217	0	0	-51	81	51	0	556	
					12.4	1158.5	Grid Electricity	965.196	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-259.97	390.54	248.75	0	601	501	0	0	-135	203		0	1,170	270	225	0	0	-61	91		0	525	
					13.6	422.96	Grid Electricity	803.392	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-138.95	233.81	134.61	0	220	417	0	0	-72	121	70	0	756	99	187	0	0	-32	54	31	0	339	
					9.5	286.284	Grid Electricity	894.74	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-192.73	312.76	174.84	0	149	464	0	0	-100	162	91	0	766	67	208	0	0	-45	73	41	0	344	
					13.1	394.764	Grid Electricity	810.52	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-138.95	239.82	137.1	0	205	421	0	0	-72	124	71	0	749	92	189	0	0	-32	56	32	0	336	
					13.3	391.204	Grid Electricity	803.392	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-138.95	233.81	133.81	0	203	417	0	0	-72	121	69	0	739	91	187	0	0	-32	54	31	0	332	
					15.0	552.204	Grid Electricity	803.392	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-138.95	233.81	137.84	0	287	417	0	0	-72	121	72	0	824	129	187	0	0	-32	54	32	0	370	
					11.3	517.552	Grid Electricity	894.74	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-192.73	312.76	180.62	0	269	464	0	0	-100	162	94	0	889	121	208	0	0	-45	73	42	0	399	
																												#REF!									#REF!	
					15.1	584.76	Grid Electricity	810.52	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	Grid Electricity	0	-138.95	239.82	141.85	0	303	421	0	0	-72	124	74	0	850	136	189	0	0	-32	56	33	0	382	
Sum	1,387	23	1,387	14.5	-	13,516	N/A	19,456	N/A	0	N/A	0	N/A	0	N/A	0	-4,094	6,243	3,661	0	7,015	10,098	0	0	-2,125	3,240	#REF!	0	20,128	3,149	4,533	0	0	-954	1,455	#REF!	0	9,036	6.5

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

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	23	27,223
After energy demand reduction	22	27,223
After heat network / CHP	22	27,223
After renewable energy	9	27,223