SYNTEGRA CONSULTING

9 Upper Crown Street,
Reading,
RG1 2SS

Energy and Sustainability Statement

July 2021



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1. EXECUTIVE SUMMARY 5

2. INTRODUCTION 8

3. PLANNING POLICY 9

4. SUSTAINABILITY STATEMENT 11

5. ENERGY STATEMENT - ASSESSMENT METHODOLOGY 15

6. ENERGY STATEMENT - BASELINE 17

7. ENERGY STATEMENT - 1ST STAGE 18

8. ENERGY STATEMENT - 2ND STAGE 20

9. ENERGY STATEMENT - 3RD STAGE 21

10. CONCLUSION 26

11. APPENDIX – SAP REPORTS 27

Quality Standards Control

The signatories below verify that this document has been prepared in accordance with our quality control requirements. These procedures do not affect the content and views expressed by the originator.

Revision	*Initial*	*Rev A*	*Rev B*	*Rev C*
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1. Executive Summary

This report demonstrates the predicted energy performance and carbon dioxide emissions of the proposed development at **9 Upper Crown Street, Reading, RG1 2SS**. The proposed scheme is **new construction of 46 dwellings within Reading Borough.**

1.1. Policy Requirements

The Council requires new developments to incorporate sustainable design and construction measures. The table below summarises the local policy requirements for the proposed development.

Policy/Regulation	Requirement	Compliance Check
Building Regulation Part L1A	Target Emission Rate and Targe Fabric Energy Efficiency are required to meet.	The proposed development meets TER and TFEE as per Part L1A. Furthermore, the scheme achieves a 39.53% carbon reduction via energy efficient measures and Air Source Heat Pumps against the Part L TER.
Local Plan Policy CC3	All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change.	The proposed development incorporates all possible measures to adapt to climate change. Details can be found in section 4 of this report.
Local Plan Policy CC4	Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sqm shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.	The proposed development will have the site-wide decentralised energy provision through communal Air Source Heat Pumps for space heating and hot water.

Table 1 Policy Requirements

1.2. Methodology and Strategies

The methodology used to determine the CO_2 emissions is in accordance with the three-step Energy Hierarchy. The below table shows the Energy Hierarchy and suggested strategies for the proposed development.

Stages	Strategies
1st Stage Energy efficient design	• Improved U-values and air permeability beyond the Building Regulations Part L minimum requirements. • Accredited Construction Details for all thermal bridging junctions in new-build units. • Energy efficient lighting. • Low water consumption. • Natural ventilation with extract fans in wet rooms.
2nd Stage Combined Heat and Power	• Not applicable for this scheme, further details can be found under section 8 of this report.
3rd Stage On-site renewable technologies	• Air Source Heat Pump for space heating and hot water, further details can be found in section 9.2.

Table 2 Energy Hierarchy and suggested strategies

1.3. Assessment Results

After the application of all strategies based on the Energy Hierarchy, the regulated carbon dioxide emissions have been reduced as follows.

Energy Hierarchy		Regulated Carbon Emissions (Tonnes CO_2/yr)
BASELINE	TER set by Building Regulations 2013 Part L	2.71
1st Stage	After energy demand reduction	1.88
2nd Stage	After CHP/ Communal Heating	1.88
3rd Stage	After renewable energy	1.63

Table 3 Carbon Emissions after each stage of the proposed strategy

The carbon savings from each stage can be calculated based on the results above. The chart below summarises the total cumulative savings on the site. Given the total cumulative savings, **the proposed development meets a 39.53% reduction on the site.**

Regulated Carbon Savings		Carbon Reduction	
		Tonnes CO_2/yr	%
1st Stage	After energy demand reduction	0.83	30.66 %
2nd Stage	After Combined Heat and Power	0	0 %
3rd Stage	After renewable energy	0.24	8.87 %
Total Cumulative Savings		**1.07**	**39.53 %**

Table 4 Carbon dioxide Emissions after each stage of the Energy Hierarchy

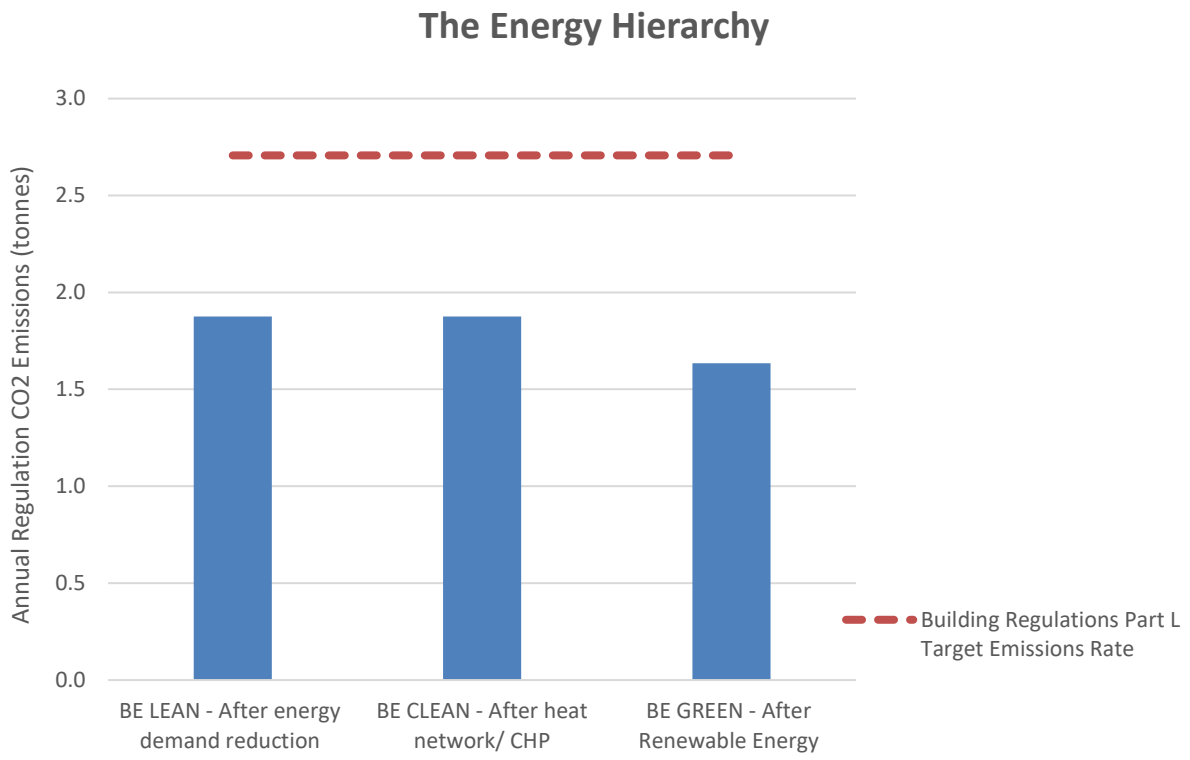


Figure 1 The Energy Hierarchy

2. Introduction

This report will be included as part of the planning application that addresses the environmental impact of the development. This report focuses on the energy strategy for the proposed scheme and how energy consumption and carbon emissions will be minimised and to meet the targeted carbon emissions.

The development is to be located in Reading Borough and it is in close proximity to Reading Station (0.8 mile to North). The proposal is **new construction of 46 dwellings at 9 Upper Crown Street, Reading, RG1 2SS.**

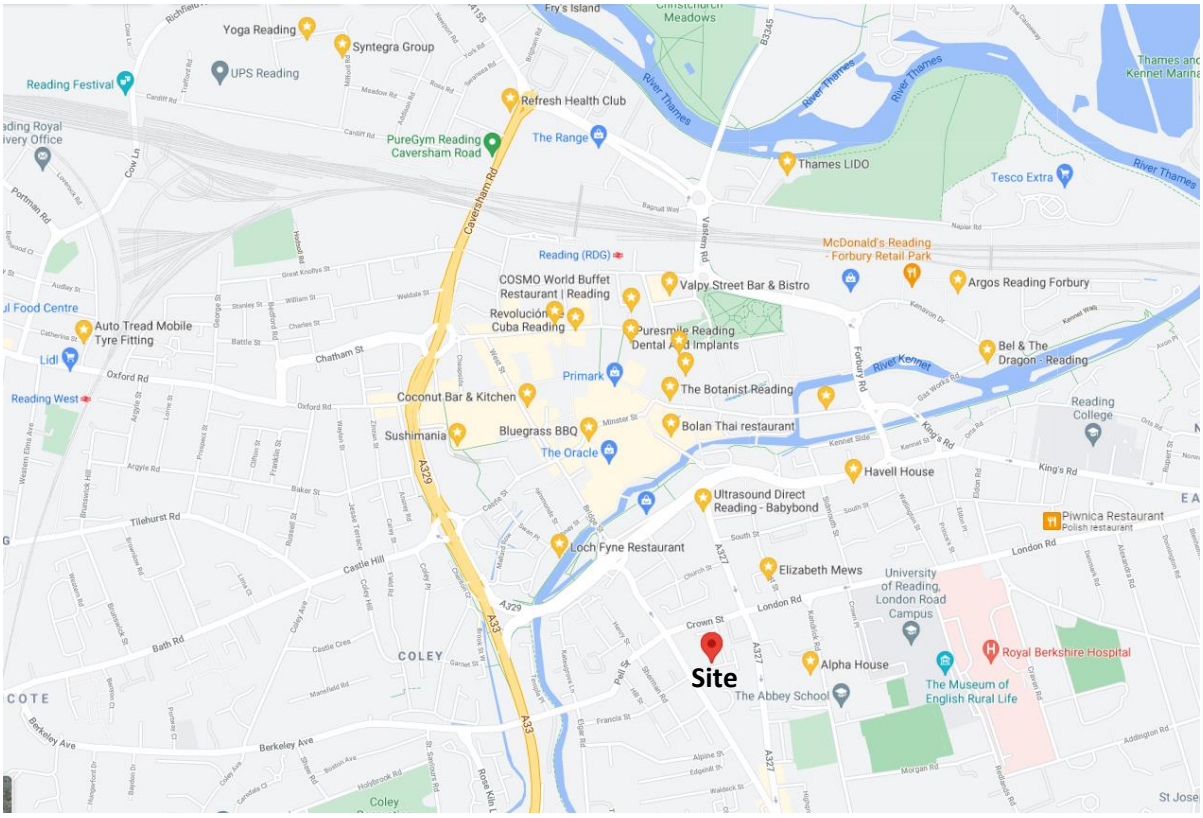


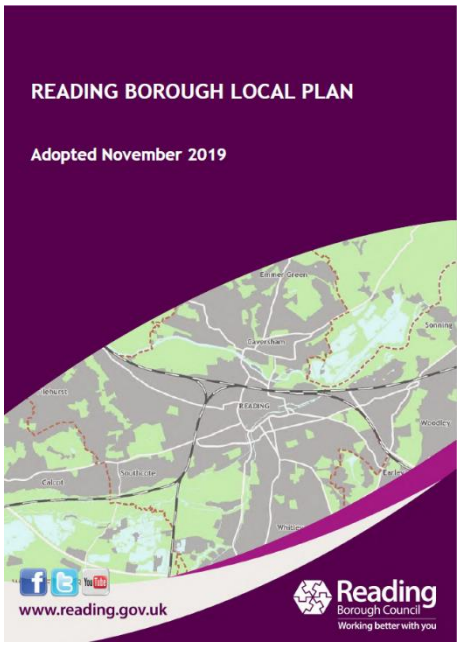
Figure 2 Site Location

3. Planning Policy

3.1. National Planning Policy Framework (February 2019)

The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

3.2. Reading Borough Council



Local Plan (Adopted November 2019)

Policy CC2: SUSTAINABLE DESIGN AND CONSTRUCTION

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

To meet these requirements:

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

Policy CC3: ADAPTATION TO CLIMATE CHANGE

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

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

increases in river flooding levels as a result of climate change.

Policy CC4: DECENTRALISED ENERGY

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

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

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

4. Sustainability Statement

4.1. Materials

The development would utilise low embodied materials - at least three of the key elements of the building envelope are to achieve a rating of A+ to D in the BRE's The Green Guide of specification. At least 50% of timber and timber products will be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of forestry certification (PEFC) where feasible. All material used would be durable to cater for their level of use and exposure and will not release toxins into the internal and external environment where feasible.

4.2. Nature conservation and biodiversity

There would be no loss in the quality and quantity of biodiversity by this development, as the site was already developed, and the proposed scheme includes making new gardens and plants. Therefore, the development would make a contribution to biodiversity on the site in the course of design development.

4.3. Waste

The construction waste would be considered to minimise, recycle and reuse on site where possible, this will reduce the overall construction cost and at the same time minimise the amount of waste diverting to landfill. Site Waste Management Plan (SWMP) would be formalised before the construction works start and updated as the works continue on the site.

The proposed development would adopt the best waste management procedures to reduce the amount of waste going to landfill. This would be established by creating provisions for recycling and also waste segregation from general to recyclable waste. This development would have separated bin storages, and the storages include refuse and recycling with enough sizes in accordance with borough requirements.

4.4. Health and Wellbeing

The health and wellbeing of the building occupant has been considered in this development. The proposed scheme is designed to maximise the opportunity for daylighting potential in habitable areas. The proposed development would ensure to introduce the occupant controlled and zoned space heating systems in accordance with space requirements and window orientation. This would provide occupant thermal comfort but at the same time it would reduce the overall energy cost and the carbon footprint.

4.5. Water Efficiency

The development will be based upon the specification of water efficient fittings including low volume dual flush WCs, and low flow taps/ showers/ bath. These measures will result in the internal water consumption rate of **105 litres/person/day or less**, excluding an allowance 5 litres per person per day for external water consumption. The design stage water use calculation is below.

Installation Type	Unit of Measure	Capacity/ flow rate (1)	Use factor (2)	Fixed use (litres/head/day) (3)	Total Consumption Litres/head/day (1)x(2)+(3) =(4)
WC (dual flush)	Full Flush Volume (litres)	**6**	1.46	0	**8.76**
	Part flush Volume (litres)	**4**	2.96	0	**11.85**
Taps (excluding kitchen/ utility room taps)	Flow rate (litres/minute)	**6.5**	1.58	1.58	**11.85**
Bath (where shower also present)	Capacity to overflow (litres)	**120**	0.11	0	**13.20**
Shower (where bath also present)	Flow rate (litres/minute)	**7.5**	4.37	0	**32.78**
Kitchen / utility room sink taps	Flow rate (litres/minute)	**6.5**	0.44	10.36	**13.22**
Washing machine	Litres/kg dry load	**9**	2.1	0	**18.90**
Dishwasher	Litres/place setting	**1.2**	3.6	0	**4.32**
Waste disposal unit	Litres/use	**If present = 1 If absent = 0**	3.08	0.00	**0**
Water Softener	Litres/person/day	-	1.00	0.00	-
(5)	**Total calculated use (litres/person/day) = Sum column 4**				**114.9**
(6)	**Contribution from greywater (litres/person/day)**				**0**
(7)	**Contribution from rainwater (litres/person/day)**				**0**
(8)	**Normalisation Factor**				**0.91**
Total water consumption (litres/person/day)					**104.5**
	External water use				**5**

Table 5 Design stage water use calculations

4.6. Flood Risk

The flood map for planning shows that the site is located **within Zone 1 of the flood risk** (see below image). Therefore, the detailed flood risk assessment has not been carried out for the site. In order to protect the site for future climate change impacts the Sustainable drainage strategy (SUDS) would be developed to incorporate attenuation for surface water runoff as well as habitat, water quality and amenity benefits. Therefore, there would be a net decrease in both the volume and rate of run-off leaving the site. As part of this, permeable paving materials will be used to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses. And also, rainwater collection and recycling systems would be considered at detailed design stage where feasible.

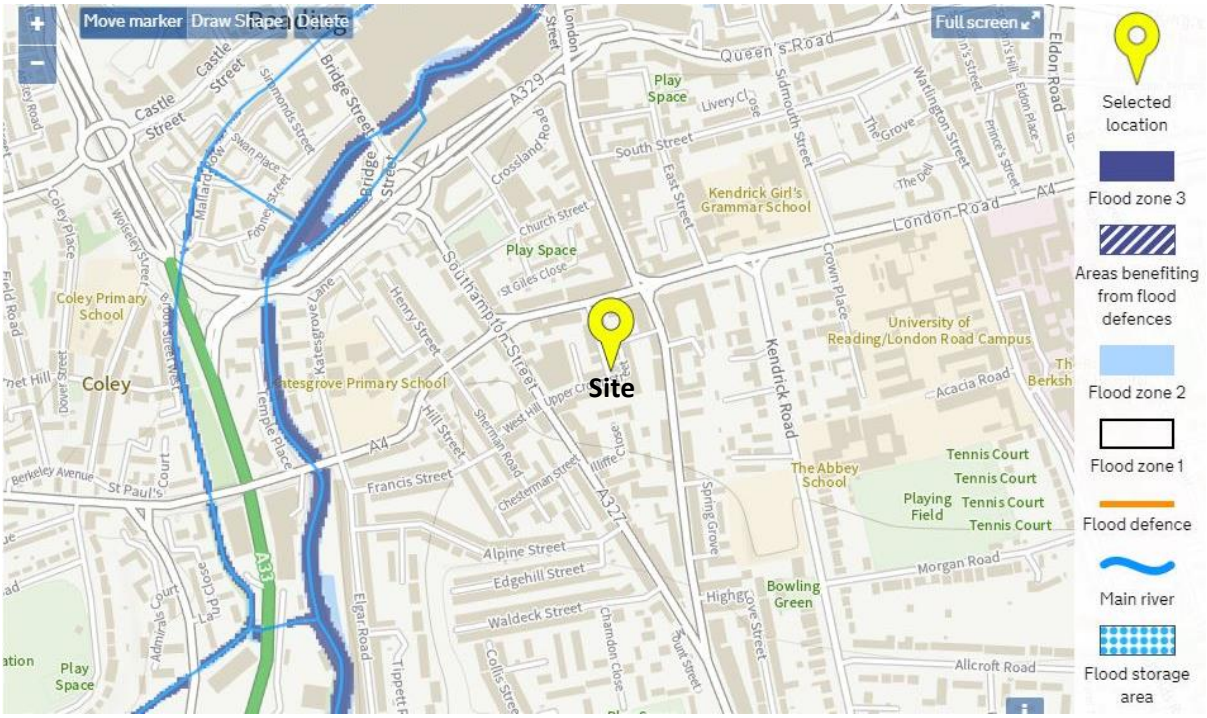


Figure 3 Flood map

4.7. Pollution

- Air

The proposed scheme has been designed to minimise the generation of air pollution and mitigate against increased exposure to poor air quality. This would include low NOx heating systems and non-toxic building materials where feasible. Contractor would follow the guidance set out in the emerging Minimising dust and emissions from construction and demolition when constructing their development.

- Noise

The mitigation measures would be incorporated to the proposed building at construction stage to reduce sources of noise – insulate and soundproofing doors, walls, windows, floors and ceilings, and seal air gaps around windows etc.

- Light

Lighting scheme would be designed to minimise light pollution where feasible. Guidance Notes for the Reduction of Obtrusive Light (2005) would be utilised to reduce obtrusive light.

5. Energy Statement - Assessment Methodology

5.1. Energy Hierarchy

The energy hierarchy is a classification of different methods to improve energy performance in a parallel sequence. This includes primarily a focus on reducing energy use by avoiding unnecessary use, to then improving the efficiency of energy systems to minimise loss, this is followed by exploiting renewable energy sources and then low carbon energy solutions for energy needs and finally, any remaining demand can be catered for by conventional fuel sources.

The Energy Strategy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. The following hierarchy has been used:

- **Stage 1** – By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.
- **Stage 2** – By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.
- **Stage 3** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.

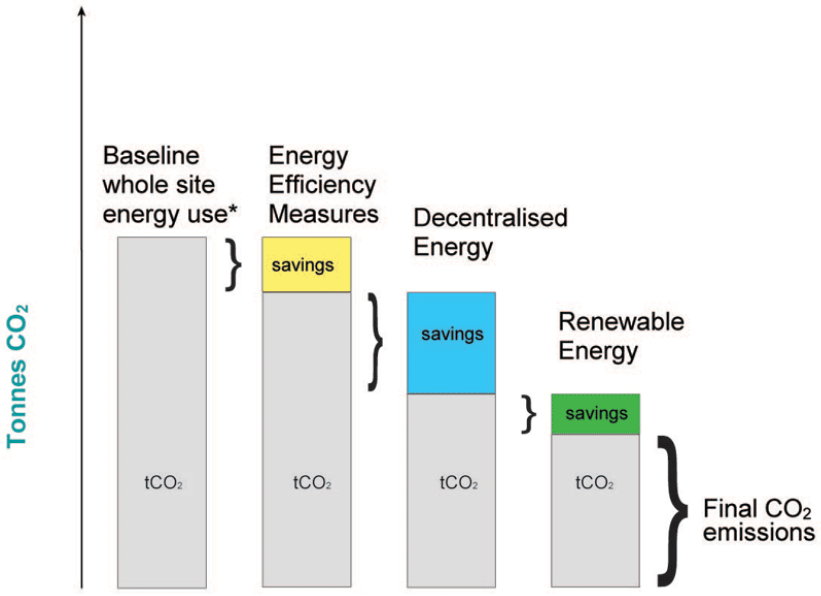


Figure 4 Energy Hierarchy

5.1. Software and Input data

The Government approved software, i.e. FSAP has been utilised to carry out Standard Assessment Procedure (SAP) calculations. Syntegra received the architectural drawings and relevant documents, and they were used to undertake the energy assessments. The document references are listed in the table below.

No.	Document Name	Format	Received Date
1	CA-222-P001	dwg	07-06-2021
2	CA-222-P008	dwg	07-06-2021
3	CA-222-P009	dwg	07-06-2021
4	CA-222-P010	dwg	07-06-2021
5	CA-222-P011	dwg	07-06-2021
6	CA-222-P012	dwg	07-06-2021
7	CA-222-P013	dwg	07-06-2021
8	CA-222-P014	dwg	07-06-2021
9	CA-222-P015	dwg	07-06-2021
10	CA-222-P016	dwg	07-06-2021
11	CA-222-P017	dwg	07-06-2021
12	CA-222-P018	dwg	07-06-2021
13	CA-222-P019	dwg	07-06-2021
14	CA-222-P020	dwg	07-06-2021
15	CA-222-P021	dwg	07-06-2021
16	CA-222-P022	dwg	07-06-2021
17	CA-222-P023	dwg	07-06-2021
18	CA-222-P024	dwg	07-06-2021
19	CA-222-P025	dwg	07-06-2021
20	CA-222-P026	dwg	07-06-2021
21	CA-222-P027	dwg	07-06-2021
22	CA-222-P028	dwg	07-06-2021
23	CA-222-P029	dwg	07-06-2021
24	CA-222-P030	dwg	07-06-2021
25	CA-222-P031	dwg	07-06-2021
26	CA-222-P032	dwg	07-06-2021
27	CA-222-P033	dwg	07-06-2021
28	CA-222-P034	dwg	07-06-2021
29	CA-222-P035	dwg	07-06-2021
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31	CA-222-P037	dwg	07-06-2021
32	CA-222-P038	dwg	07-06-2021
33	CA-222-P039	dwg	07-06-2021
34	CA-222-P040	dwg	07-06-2021
35	CA-222-P041	dwg	07-06-2021
36	CA-222-P042	dwg	07-06-2021
37	CA-222-P043	dwg	07-06-2021
38	CA-222-P090	dwg	07-06-2021

Table 6 The document list

6. Energy Statement - BASELINE

The baseline (known as Target Emission Rate), as calculated in line with the Building Regulation 2013, is the maximum amount of carbon dioxide a dwelling or non-residential unit is allowed to emit. The Target Emission Rate (TER) includes carbon dioxide emissions which are covered by Part L of the Building Regulations, known as regulated emissions (space and water heating, ventilation, lighting, pumps, fans & controls). The baseline energy uses and resulting CO_2 emissions rates of the development have been assessed using the Government approved software.

The baseline regulated CO_2 emissions for the development as a whole are presented in the tables below:

BASELINE

BASELINE: TER	CO_2 Emissions (Tonnes CO_2/yr)
9 Upper Crown Street	2.71

Table 7 Regulated Carbon Emissions at Baseline

7. Energy Statement - 1st Stage

This section outlines the energy efficient measures taken in order to minimise the building's energy demand and therefore reduce energy use and CO_2 emissions further than the Baseline requirements (Building Regulations 2013 Part L compliance).

7.1. Passive Design Measures

- **Enhanced Building Elements**

At the 1st stage of the energy hierarchy, energy efficient building elements have been incorporated into the build. The heat loss of different building element is dependent upon their U-value and air tightness. Therefore, better U-values and air permeability than the minimum values set in the Part L 2013 have been suggested in this development. Please see below more specifically:

		Part L1A 2013 min. required values	Proposed values
U-value (W/m^2 K)	Wall	0.30	0.15
	Window	2.0	1.4
	Floor	0.25	0.13
	Roof	0.20	0.13
	Solid Door	Notional 1.0	1.4
	Party Wall	0.2	0.0
Air Permeability ($m^3/h.m^2$ at 50 Pa)		10	4
Use of Accredited Construction Details		-	YES

Table 8 Proposed Building Elements

- **Orientation & Natural Daylighting**

Passive solar gain reduces the amount of energy required for space heating during the winter months. The development has sufficient windows and open spaces, which improve the passive solar gains into the majority of the scheme throughout the day. Moreover, the internal layout has been designed to improve daylighting in all habitable spaces, as a way of improving the health and wellbeing of occupants.

- **Solar Shading**

The building would incorporate internal curtains/blinds, which will provide solar shading and thus can avoid installing cooling systems for summer.

- **Efficient Use of Water**

The development will be based upon the specification of water efficient fittings including low volume dual flush WCs, and low flow taps/ showers/ bath. These measures will result in the internal water consumption rate of 105 litres/person/day or less, including an allowance 5 litres per person per day for external water consumption. The design stage calculation is provided in section 4.5 of this report.

7.2. Active Design Measures

- **High Efficiency Lighting**

The proposed light fittings will be 100% energy efficient fittings, i.e. LED lightings are considered for the energy analysis.

- **Natural Ventilation**

A natural ventilation strategy with extract fans in wet rooms would be adopted. Therefore, higher energy consumption and CO_2 emissions due to mechanical ventilation is avoided.

- **Heating and Hot Water System**

At the 1st stage high efficiency gas boilers have been examined for space heating and hot water demand. Detailed specifications in the table below are used only for the calculation at 1st Stage. **The proposed heating and hot water system will be demonstrated at 3rd Stage as the low carbon technology (Air Source Heat Pump) has been suggested.**

Systems	General Specification	Controls/ Other inputs
Heating and Hot water	Gas combi boilers for underfloor heating (efficiency of 89.5%)	• Controls – Programmer and at least two room thermostats

Table 9 Heating and Hot water systems at Be Lean Stage

As shown in the table below, the carbon reduction of ***30.66%*** can be achieved from the energy efficiency measures at 1st stage.

1st STAGE

	BASELINE CO_2 Emissions (Tonnes CO_2/yr)	**1st Stage CO_2 Emissions** (Tonnes CO_2/yr)	**Carbon Reduction** (%)
9 Upper Crown Street	2.71	1.88	30.66%

Table 10 Regulated Carbon Emissions at 1st Stage

8. Energy Statement - 2nd Stage

The Energy Hierarchy identifies the combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP. The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

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

To ensure that CHP is financially viable it is essential that the unit is selected to meet the base heat load and that this load is maintained over a large proportion of the day (a figure of 14 – 17 hours per day is often quoted subject to the load profiles and gas and electricity prices) to ensure that the additional costs (maintenance) associated with running a CHP unit can be recovered. This need to run the CHP plant, as far as possible continuously makes the building load profile of prime importance when reviewing the viability of such solutions and in particular the summertime heat load profile. To enable the CHP plant to run continuously when it is operating, a thermal store is often used so that excess CHP capacity can be used to generate hot water for use at a later time.

Since this development consists of 46 dwellings that would not require high heating loads, installing the CHP system would not be beneficial given the cost. Generally, the development consisting at least 50 residential units would obtain the benefits of the micro CHP system. **Hence the CHP system has not been considered for this development.**

9. Energy Statement - 3rd Stage

In this section the viable renewable energy technologies that could reduce the development's CO_2 emissions are examined. In determining the appropriate renewable technology for the site, the following factors were considered.

- Renewable energy resource or fuel availability of the LZC technology on the site.
- Space limitations due to building design and urban location of the site.
- Capital, operating and maintenance cost.
- Planning Permission
- Implementation with regards the overall M&E design strategy for building type
- Available Grants

The table below summarises the various low zero carbon technologies considered for the projects, and we have identified that **Photovoltaic (PV) and Air Source Heat Pumps (ASHP)** would be the most appropriate options in this development.

	Impacts	Available Grants/ Funding	Feasibility
Photovoltaic (PV)	Spatial and Shadowing	-	**HIGH**
Air Source Heat Pumps (ASHP)	Noise Issues from External units	Renewable Heat Incentive (RHI)	**HIGH**
Solar Thermal	Spatial and Shadowing	Renewable Heat Incentive (RHI)	**LOW**
Ground Source Heat Pumps (GSHP)	Spatial issues for Bore Holes and noise	Renewable Heat Incentive (RHI)	**Medium**
Biomass	Spatial requirement for fuel storage and biomass odour	Renewable Heat Incentive (RHI)	**LOW**
Wind Power	Extensive planning requirements for noise and local biodiversity	-	**LOW**
Hydro Power	Extensive planning requirements for noise and water quality	-	**ZERO**

Table 11 Feasibility Study of LZC Technologies

9.1. Non-feasible Technology

- **Ground Source Heat Pumps (GSHP)**

Ground source heat pump would be a feasible option to meet the space heating requirements, however, it requires ground space for bore holes to extract the ground heat to be utilised for space heating requirements. In this case there is no available ground space for a borehole or trench system, the ground source loop would have to be incorporated within the foundation piles of the structure, which would result in additional cost. Hence, this option is not suitable for this development.

- **Solar Thermal**

The use of solar thermal for this development would be limited to domestic hot water only. The use of solar thermal for space heating would not be practical as it is not required when solar thermal is at its most effective during the summer months. Therefore, this system would require additional plumbing and space for hot water storage, incurring additional financial cost. Moreover, the amount of carbon offset from the system is generally lower than other technologies. Therefore, this technology is deemed to be unsuitable for this development.

- **Hydro power**

The hydro-electric power system will not be studied because this small development would not have the benefit of a system given the cost.

- **Wind Power**

Wind turbines need extensive planning requirements and they are only feasible at consistent wind speed. Moreover, since the development is located in an urban area, the site does not have sufficient wind speed to operate wind turbine at the height of 10 meters as shown below (http://www.renew-reuse-recycle.com/noabl.pl?n=503). Hence this option has been discounted.

Estimated average windspeeds around RG1 2..

Wind speed at 10m above ground level (m/s)		
4.5	4.6	4.6
4.6	**4.6**	4.6
4.8	4.8	4.8

Wind speed at 25m above ground level (m/s)		
5.3	5.3	5.4
5.4	**5.4**	5.4
5.5	5.6	5.6

Wind speed at 45m above ground level (m/s)		
5.8	5.8	5.9
5.9	**5.9**	5.9
6	6	6.1

Squares surrounding the central square correspond to wind speeds for surrounding grid squares. Power generated is related to windspeed by a cubic ratio. That means if you halve the windspeed, the power goes down by a factor of 8 (which is 2 x 2 x 2). A quarter of the windspeed gives you a 64th of the power (4 x 4 x 4). As a rough guide, if your turbine is rated at producing 1KW at 12m/s then it will produce 125W at 6m/s and 15W at 3m/s.

Please note that bear in mind that the NOABL windspeed dataset used here is a model of windspeeds across the country, assuming completely flat terrain. It isn't a database of measured windspeeds.

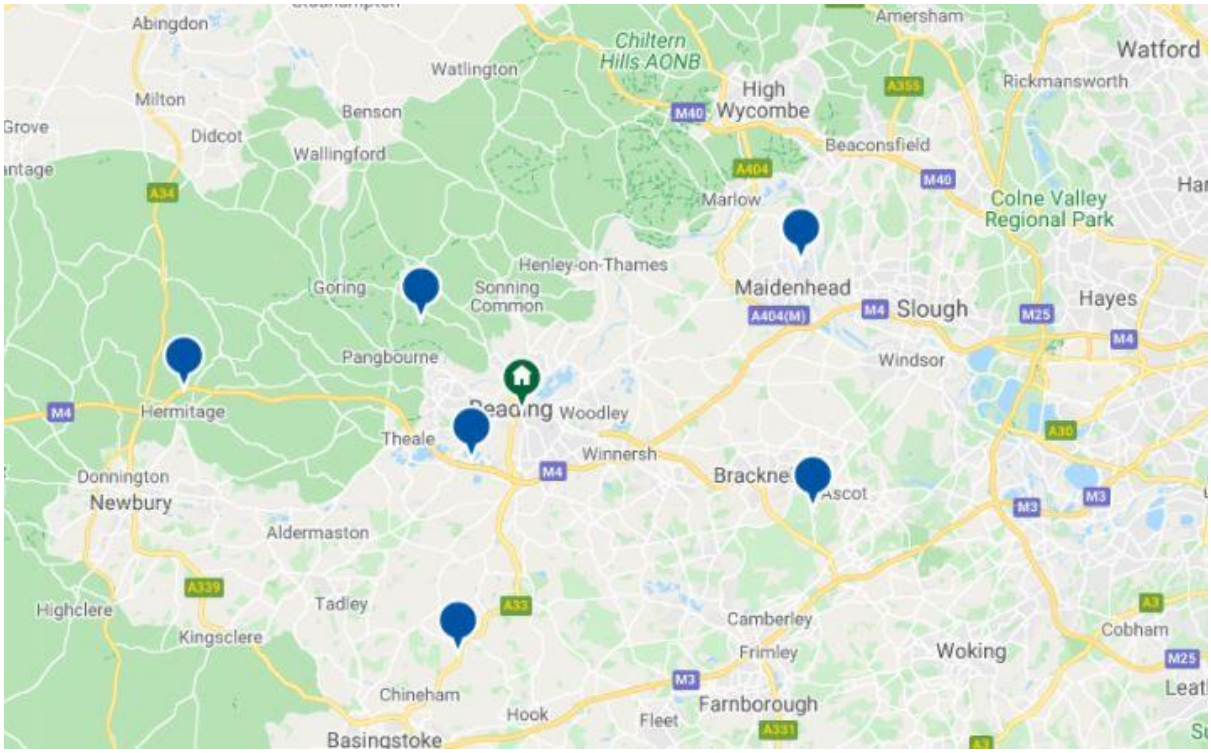
Other factors such as hills, houses, trees and other obstructions in your vicinity need to be considered as well as they can have a significant effect. If you're thinking about installing a wind turbine, you should perform your own windspeed measurements using an anemometer to determine what the actual figures are.

- **Biomass**

A biomass system designed for this development would be fueled by wood pellets which have a high energy content. However, a biomass system would not be an appropriate technology for the site for the following reasons:

i. The burning of wood pellets releases substantially more NOx emissions when compared to similar gas boilers. As the development is situated within an urban area, the installation of a biomass boiler would further impact on the air quality in this area.
ii. the lack of spaces for pellet boiler and storage on the site.
iii. Pellets would need to be transported from local pellet suppliers, which causes carbon emissions to the air.

However, if the biomass system is considered at detailed design stage, local suppliers can be found near the site as shown in the map below (http://biomass-suppliers-list.service.gov.uk).



Company name	Postcode	Contact	Fuel Supplied	Telephone
J Mould (Reading) Limited	RG30 3XA	www.jmouldreading.co.uk will.fleming@jmouldreading.co.uk	Chip	01189512222
Oxford Renewables Limited	RG8 7RE	www.oxfordrenewables.co.uk jane.yamamoto@oxfordrenewables.co.uk	Pellets	01189841753
Mole Valley Farmers Ltd	RG27 0HA	www.molecountrystores.co.uk basingstoke@molecountrystores.com	Pellets	01256 882776
The Crown Estate	SL5 8AZ	www.windsorgreatpark.co.uk john.deakin@thecrownestate.co.uk	Chip	01753847504
LC Energy Ltd	SL5 8AZ	www.LCEnergy.co.uk INFO@LCENERGY.CO.UK	Chip	01483209360
Balcas Timber Ltd	SL6 8SP	www.balcasenergy.com energy@balcas.com	Pellets	01628509609
Balcas Timber Ltd	SL6 8SP	www.balcasenergy.com energy@balcas.com	Pellets	01628509690
Balcas Timber Ltd	SL6 8SP	www.balcasenergy.com energy@balcas.com	Pellets	01628509690
Mole Valley Farmers Ltd	SL6 8SP	www.molevalleyfarmers.com mvp.admin@molevalleyfarmers.com	Pellets	01769 575674
AMP Biomass Fuel Ltd	RG18 9SD	www.forestfuels.co.uk admin@forestfuels.co.uk	Pellets	01409281977

9.2. Feasible Technology

- **Air Source Heat Pumps (ASHP)**

The ASHP can meet the space heating and hot water demands on site efficiently in comparison with gas boilers. Although this low carbon technology consumes electricity to operate, due to higher efficiency the heat output is much greater. Therefore, it has been suggested for the space heating and hot water systems.

System	General Specification	Controls/ Other inputs
Heating	Communal ASHPs for underfloor heating (250% efficiency)	• Controls – charging system linked to use of community heating, programmer and at least two thermostats. • Distribution – piping pre-insulated, low temp, variable flow.
Hot water	From communal ASHPs	-

Table 12 3rd Stage Heating and hot water systems

- **Photovoltaic (PV)**

Based on the feasibility study above, PV would be one of suitable renewable technologies for the following reasons:

i. The installation of PV is much simpler when compared to other renewable technologies
ii. There is sufficient roof space available to install enough PV modules to have a significant impact on carbon emissions of the development
iii. PV panels sited on the roof within an urban area are less visually intrusive when compared to wind turbines

However, the PV panels have not been adopted for this development as the ASHP results in significant carbon reduction on the site. Hence further reduction via PV panels have not been targeted.

From the proposed ASHPs, a ***8.87%*** carbon reduction has been achieved at 3rd stage against 1st stage.

3rd stage

	1st Stage CO_2 Emissions (Tonnes CO_2/yr)	3rd Stage CO_2 Emissions (Tonnes CO_2/yr)	Carbon Reduction (%)
9 Upper Crown Street	1.88	1.63	**8.87 %**

Table 13 Regulated Carbon Reduction at 3rd Stage

10. Conclusion

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at **9 Upper Crown Street, Reading, RG1 2SS** based on the information provided by the design team.

By incorporating all measures in each stage of the Energy Hierarchy, the proposed development can achieve **overall 39.53% CO_2 reduction on the site** against Building Regulations Part L baseline.

Regulated Carbon Savings		Carbon Reduction	
		Tonnes CO_2/yr	%
1st Stage	After energy demand reduction	0.83	30.66 %
2nd Stage	After Combined Heat and Power	0	0 %
3rd Stage	After renewable energy	0.24	8.87 %
Total Cumulative Savings		**1.07**	**39.53 %**

Table 14 Carbon dioxide Emissions after each stage of the Energy Hierarchy

11. Appendix – SAP Reports

Block Compliance WorkSheet: 9 Upper Crown Street

User Details

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.0.5.41

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
Building 1 - House 1	16.27	26.95	48.5	58.8	100.442
Building 1 - House 2	14.87	24.25	41.9	49.7	100.442
Building 1 - House 3	14.87	24.25	41.9	49.7	100.442
Building 1 - House 4	16.27	26.96	48.5	58.9	100.442
Building 2 - Flat 1	19.62	31.99	55.2	62.1	55.768
Building 2 - Flat 2	20.23	32.41	55.5	60.3	50.083
Building 2 - Flat 3	17.24	27.93	48.1	54.3	70.193
Building 2 - Flat 4	17.02	28.64	46.6	56.7	70.903
Building 2 - Flat 5	16.63	27.24	41.1	46.2	55.768
Building 2 - Flat 6	17.69	28.55	44.1	47.4	50.083
Building 2 - Flat 7	14.95	24.31	38	42.4	70.193
Building 2 - Flat 8	14.44	23.85	38.8	45.3	85.938
Building 2 - Flat 9	17.85	30.24	46.6	56.2	55.768
Building 2 - Flat 10	19.27	32.15	51.2	59.4	50.083
Building 2 - Flat 11	16.77	28.74	46.9	57	70.193
Building 2 - Flat 12	15.5	26.84	43.6	55.2	85.938
Building 2 - Flat 13	17.84	31.22	55.8	70.2	87.785
Building 2 - Flat 14	17.84	31.22	55.8	70.2	87.785
Building 3 - Flat 1	23.04	36.18	69.4	74.4	53.503
Building 3 - Flat 2	20.93	33.71	58.5	64.8	50.748
Building 3 - Flat 3	17.76	29.91	44	51.6	50.083
Building 3 - Flat 4	15.34	25.87	42.3	51.7	86.213
Building 3 - Flat 5	18.05	28.39	51.5	55.3	70.193
Building 3 - Flat 6	17.9	28.86	44.6	48.2	50.083
Building 3 - Flat 7	15.53	26.32	34	39.5	50.083
Building 3 - Flat 8	12.85	21.71	31.2	37.9	86.213

Block Compliance WorkSheet: 9 Upper Crown StreetCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
Building 3 - Flat 9	18.83	31.04	55	64.1	70.193
Building 3 - Flat 10	19.57	32.27	52.1	59.6	50.083
Building 3 - Flat 11	17.32	30.5	42.1	53.6	50.083
Building 3 - Flat 12	14.12	24.2	36.9	46.2	86.213
Building 3 - Flat 13	19.16	32.52	61.3	74.4	87.785
Building 3 - Flat 14	16.63	29.89	50.4	65.8	87.785
Building 4 - Flat 1	17.48	29.19	49.2	58.8	71.012
Building 4 - Flat 2	22.56	37.59	58	65.3	37.82
Building 4 - Flat 3	18.15	29.37	53.5	61	77.581
Building 4 - Flat 4	14.98	24.86	38	44.5	71.012
Building 4 - Flat 5	17.93	29.16	45	49.5	49.98
Building 4 - Flat 6	16.01	25.86	43.9	49.3	77.581
Building 4 - Flat 7	14.71	24.4	36.8	43	71.012
Building 4 - Flat 8	16.44	26.69	38.4	41.3	49.98
Building 4 - Flat 9	16.01	25.86	43.9	49.3	77.581
Building 4 - Flat 10	15.96	27.34	42.4	52.7	71.012
Building 4 - Flat 11	19.3	32.8	51.2	61.6	49.98
Building 4 - Flat 12	16.8	28.19	47.4	57	77.581
Building 4 - Flat 13	16.47	29.11	48.2	63.6	88.958
Building 4 - Flat 14	18.7	32.25	56.3	71.2	78.922

Calculation Summary

Total Floor Area	3227.52
Average TER	28.31
Average DER	16.96
Average DFEE	46.99

Block Compliance WorkSheet: 9 Upper Crown StreetCont...

Average TFEE	55.69
Compliance	Pass
% Improvement DER|TER	40.09
% Improvement DFEE|TFEE	15.62

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 1 - House 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	41.37 (1a)	x	2.4 (2a)	=	99.29	(3a)
First floor	35.51 (1b)	x	2.7 (2b)	=	95.88	(3b)
Second floor	23.56 (1c)	x	3.18 (2c)	=	74.93	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.44	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	270.09	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.15 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

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

(24d)

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

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

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.86	x	1.4	=	2.6012			(26)
Windows Type 1			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Windows Type 2			0.9	x1/[1/(1.4)+ 0.04]		=	1.19			(27)
Windows Type 3			5.67	x1/[1/(1.4)+ 0.04]		=	7.52			(27)
Windows Type 4			1.08	x1/[1/(1.4)+ 0.04]		=	1.43			(27)
Windows Type 5			5.67	x1/[1/(1.4)+ 0.04]		=	7.52			(27)
Windows Type 6			0.72	x1/[1/(1.4)+ 0.04]		=	0.95			(27)
Rooflights			1.2	x1/[1/(1.4) + 0.04]		=	1.68			(27b)
Floor			41.37	x	0.13	=	5.378099			(28)
Walls	117.95	20.58	97.37	x	0.15	=	14.61			(29)
Roof Type1	5.88	0	5.88	x	0.13	=	0.76			(30)
Roof Type2	4.06	0	4.06	x	0.13	=	0.53			(30)
Roof Type3	26.07	1.2	24.87	x	0.13	=	3.23			(30)
Roof Type4	1.08	0	1.08	x	0.13	=	0.14			(30)
Total area of elements, m²			196.41							(31)
Party wall			62.25	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) = 53.66 (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 17.42 (36)

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

Total fabric heat loss (33) + (36) = 71.08 (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=	52.08	51.78	51.5	50.16	49.9	48.74	48.74	48.52	49.19	49.9	50.41	50.94	(38)

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

(39)m=	123.15	122.86	122.58	121.23	120.98	119.81	119.81	119.6	120.26	120.98	121.49	122.02	

Average = Sum(39)$_{1...12}$ /12= 121.23 (39)

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

(40)m=	1.23	1.22	1.22	1.21	1.2	1.19	1.19	1.19	1.2	1.2	1.21	1.21	

Average = Sum(40)$_{1...12}$ /12= 1.21 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.74 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.36 (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=	109.3	105.32	101.35	97.37	93.4	89.42	89.42	93.4	97.37	101.35	105.32	109.3	

Total = Sum(44)$_{1...12}$ = 1192.32 (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=	162.08	141.76	146.28	127.53	122.37	105.6	97.85	112.28	113.63	132.42	144.55	156.97	

Total = Sum(45)$_{1...12}$ = 1563.32 (45)

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

(46)m=	24.31	21.26	21.94	19.13	18.36	15.84	14.68	16.84	17.04	19.86	21.68	23.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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	(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)		0.96	(55)

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	215.11	189.65	199.3	178.84	175.39	156.91	150.87	165.31	164.94	185.44	195.86	209.99	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	215.11	189.65	199.3	178.84	175.39	156.91	150.87	165.31	164.94	185.44	195.86	209.99	

Output from water heater (annual)$_{1...12}$ 2187.62 (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=	96.31	85.45	91.06	83.45	83.11	76.16	74.95	79.75	78.83	86.45	89.11	94.61	(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=	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	(66)

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

(67)m=	23.07	20.49	16.66	12.61	9.43	7.96	8.6	11.18	15.01	19.06	22.24	23.71	(67)

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

(68)m=	257.04	259.71	252.99	238.68	220.61	203.64	192.3	189.63	196.35	210.66	228.72	245.7	(68)

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

(69)m=	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	(71)

Water heating gains (Table 5)

(72)m=	129.45	127.15	122.39	115.91	111.7	105.78	100.74	107.19	109.49	116.19	123.77	127.16	(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=	473.71	471.5	456.19	431.35	405.9	381.53	365.8	372.16	385	410.06	438.88	460.73	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	5.67	x	10.63	x	0.76	x	0.7	=	22.23	(74)
North	0.9x 0.77	x	1.08	x	10.63	x	0.76	x	0.7	=	8.47	(74)
North	0.9x 0.77	x	5.67	x	10.63	x	0.76	x	0.7	=	22.23	(74)
North	0.9x 0.77	x	5.67	x	20.32	x	0.76	x	0.7	=	42.48	(74)
North	0.9x 0.77	x	1.08	x	20.32	x	0.76	x	0.7	=	16.18	(74)
North	0.9x 0.77	x	5.67	x	20.32	x	0.76	x	0.7	=	42.48	(74)
North	0.9x 0.77	x	5.67	x	34.53	x	0.76	x	0.7	=	72.18	(74)
North	0.9x 0.77	x	1.08	x	34.53	x	0.76	x	0.7	=	27.5	(74)
North	0.9x 0.77	x	5.67	x	34.53	x	0.76	x	0.7	=	72.18	(74)
North	0.9x 0.77	x	5.67	x	55.46	x	0.76	x	0.7	=	115.94	(74)
North	0.9x 0.77	x	1.08	x	55.46	x	0.76	x	0.7	=	44.17	(74)
North	0.9x 0.77	x	5.67	x	55.46	x	0.76	x	0.7	=	115.94	(74)
North	0.9x 0.77	x	5.67	x	74.72	x	0.76	x	0.7	=	156.19	(74)
North	0.9x 0.77	x	1.08	x	74.72	x	0.76	x	0.7	=	59.5	(74)
North	0.9x 0.77	x	5.67	x	74.72	x	0.76	x	0.7	=	156.19	(74)
North	0.9x 0.77	x	5.67	x	79.99	x	0.76	x	0.7	=	167.2	(74)
North	0.9x 0.77	x	1.08	x	79.99	x	0.76	x	0.7	=	63.7	(74)
North	0.9x 0.77	x	5.67	x	79.99	x	0.76	x	0.7	=	167.2	(74)
North	0.9x 0.77	x	5.67	x	74.68	x	0.76	x	0.7	=	156.1	(74)
North	0.9x 0.77	x	1.08	x	74.68	x	0.76	x	0.7	=	59.47	(74)
North	0.9x 0.77	x	5.67	x	74.68	x	0.76	x	0.7	=	156.1	(74)
North	0.9x 0.77	x	5.67	x	59.25	x	0.76	x	0.7	=	123.85	(74)
North	0.9x 0.77	x	1.08	x	59.25	x	0.76	x	0.7	=	47.18	(74)
North	0.9x 0.77	x	5.67	x	59.25	x	0.76	x	0.7	=	123.85	(74)
North	0.9x 0.77	x	5.67	x	41.52	x	0.76	x	0.7	=	86.79	(74)
North	0.9x 0.77	x	1.08	x	41.52	x	0.76	x	0.7	=	33.06	(74)
North	0.9x 0.77	x	5.67	x	41.52	x	0.76	x	0.7	=	86.79	(74)
North	0.9x 0.77	x	5.67	x	24.19	x	0.76	x	0.7	=	50.57	(74)
North	0.9x 0.77	x	1.08	x	24.19	x	0.76	x	0.7	=	19.26	(74)
North	0.9x 0.77	x	5.67	x	24.19	x	0.76	x	0.7	=	50.57	(74)
North	0.9x 0.77	x	5.67	x	13.12	x	0.76	x	0.7	=	27.42	(74)
North	0.9x 0.77	x	1.08	x	13.12	x	0.76	x	0.7	=	10.45	(74)
North	0.9x 0.77	x	5.67	x	13.12	x	0.76	x	0.7	=	27.42	(74)
North	0.9x 0.77	x	5.67	x	8.86	x	0.76	x	0.7	=	18.53	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.08	x	8.86	x	0.76	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	5.67	x	8.86	x	0.76	x	0.7	=	18.53	(74)
South	0.9x	0.77	x	1.8	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	0.9	x	46.75	x	0.76	x	0.7	=	15.51	(78)
South	0.9x	0.77	x	1.8	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	0.9	x	76.57	x	0.76	x	0.7	=	25.41	(78)
South	0.9x	0.77	x	1.8	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	0.9	x	97.53	x	0.76	x	0.7	=	32.36	(78)
South	0.9x	0.77	x	1.8	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	0.9	x	110.23	x	0.76	x	0.7	=	36.58	(78)
South	0.9x	0.77	x	1.8	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	0.9	x	114.87	x	0.76	x	0.7	=	38.12	(78)
South	0.9x	0.77	x	1.8	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	0.9	x	110.55	x	0.76	x	0.7	=	36.68	(78)
South	0.9x	0.77	x	1.8	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	0.9	x	108.01	x	0.76	x	0.7	=	35.84	(78)
South	0.9x	0.77	x	1.8	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	0.9	x	104.89	x	0.76	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.8	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	0.9	x	101.89	x	0.76	x	0.7	=	33.81	(78)
South	0.9x	0.77	x	1.8	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	0.9	x	82.59	x	0.76	x	0.7	=	27.4	(78)
South	0.9x	0.77	x	1.8	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	0.9	x	55.42	x	0.76	x	0.7	=	18.39	(78)
South	0.9x	0.77	x	1.8	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	0.9	x	40.4	x	0.76	x	0.7	=	13.4	(78)
West	0.9x	0.77	x	0.72	x	19.64	x	0.76	x	0.7	=	5.21	(80)
West	0.9x	0.77	x	0.72	x	38.42	x	0.76	x	0.7	=	10.2	(80)
West	0.9x	0.77	x	0.72	x	63.27	x	0.76	x	0.7	=	16.8	(80)
West	0.9x	0.77	x	0.72	x	92.28	x	0.76	x	0.7	=	24.5	(80)
West	0.9x	0.77	x	0.72	x	113.09	x	0.76	x	0.7	=	30.02	(80)
West	0.9x	0.77	x	0.72	x	115.77	x	0.76	x	0.7	=	30.73	(80)
West	0.9x	0.77	x	0.72	x	110.22	x	0.76	x	0.7	=	29.26	(80)
West	0.9x	0.77	x	0.72	x	94.68	x	0.76	x	0.7	=	25.13	(80)
West	0.9x	0.77	x	0.72	x	73.59	x	0.76	x	0.7	=	19.53	(80)
West	0.9x	0.77	x	0.72	x	45.59	x	0.76	x	0.7	=	12.1	(80)
West	0.9x	0.77	x	0.72	x	24.49	x	0.76	x	0.7	=	6.5	(80)
West	0.9x	0.77	x	0.72	x	16.15	x	0.76	x	0.7	=	4.29	(80)
Rooflights	0.9x	1	x	1.2	x	46.22	x	0.76	x	0.7	=	26.56	(82)
Rooflights	0.9x	1	x	1.2	x	83.02	x	0.76	x	0.7	=	47.7	(82)
Rooflights	0.9x	1	x	1.2	x	122.59	x	0.76	x	0.7	=	70.44	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.2	x	163.13	x	0.76	x	0.7	=	93.73	(82)
Rooflights 0.9x	1	x	1.2	x	190.18	x	0.76	x	0.7	=	109.27	(82)
Rooflights 0.9x	1	x	1.2	x	191.34	x	0.76	x	0.7	=	109.93	(82)
Rooflights 0.9x	1	x	1.2	x	183.47	x	0.76	x	0.7	=	105.41	(82)
Rooflights 0.9x	1	x	1.2	x	163.4	x	0.76	x	0.7	=	93.88	(82)
Rooflights 0.9x	1	x	1.2	x	136.91	x	0.76	x	0.7	=	78.66	(82)
Rooflights 0.9x	1	x	1.2	x	94.41	x	0.76	x	0.7	=	54.24	(82)
Rooflights 0.9x	1	x	1.2	x	56.2	x	0.76	x	0.7	=	32.29	(82)
Rooflights 0.9x	1	x	1.2	x	38.99	x	0.76	x	0.7	=	22.4	(82)

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

(83)m=	162.26	286.07	420.91	577.16	701.73	722.17	685.54	587.91	473.86	323.75	196.02	137.83	(83)

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

(84)m=	635.97	757.57	877.1	1008.52	1107.63	1103.7	1051.34	960.07	858.86	733.81	634.9	598.55	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.65	0.49	0.56	0.81	0.97	0.99	1	(86)

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

(87)m=	19.69	19.87	20.15	20.52	20.81	20.96	20.99	20.99	20.88	20.49	20.02	19.66	(87)

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

(88)m=	19.9	19.9	19.9	19.91	19.92	19.93	19.93	19.93	19.92	19.92	19.91	19.91	(88)

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

(89)m=	1	0.99	0.98	0.92	0.78	0.56	0.38	0.43	0.74	0.95	0.99	1	(89)

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

(90)m=	18.16	18.43	18.84	19.36	19.74	19.9	19.92	19.92	19.83	19.34	18.66	18.12	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.66	18.9	19.27	19.75	20.1	20.25	20.28	20.27	20.18	19.72	19.11	18.63	(92)

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

(93)m=	18.66	18.9	19.27	19.75	20.1	20.25	20.28	20.27	20.18	19.72	19.11	18.63	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.92	0.79	0.59	0.42	0.48	0.76	0.95	0.99	1	(94)

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

(95)m=	632.89	749.12	852.25	925.78	876.26	651.32	436.68	456.26	649.61	696.23	628.39	596.35	(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=	1769.05	1720.34	1565.78	1314.97	1015.75	676.81	440.36	463.14	730.69	1103.07	1458.78	1760.62	(97)

DER WorkSheet: New dwelling design stage

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

(98)m=	845.31	652.66	530.87	280.22	103.78	0	0	0	0	302.69	597.88	866.22

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4179.61 (98)

Space heating requirement in kWh/m²/year 41.61 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community heat pump 1 (303a)

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

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

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

Space heating		**kWh/year**	
Annual space heating requirement		4179.61	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	4388.59	(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 2187.62

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 2297 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 66.86 (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 0 (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) = 0 (331)

Energy for lighting (calculated in Appendix L) 407.38 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 7092.97 (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)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	1387.93	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	34.7	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1422.63	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1422.63	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	211.43	(379)
Total CO2, kg/year	sum of (376)…(382) =			1634.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.27	(384)
EI rating (section 14)				84.94	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 1 - House 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	41.37 (1a)	x	2.4 (2a)	=	99.29	(3a)
First floor	35.51 (1b)	x	2.7 (2b)	=	95.88	(3b)
Second floor	23.56 (1c)	x	3.18 (2c)	=	74.93	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.44	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	270.09	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.15 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.38	0.37	0.36	0.33	0.32	0.28	0.28	0.27	0.3	0.32	0.33	0.35

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

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(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			1.86	x	1.4	=	2.6012			(26)
Windows Type 1			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Windows Type 2			0.9	x1/[1/(1.4)+ 0.04]		=	1.19			(27)
Windows Type 3			5.67	x1/[1/(1.4)+ 0.04]		=	7.52			(27)
Windows Type 4			1.08	x1/[1/(1.4)+ 0.04]		=	1.43			(27)
Windows Type 5			5.69	x1/[1/(1.4)+ 0.04]		=	7.54			(27)
Rooflights			1.2	x1/[1/(1.4) + 0.04]		=	1.68			(27b)
Floor			41.37	x	0.13	=	5.378099			(28)
Walls	55.68	19.88	35.81	x	0.15	=	5.37			(29)
Roof Type1	5.88	0	5.88	x	0.13	=	0.76			(30)
Roof Type2	4.06	0	4.06	x	0.13	=	0.53			(30)
Roof Type3	26.07	1.2	24.87	x	0.13	=	3.23			(30)
Roof Type4	1.08	0	1.08	x	0.13	=	0.14			(30)
Total area of elements, m²			134.15							(31)
Party wall			124.5	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) = 43.5 (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 16.21 (36)

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

Total fabric heat loss (33) + (36) = 59.71 (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=	50.91	50.66	50.42	49.29	49.07	48.09	48.09	47.9	48.47	49.07	49.5	49.95	(38)

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

(39)m=	110.62	110.37	110.13	109	108.79	107.8	107.8	107.62	108.18	108.79	109.22	109.66	

Average = Sum(39)$_{1...12}$ /12= 109 (39)

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

(40)m=	1.1	1.1	1.1	1.09	1.08	1.07	1.07	1.07	1.08	1.08	1.09	1.09	

Average = Sum(40)$_{1...12}$ /12= 1.09 (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 2.74 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.36 (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=	109.3	105.32	101.35	97.37	93.4	89.42	89.42	93.4	97.37	101.35	105.32	109.3	

Total = Sum(44)$_{1...12}$ = 1192.32 (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=	162.08	141.76	146.28	127.53	122.37	105.6	97.85	112.28	113.63	132.42	144.55	156.97	

Total = Sum(45)$_{1...12}$ = 1563.32 (45)

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

(46)m=	24.31	21.26	21.94	19.13	18.36	15.84	14.68	16.84	17.04	19.86	21.68	23.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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	(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)		0.96	(55)

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	215.11	189.65	199.3	178.84	175.39	156.91	150.87	165.31	164.94	185.44	195.86	209.99	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	215.11	189.65	199.3	178.84	175.39	156.91	150.87	165.31	164.94	185.44	195.86	209.99	

Output from water heater (annual)$_{1...12}$ 2187.62 (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=	96.31	85.45	91.06	83.45	83.11	76.16	74.95	79.75	78.83	86.45	89.11	94.61	(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=	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	(66)

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

(67)m=	23.16	20.57	16.73	12.66	9.47	7.99	8.64	11.23	15.07	19.13	22.33	23.8	(67)

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

(68)m=	257.04	259.71	252.99	238.68	220.61	203.64	192.3	189.63	196.35	210.66	228.72	245.7	(68)

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

(69)m=	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	(71)

Water heating gains (Table 5)

(72)m=	129.45	127.15	122.39	115.91	111.7	105.78	100.74	107.19	109.49	116.19	123.77	127.16	(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=	473.8	471.59	456.26	431.4	405.94	381.56	365.83	372.2	385.06	410.14	438.97	460.82	(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	5.67	x	10.63	x	0.76	x	0.7	=	22.23	(74)
North	0.9x 0.77	x	1.08	x	10.63	x	0.76	x	0.7	=	8.47	(74)
North	0.9x 0.77	x	5.69	x	10.63	x	0.76	x	0.7	=	22.31	(74)
North	0.9x 0.77	x	5.67	x	20.32	x	0.76	x	0.7	=	42.48	(74)
North	0.9x 0.77	x	1.08	x	20.32	x	0.76	x	0.7	=	16.18	(74)
North	0.9x 0.77	x	5.69	x	20.32	x	0.76	x	0.7	=	42.63	(74)
North	0.9x 0.77	x	5.67	x	34.53	x	0.76	x	0.7	=	72.18	(74)
North	0.9x 0.77	x	1.08	x	34.53	x	0.76	x	0.7	=	27.5	(74)
North	0.9x 0.77	x	5.69	x	34.53	x	0.76	x	0.7	=	72.44	(74)
North	0.9x 0.77	x	5.67	x	55.46	x	0.76	x	0.7	=	115.94	(74)
North	0.9x 0.77	x	1.08	x	55.46	x	0.76	x	0.7	=	44.17	(74)
North	0.9x 0.77	x	5.69	x	55.46	x	0.76	x	0.7	=	116.35	(74)
North	0.9x 0.77	x	5.67	x	74.72	x	0.76	x	0.7	=	156.19	(74)
North	0.9x 0.77	x	1.08	x	74.72	x	0.76	x	0.7	=	59.5	(74)
North	0.9x 0.77	x	5.69	x	74.72	x	0.76	x	0.7	=	156.74	(74)
North	0.9x 0.77	x	5.67	x	79.99	x	0.76	x	0.7	=	167.2	(74)
North	0.9x 0.77	x	1.08	x	79.99	x	0.76	x	0.7	=	63.7	(74)
North	0.9x 0.77	x	5.69	x	79.99	x	0.76	x	0.7	=	167.79	(74)
North	0.9x 0.77	x	5.67	x	74.68	x	0.76	x	0.7	=	156.1	(74)
North	0.9x 0.77	x	1.08	x	74.68	x	0.76	x	0.7	=	59.47	(74)
North	0.9x 0.77	x	5.69	x	74.68	x	0.76	x	0.7	=	156.65	(74)
North	0.9x 0.77	x	5.67	x	59.25	x	0.76	x	0.7	=	123.85	(74)
North	0.9x 0.77	x	1.08	x	59.25	x	0.76	x	0.7	=	47.18	(74)
North	0.9x 0.77	x	5.69	x	59.25	x	0.76	x	0.7	=	124.28	(74)
North	0.9x 0.77	x	5.67	x	41.52	x	0.76	x	0.7	=	86.79	(74)
North	0.9x 0.77	x	1.08	x	41.52	x	0.76	x	0.7	=	33.06	(74)
North	0.9x 0.77	x	5.69	x	41.52	x	0.76	x	0.7	=	87.09	(74)
North	0.9x 0.77	x	5.67	x	24.19	x	0.76	x	0.7	=	50.57	(74)
North	0.9x 0.77	x	1.08	x	24.19	x	0.76	x	0.7	=	19.26	(74)
North	0.9x 0.77	x	5.69	x	24.19	x	0.76	x	0.7	=	50.74	(74)
North	0.9x 0.77	x	5.67	x	13.12	x	0.76	x	0.7	=	27.42	(74)
North	0.9x 0.77	x	1.08	x	13.12	x	0.76	x	0.7	=	10.45	(74)
North	0.9x 0.77	x	5.69	x	13.12	x	0.76	x	0.7	=	27.52	(74)
North	0.9x 0.77	x	5.67	x	8.86	x	0.76	x	0.7	=	18.53	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.08	x	8.86	x	0.76	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	5.69	x	8.86	x	0.76	x	0.7	=	18.6	(74)
South	0.9x	0.77	x	1.8	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	0.9	x	46.75	x	0.76	x	0.7	=	15.51	(78)
South	0.9x	0.77	x	1.8	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	0.9	x	76.57	x	0.76	x	0.7	=	25.41	(78)
South	0.9x	0.77	x	1.8	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	0.9	x	97.53	x	0.76	x	0.7	=	32.36	(78)
South	0.9x	0.77	x	1.8	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	0.9	x	110.23	x	0.76	x	0.7	=	36.58	(78)
South	0.9x	0.77	x	1.8	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	0.9	x	114.87	x	0.76	x	0.7	=	38.12	(78)
South	0.9x	0.77	x	1.8	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	0.9	x	110.55	x	0.76	x	0.7	=	36.68	(78)
South	0.9x	0.77	x	1.8	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	0.9	x	108.01	x	0.76	x	0.7	=	35.84	(78)
South	0.9x	0.77	x	1.8	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	0.9	x	104.89	x	0.76	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.8	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	0.9	x	101.89	x	0.76	x	0.7	=	33.81	(78)
South	0.9x	0.77	x	1.8	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	0.9	x	82.59	x	0.76	x	0.7	=	27.4	(78)
South	0.9x	0.77	x	1.8	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	0.9	x	55.42	x	0.76	x	0.7	=	18.39	(78)
South	0.9x	0.77	x	1.8	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	0.9	x	40.4	x	0.76	x	0.7	=	13.4	(78)
Rooflights	0.9x	1	x	1.2	x	46.22	x	0.76	x	0.7	=	26.56	(82)
Rooflights	0.9x	1	x	1.2	x	83.02	x	0.76	x	0.7	=	47.7	(82)
Rooflights	0.9x	1	x	1.2	x	122.59	x	0.76	x	0.7	=	70.44	(82)
Rooflights	0.9x	1	x	1.2	x	163.13	x	0.76	x	0.7	=	93.73	(82)
Rooflights	0.9x	1	x	1.2	x	190.18	x	0.76	x	0.7	=	109.27	(82)
Rooflights	0.9x	1	x	1.2	x	191.34	x	0.76	x	0.7	=	109.93	(82)
Rooflights	0.9x	1	x	1.2	x	183.47	x	0.76	x	0.7	=	105.41	(82)
Rooflights	0.9x	1	x	1.2	x	163.4	x	0.76	x	0.7	=	93.88	(82)
Rooflights	0.9x	1	x	1.2	x	136.91	x	0.76	x	0.7	=	78.66	(82)
Rooflights	0.9x	1	x	1.2	x	94.41	x	0.76	x	0.7	=	54.24	(82)
Rooflights	0.9x	1	x	1.2	x	56.2	x	0.76	x	0.7	=	32.29	(82)
Rooflights	0.9x	1	x	1.2	x	38.99	x	0.76	x	0.7	=	22.4	(82)

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

(83)m=	157.12	276.02	404.37	553.08	672.26	692.02	656.84	563.22	454.63	311.83	189.62	133.61

(83)

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

(84)m=	630.93	747.6	860.62	984.48	1078.2	1073.59	1022.67	935.42	839.69	721.97	628.59	594.43

(84)

DER WorkSheet: New dwelling design stage

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	0.81	0.62	0.46	0.52	0.79	0.96	0.99	1	(86)

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

(87)m=	19.85	20.02	20.29	20.62	20.87	20.98	21	20.99	20.92	20.59	20.16	19.82	(87)

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

(88)m=	20	20	20	20.01	20.01	20.02	20.02	20.02	20.02	20.01	20.01	20.01	(88)

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

(89)m=	1	0.99	0.97	0.91	0.76	0.53	0.36	0.41	0.71	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=	18.47	18.72	19.11	19.58	19.89	20.01	20.02	20.02	19.96	19.54	18.92	18.43	(90)

fLA = Living area ÷ (4) = | 0.33 | (91)

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

(92)m=	18.93	19.15	19.5	19.92	20.22	20.33	20.34	20.34	20.28	19.89	19.33	18.89	(92)

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

(93)m=	18.93	19.15	19.5	19.92	20.22	20.33	20.34	20.34	20.28	19.89	19.33	18.89	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.91	0.77	0.56	0.39	0.45	0.73	0.94	0.99	1	(94)

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

(95)m=	628.05	739.4	835.49	897.17	831.09	603.1	401.73	420.72	614.79	682.13	622.2	592.4	(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=	1617.82	1573.02	1431.44	1201.68	926.56	617.4	403.48	424.19	668.06	1010.39	1335.57	1610.73	(97)

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

(98)m=	736.39	560.19	443.39	219.25	71.03	0	0	0	0	244.23	513.62	757.63	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 3545.74 | (98)

Space heating requirement in kWh/m²/year | 35.3 | (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)

DER WorkSheet: New dwelling design stage

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		1.05	(306)

Space heating — **kWh/year**

Annual space heating requirement		3545.74	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3723.02	(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		2187.62	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2297	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	60.2	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		409.01	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		6429.03	(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	=	1249.76	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	31.24	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1281	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1281	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	212.28	(379)
Total CO2, kg/year	sum of (376)…(382) =				1493.28	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.87	(384)
EI rating (section 14)					86.24	(385)

DER WorkSheet: New dwelling design stage

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 1 - House 3

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	41.37 (1a)	x	2.4 (2a)	=	99.29	(3a)
First floor	35.51 (1b)	x	2.7 (2b)	=	95.88	(3b)
Second floor	23.56 (1c)	x	3.18 (2c)	=	74.93	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.44	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	270.09	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.15 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.38	0.37	0.36	0.33	0.32	0.28	0.28	0.27	0.3	0.32	0.33	0.35

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

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(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			1.86	x	1.4	=	2.6012			(26)
Windows Type 1			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Windows Type 2			0.9	x1/[1/(1.4)+ 0.04]		=	1.19			(27)
Windows Type 3			5.67	x1/[1/(1.4)+ 0.04]		=	7.52			(27)
Windows Type 4			1.08	x1/[1/(1.4)+ 0.04]		=	1.43			(27)
Windows Type 5			5.69	x1/[1/(1.4)+ 0.04]		=	7.54			(27)
Rooflights			1.2	x1/[1/(1.4) + 0.04]		=	1.68			(27b)
Floor			41.37	x	0.13	=	5.378099			(28)
Walls	55.68	19.88	35.81	x	0.15	=	5.37			(29)
Roof Type1	5.88	0	5.88	x	0.13	=	0.76			(30)
Roof Type2	4.06	0	4.06	x	0.13	=	0.53			(30)
Roof Type3	26.07	1.2	24.87	x	0.13	=	3.23			(30)
Roof Type4	1.08	0	1.08	x	0.13	=	0.14			(30)
Total area of elements, m²			134.15							(31)
Party wall			124.5	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) = 43.5 (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 16.21 (36)

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

Total fabric heat loss (33) + (36) = 59.71 (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=	50.91	50.66	50.42	49.29	49.07	48.09	48.09	47.9	48.47	49.07	49.5	49.95	(38)

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

(39)m=	110.62	110.37	110.13	109	108.79	107.8	107.8	107.62	108.18	108.79	109.22	109.66	

Average = Sum(39)$_{1...12}$ /12= 109 (39)

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

(40)m=	1.1	1.1	1.1	1.09	1.08	1.07	1.07	1.07	1.08	1.08	1.09	1.09	

Average = Sum(40)$_{1...12}$ /12= 1.09 (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 2.74 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.36 (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=	109.3	105.32	101.35	97.37	93.4	89.42	89.42	93.4	97.37	101.35	105.32	109.3	

Total = Sum(44)$_{1...12}$ = 1192.32 (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=	162.08	141.76	146.28	127.53	122.37	105.6	97.85	112.28	113.63	132.42	144.55	156.97	

Total = Sum(45)$_{1...12}$ = 1563.32 (45)

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

(46)m=	24.31	21.26	21.94	19.13	18.36	15.84	14.68	16.84	17.04	19.86	21.68	23.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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	(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)		0.96	(55)

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	215.11	189.65	199.3	178.84	175.39	156.91	150.87	165.31	164.94	185.44	195.86	209.99	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	215.11	189.65	199.3	178.84	175.39	156.91	150.87	165.31	164.94	185.44	195.86	209.99	

Output from water heater (annual)$_{1...12}$ 2187.62 (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=	96.31	85.45	91.06	83.45	83.11	76.16	74.95	79.75	78.83	86.45	89.11	94.61	(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=	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	(66)

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

(67)m=	23.16	20.57	16.73	12.66	9.47	7.99	8.64	11.23	15.07	19.13	22.33	23.8	(67)

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

(68)m=	257.04	259.71	252.99	238.68	220.61	203.64	192.3	189.63	196.35	210.66	228.72	245.7	(68)

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

(69)m=	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	(71)

Water heating gains (Table 5)

(72)m=	129.45	127.15	122.39	115.91	111.7	105.78	100.74	107.19	109.49	116.19	123.77	127.16	(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=	473.8	471.59	456.26	431.4	405.94	381.56	365.83	372.2	385.06	410.14	438.97	460.82	(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	5.67	x	10.63	x	0.76	x	0.7	=	22.23	(74)
North	0.9x 0.77	x	1.08	x	10.63	x	0.76	x	0.7	=	8.47	(74)
North	0.9x 0.77	x	5.69	x	10.63	x	0.76	x	0.7	=	22.31	(74)
North	0.9x 0.77	x	5.67	x	20.32	x	0.76	x	0.7	=	42.48	(74)
North	0.9x 0.77	x	1.08	x	20.32	x	0.76	x	0.7	=	16.18	(74)
North	0.9x 0.77	x	5.69	x	20.32	x	0.76	x	0.7	=	42.63	(74)
North	0.9x 0.77	x	5.67	x	34.53	x	0.76	x	0.7	=	72.18	(74)
North	0.9x 0.77	x	1.08	x	34.53	x	0.76	x	0.7	=	27.5	(74)
North	0.9x 0.77	x	5.69	x	34.53	x	0.76	x	0.7	=	72.44	(74)
North	0.9x 0.77	x	5.67	x	55.46	x	0.76	x	0.7	=	115.94	(74)
North	0.9x 0.77	x	1.08	x	55.46	x	0.76	x	0.7	=	44.17	(74)
North	0.9x 0.77	x	5.69	x	55.46	x	0.76	x	0.7	=	116.35	(74)
North	0.9x 0.77	x	5.67	x	74.72	x	0.76	x	0.7	=	156.19	(74)
North	0.9x 0.77	x	1.08	x	74.72	x	0.76	x	0.7	=	59.5	(74)
North	0.9x 0.77	x	5.69	x	74.72	x	0.76	x	0.7	=	156.74	(74)
North	0.9x 0.77	x	5.67	x	79.99	x	0.76	x	0.7	=	167.2	(74)
North	0.9x 0.77	x	1.08	x	79.99	x	0.76	x	0.7	=	63.7	(74)
North	0.9x 0.77	x	5.69	x	79.99	x	0.76	x	0.7	=	167.79	(74)
North	0.9x 0.77	x	5.67	x	74.68	x	0.76	x	0.7	=	156.1	(74)
North	0.9x 0.77	x	1.08	x	74.68	x	0.76	x	0.7	=	59.47	(74)
North	0.9x 0.77	x	5.69	x	74.68	x	0.76	x	0.7	=	156.65	(74)
North	0.9x 0.77	x	5.67	x	59.25	x	0.76	x	0.7	=	123.85	(74)
North	0.9x 0.77	x	1.08	x	59.25	x	0.76	x	0.7	=	47.18	(74)
North	0.9x 0.77	x	5.69	x	59.25	x	0.76	x	0.7	=	124.28	(74)
North	0.9x 0.77	x	5.67	x	41.52	x	0.76	x	0.7	=	86.79	(74)
North	0.9x 0.77	x	1.08	x	41.52	x	0.76	x	0.7	=	33.06	(74)
North	0.9x 0.77	x	5.69	x	41.52	x	0.76	x	0.7	=	87.09	(74)
North	0.9x 0.77	x	5.67	x	24.19	x	0.76	x	0.7	=	50.57	(74)
North	0.9x 0.77	x	1.08	x	24.19	x	0.76	x	0.7	=	19.26	(74)
North	0.9x 0.77	x	5.69	x	24.19	x	0.76	x	0.7	=	50.74	(74)
North	0.9x 0.77	x	5.67	x	13.12	x	0.76	x	0.7	=	27.42	(74)
North	0.9x 0.77	x	1.08	x	13.12	x	0.76	x	0.7	=	10.45	(74)
North	0.9x 0.77	x	5.69	x	13.12	x	0.76	x	0.7	=	27.52	(74)
North	0.9x 0.77	x	5.67	x	8.86	x	0.76	x	0.7	=	18.53	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.08	x	8.86	x	0.76	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	5.69	x	8.86	x	0.76	x	0.7	=	18.6	(74)
South	0.9x	0.77	x	1.8	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	0.9	x	46.75	x	0.76	x	0.7	=	15.51	(78)
South	0.9x	0.77	x	1.8	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	0.9	x	76.57	x	0.76	x	0.7	=	25.41	(78)
South	0.9x	0.77	x	1.8	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	0.9	x	97.53	x	0.76	x	0.7	=	32.36	(78)
South	0.9x	0.77	x	1.8	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	0.9	x	110.23	x	0.76	x	0.7	=	36.58	(78)
South	0.9x	0.77	x	1.8	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	0.9	x	114.87	x	0.76	x	0.7	=	38.12	(78)
South	0.9x	0.77	x	1.8	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	0.9	x	110.55	x	0.76	x	0.7	=	36.68	(78)
South	0.9x	0.77	x	1.8	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	0.9	x	108.01	x	0.76	x	0.7	=	35.84	(78)
South	0.9x	0.77	x	1.8	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	0.9	x	104.89	x	0.76	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.8	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	0.9	x	101.89	x	0.76	x	0.7	=	33.81	(78)
South	0.9x	0.77	x	1.8	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	0.9	x	82.59	x	0.76	x	0.7	=	27.4	(78)
South	0.9x	0.77	x	1.8	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	0.9	x	55.42	x	0.76	x	0.7	=	18.39	(78)
South	0.9x	0.77	x	1.8	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	0.9	x	40.4	x	0.76	x	0.7	=	13.4	(78)
Rooflights	0.9x	1	x	1.2	x	46.22	x	0.76	x	0.7	=	26.56	(82)
Rooflights	0.9x	1	x	1.2	x	83.02	x	0.76	x	0.7	=	47.7	(82)
Rooflights	0.9x	1	x	1.2	x	122.59	x	0.76	x	0.7	=	70.44	(82)
Rooflights	0.9x	1	x	1.2	x	163.13	x	0.76	x	0.7	=	93.73	(82)
Rooflights	0.9x	1	x	1.2	x	190.18	x	0.76	x	0.7	=	109.27	(82)
Rooflights	0.9x	1	x	1.2	x	191.34	x	0.76	x	0.7	=	109.93	(82)
Rooflights	0.9x	1	x	1.2	x	183.47	x	0.76	x	0.7	=	105.41	(82)
Rooflights	0.9x	1	x	1.2	x	163.4	x	0.76	x	0.7	=	93.88	(82)
Rooflights	0.9x	1	x	1.2	x	136.91	x	0.76	x	0.7	=	78.66	(82)
Rooflights	0.9x	1	x	1.2	x	94.41	x	0.76	x	0.7	=	54.24	(82)
Rooflights	0.9x	1	x	1.2	x	56.2	x	0.76	x	0.7	=	32.29	(82)
Rooflights	0.9x	1	x	1.2	x	38.99	x	0.76	x	0.7	=	22.4	(82)

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

(83)m=	157.12	276.02	404.37	553.08	672.26	692.02	656.84	563.22	454.63	311.83	189.62	133.61

(83)

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

(84)m=	630.93	747.6	860.62	984.48	1078.2	1073.59	1022.67	935.42	839.69	721.97	628.59	594.43

(84)

DER WorkSheet: New dwelling design stage

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	0.81	0.62	0.46	0.52	0.79	0.96	0.99	1	(86)

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

(87)m=	19.85	20.02	20.29	20.62	20.87	20.98	21	20.99	20.92	20.59	20.16	19.82	(87)

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

(88)m=	20	20	20	20.01	20.01	20.02	20.02	20.02	20.02	20.01	20.01	20.01	(88)

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

(89)m=	1	0.99	0.97	0.91	0.76	0.53	0.36	0.41	0.71	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=	18.47	18.72	19.11	19.58	19.89	20.01	20.02	20.02	19.96	19.54	18.92	18.43	(90)

fLA = Living area ÷ (4) = | 0.33 | (91)

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

(92)m=	18.93	19.15	19.5	19.92	20.22	20.33	20.34	20.34	20.28	19.89	19.33	18.89	(92)

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

(93)m=	18.93	19.15	19.5	19.92	20.22	20.33	20.34	20.34	20.28	19.89	19.33	18.89	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.91	0.77	0.56	0.39	0.45	0.73	0.94	0.99	1	(94)

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

(95)m=	628.05	739.4	835.49	897.17	831.09	603.1	401.73	420.72	614.79	682.13	622.2	592.4	(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=	1617.82	1573.02	1431.44	1201.68	926.56	617.4	403.48	424.19	668.06	1010.39	1335.57	1610.73	(97)

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

(98)m=	736.39	560.19	443.39	219.25	71.03	0	0	0	0	244.23	513.62	757.63	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 3545.74 | (98)

Space heating requirement in kWh/m²/year | 35.3 | (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)

DER WorkSheet: New dwelling design stage

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		1.05	(306)

Space heating — **kWh/year**

Annual space heating requirement		3545.74	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3723.02	(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		2187.62	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2297	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	60.2	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		409.01	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		6429.03	(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	=	1249.76	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	31.24	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1281	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1281	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	212.28	(379)
Total CO2, kg/year	sum of (376)…(382) =				1493.28	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.87	(384)
EI rating (section 14)					86.24	(385)

DER WorkSheet: New dwelling design stage

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 1 - House 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	41.37 (1a)	x	2.4 (2a)	=	99.29	(3a)
First floor	35.51 (1b)	x	2.7 (2b)	=	95.88	(3b)
Second floor	23.56 (1c)	x	3.18 (2c)	=	74.93	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.44	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	270.09	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.15 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

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

(24d)

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

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

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.86	x	1.4	=	2.6012			(26)
Windows Type 1			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Windows Type 2			0.9	x1/[1/(1.4)+ 0.04]		=	1.19			(27)
Windows Type 3			5.67	x1/[1/(1.4)+ 0.04]		=	7.52			(27)
Windows Type 4			1.08	x1/[1/(1.4)+ 0.04]		=	1.43			(27)
Windows Type 5			5.69	x1/[1/(1.4)+ 0.04]		=	7.54			(27)
Windows Type 6			0.72	x1/[1/(1.4)+ 0.04]		=	0.95			(27)
Rooflights			1.2	x1/[1/(1.4) + 0.04]		=	1.68			(27b)
Floor			41.37	x	0.13	=	5.378099			(28)
Walls	117.95	20.6	97.35	x	0.15	=	14.6			(29)
Roof Type1	5.88	0	5.88	x	0.13	=	0.76			(30)
Roof Type2	4.06	0	4.06	x	0.13	=	0.53			(30)
Roof Type3	26.07	1.2	24.87	x	0.13	=	3.23			(30)
Roof Type4	1.08	0	1.08	x	0.13	=	0.14			(30)
Total area of elements, m²			196.41							(31)
Party wall			62.25	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) = 53.68 (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 17.42 (36)

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

Total fabric heat loss (33) + (36) = 71.1 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	52.08	51.78	51.5	50.16	49.9	48.74	48.74	48.52	49.19	49.9	50.41	50.94	(38)

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

(39)m=	123.18	122.89	122.6	121.26	121.01	119.84	119.84	119.62	120.29	121.01	121.51	122.05	

Average = Sum(39)$_{1...12}$ /12= 121.26 (39)

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

(40)m=	1.23	1.22	1.22	1.21	1.2	1.19	1.19	1.19	1.2	1.2	1.21	1.22	

Average = Sum(40)$_{1...12}$ /12= 1.21 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.74 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.36 (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=	109.3	105.32	101.35	97.37	93.4	89.42	89.42	93.4	97.37	101.35	105.32	109.3	

Total = Sum(44)$_{1...12}$ = 1192.32 (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=	162.08	141.76	146.28	127.53	122.37	105.6	97.85	112.28	113.63	132.42	144.55	156.97	

Total = Sum(45)$_{1...12}$ = 1563.32 (45)

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

(46)m=	24.31	21.26	21.94	19.13	18.36	15.84	14.68	16.84	17.04	19.86	21.68	23.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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	(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)		0.96	(55)

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	215.11	189.65	199.3	178.84	175.39	156.91	150.87	165.31	164.94	185.44	195.86	209.99	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	215.11	189.65	199.3	178.84	175.39	156.91	150.87	165.31	164.94	185.44	195.86	209.99	

Output from water heater (annual)$_{1...12}$ 2187.62 (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=	96.31	85.45	91.06	83.45	83.11	76.16	74.95	79.75	78.83	86.45	89.11	94.61	(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=	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	137.18	(66)

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

(67)m=	23.07	20.49	16.66	12.61	9.43	7.96	8.6	11.18	15.01	19.05	22.24	23.71	(67)

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

(68)m=	257.04	259.71	252.99	238.68	220.61	203.64	192.3	189.63	196.35	210.66	228.72	245.7	(68)

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

(69)m=	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	36.72	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	-109.74	(71)

Water heating gains (Table 5)

(72)m=	129.45	127.15	122.39	115.91	111.7	105.78	100.74	107.19	109.49	116.19	123.77	127.16	(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=	473.71	471.5	456.19	431.35	405.9	381.53	365.79	372.16	385	410.06	438.88	460.72	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	5.67	x	10.63	x	0.76	x	0.7	=	22.23	(74)
North	0.9x 0.77	x	1.08	x	10.63	x	0.76	x	0.7	=	8.47	(74)
North	0.9x 0.77	x	5.69	x	10.63	x	0.76	x	0.7	=	22.31	(74)
North	0.9x 0.77	x	5.67	x	20.32	x	0.76	x	0.7	=	42.48	(74)
North	0.9x 0.77	x	1.08	x	20.32	x	0.76	x	0.7	=	16.18	(74)
North	0.9x 0.77	x	5.69	x	20.32	x	0.76	x	0.7	=	42.63	(74)
North	0.9x 0.77	x	5.67	x	34.53	x	0.76	x	0.7	=	72.18	(74)
North	0.9x 0.77	x	1.08	x	34.53	x	0.76	x	0.7	=	27.5	(74)
North	0.9x 0.77	x	5.69	x	34.53	x	0.76	x	0.7	=	72.44	(74)
North	0.9x 0.77	x	5.67	x	55.46	x	0.76	x	0.7	=	115.94	(74)
North	0.9x 0.77	x	1.08	x	55.46	x	0.76	x	0.7	=	44.17	(74)
North	0.9x 0.77	x	5.69	x	55.46	x	0.76	x	0.7	=	116.35	(74)
North	0.9x 0.77	x	5.67	x	74.72	x	0.76	x	0.7	=	156.19	(74)
North	0.9x 0.77	x	1.08	x	74.72	x	0.76	x	0.7	=	59.5	(74)
North	0.9x 0.77	x	5.69	x	74.72	x	0.76	x	0.7	=	156.74	(74)
North	0.9x 0.77	x	5.67	x	79.99	x	0.76	x	0.7	=	167.2	(74)
North	0.9x 0.77	x	1.08	x	79.99	x	0.76	x	0.7	=	63.7	(74)
North	0.9x 0.77	x	5.69	x	79.99	x	0.76	x	0.7	=	167.79	(74)
North	0.9x 0.77	x	5.67	x	74.68	x	0.76	x	0.7	=	156.1	(74)
North	0.9x 0.77	x	1.08	x	74.68	x	0.76	x	0.7	=	59.47	(74)
North	0.9x 0.77	x	5.69	x	74.68	x	0.76	x	0.7	=	156.65	(74)
North	0.9x 0.77	x	5.67	x	59.25	x	0.76	x	0.7	=	123.85	(74)
North	0.9x 0.77	x	1.08	x	59.25	x	0.76	x	0.7	=	47.18	(74)
North	0.9x 0.77	x	5.69	x	59.25	x	0.76	x	0.7	=	124.28	(74)
North	0.9x 0.77	x	5.67	x	41.52	x	0.76	x	0.7	=	86.79	(74)
North	0.9x 0.77	x	1.08	x	41.52	x	0.76	x	0.7	=	33.06	(74)
North	0.9x 0.77	x	5.69	x	41.52	x	0.76	x	0.7	=	87.09	(74)
North	0.9x 0.77	x	5.67	x	24.19	x	0.76	x	0.7	=	50.57	(74)
North	0.9x 0.77	x	1.08	x	24.19	x	0.76	x	0.7	=	19.26	(74)
North	0.9x 0.77	x	5.69	x	24.19	x	0.76	x	0.7	=	50.74	(74)
North	0.9x 0.77	x	5.67	x	13.12	x	0.76	x	0.7	=	27.42	(74)
North	0.9x 0.77	x	1.08	x	13.12	x	0.76	x	0.7	=	10.45	(74)
North	0.9x 0.77	x	5.69	x	13.12	x	0.76	x	0.7	=	27.52	(74)
North	0.9x 0.77	x	5.67	x	8.86	x	0.76	x	0.7	=	18.53	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.08	x	8.86	x	0.76	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	5.69	x	8.86	x	0.76	x	0.7	=	18.6	(74)
East	0.9x	0.77	x	0.72	x	19.64	x	0.76	x	0.7	=	5.21	(76)
East	0.9x	0.77	x	0.72	x	38.42	x	0.76	x	0.7	=	10.2	(76)
East	0.9x	0.77	x	0.72	x	63.27	x	0.76	x	0.7	=	16.8	(76)
East	0.9x	0.77	x	0.72	x	92.28	x	0.76	x	0.7	=	24.5	(76)
East	0.9x	0.77	x	0.72	x	113.09	x	0.76	x	0.7	=	30.02	(76)
East	0.9x	0.77	x	0.72	x	115.77	x	0.76	x	0.7	=	30.73	(76)
East	0.9x	0.77	x	0.72	x	110.22	x	0.76	x	0.7	=	29.26	(76)
East	0.9x	0.77	x	0.72	x	94.68	x	0.76	x	0.7	=	25.13	(76)
East	0.9x	0.77	x	0.72	x	73.59	x	0.76	x	0.7	=	19.53	(76)
East	0.9x	0.77	x	0.72	x	45.59	x	0.76	x	0.7	=	12.1	(76)
East	0.9x	0.77	x	0.72	x	24.49	x	0.76	x	0.7	=	6.5	(76)
East	0.9x	0.77	x	0.72	x	16.15	x	0.76	x	0.7	=	4.29	(76)
South	0.9x	0.77	x	1.8	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	0.9	x	46.75	x	0.76	x	0.7	=	15.51	(78)
South	0.9x	0.77	x	1.8	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	0.9	x	76.57	x	0.76	x	0.7	=	25.41	(78)
South	0.9x	0.77	x	1.8	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	0.9	x	97.53	x	0.76	x	0.7	=	32.36	(78)
South	0.9x	0.77	x	1.8	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	0.9	x	110.23	x	0.76	x	0.7	=	36.58	(78)
South	0.9x	0.77	x	1.8	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	0.9	x	114.87	x	0.76	x	0.7	=	38.12	(78)
South	0.9x	0.77	x	1.8	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	0.9	x	110.55	x	0.76	x	0.7	=	36.68	(78)
South	0.9x	0.77	x	1.8	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	0.9	x	108.01	x	0.76	x	0.7	=	35.84	(78)
South	0.9x	0.77	x	1.8	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	0.9	x	104.89	x	0.76	x	0.7	=	34.8	(78)
South	0.9x	0.77	x	1.8	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	0.9	x	101.89	x	0.76	x	0.7	=	33.81	(78)
South	0.9x	0.77	x	1.8	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	0.9	x	82.59	x	0.76	x	0.7	=	27.4	(78)
South	0.9x	0.77	x	1.8	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	0.9	x	55.42	x	0.76	x	0.7	=	18.39	(78)
South	0.9x	0.77	x	1.8	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	0.9	x	40.4	x	0.76	x	0.7	=	13.4	(78)
Rooflights	0.9x	1	x	1.2	x	46.22	x	0.76	x	0.7	=	26.56	(82)
Rooflights	0.9x	1	x	1.2	x	83.02	x	0.76	x	0.7	=	47.7	(82)
Rooflights	0.9x	1	x	1.2	x	122.59	x	0.76	x	0.7	=	70.44	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.2	x	163.13	x	0.76	x	0.7	=	93.73	(82)
Rooflights 0.9x	1	x	1.2	x	190.18	x	0.76	x	0.7	=	109.27	(82)
Rooflights 0.9x	1	x	1.2	x	191.34	x	0.76	x	0.7	=	109.93	(82)
Rooflights 0.9x	1	x	1.2	x	183.47	x	0.76	x	0.7	=	105.41	(82)
Rooflights 0.9x	1	x	1.2	x	163.4	x	0.76	x	0.7	=	93.88	(82)
Rooflights 0.9x	1	x	1.2	x	136.91	x	0.76	x	0.7	=	78.66	(82)
Rooflights 0.9x	1	x	1.2	x	94.41	x	0.76	x	0.7	=	54.24	(82)
Rooflights 0.9x	1	x	1.2	x	56.2	x	0.76	x	0.7	=	32.29	(82)
Rooflights 0.9x	1	x	1.2	x	38.99	x	0.76	x	0.7	=	22.4	(82)

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

(83)m=	162.34	286.22	421.16	577.57	702.28	722.75	686.09	588.35	474.17	323.93	196.12	137.89	(83)

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

(84)m=	636.05	757.72	877.35	1008.92	1108.18	1104.28	1051.89	960.51	859.17	733.99	635	598.62	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.65	0.49	0.56	0.81	0.97	0.99	1	(86)

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

(87)m=	19.69	19.87	20.15	20.52	20.81	20.96	20.99	20.99	20.88	20.49	20.02	19.66	(87)

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

(88)m=	19.9	19.9	19.9	19.91	19.92	19.93	19.93	19.93	19.92	19.92	19.91	19.91	(88)

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

(89)m=	1	0.99	0.98	0.92	0.78	0.56	0.38	0.43	0.74	0.95	0.99	1	(89)

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

(90)m=	18.16	18.43	18.84	19.36	19.74	19.9	19.92	19.92	19.83	19.34	18.66	18.12	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.66	18.9	19.27	19.75	20.1	20.25	20.28	20.27	20.18	19.72	19.11	18.63	(92)

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

(93)m=	18.66	18.9	19.27	19.75	20.1	20.25	20.28	20.27	20.18	19.72	19.11	18.63	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.92	0.79	0.59	0.42	0.48	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	632.96	749.26	852.48	926.08	876.52	651.45	436.76	456.34	649.75	696.38	628.48	596.41	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1769.34	1720.63	1566.06	1315.22	1015.95	676.93	440.43	463.22	730.82	1103.26	1459.03	1760.91	(97)

DER WorkSheet: New dwelling design stage

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

(98)m=	845.47	652.76	530.91	280.18	103.73	0	0	0	0	302.72	598	866.38

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4180.14 (98)

Space heating requirement in kWh/m²/year 41.62 (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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		4180.14	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	4389.15	(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 2187.62

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 2297 (310a)

Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 66.86 (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 0 (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) = 0 (331)

Energy for lighting (calculated in Appendix L) 407.34 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 7093.49 (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)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	1388.04	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	34.7	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1422.75	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1422.75	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	211.41	(379)
Total CO2, kg/year	sum of (376)…(382) =			1634.16	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.27	(384)
EI rating (section 14)				84.94	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	55.77	(1a) x	2.6	(2a) =	145	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.77	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.34	(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) =	0.29	(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

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

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

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Windows Type 4			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 5			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Floor			55.768	x	0.13	=	7.24984			(28)
Walls Type1	44.71	17.28	27.43	x	0.15	=	4.11			(29)
Walls Type2	13.39	1.99	11.4	x	0.14	=	1.64			(29)
Walls Type3	14.94	0	14.94	x	0.13	=	1.97			(29)
Total area of elements, m²			128.8							(31)
Party wall			11.44	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) = 40.67 (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 12.75 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 53.43 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.13	27.01	26.89	26.31	26.21	25.71	25.71	25.61	25.9	26.21	26.42	26.65	(38)

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

(39)m=	80.56	80.44	80.31	79.74	79.63	79.13	79.13	79.04	79.32	79.63	79.85	80.08	

Average = Sum(39)$_{1...12}$ /12= 79.74 (39)

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

(40)m=	1.44	1.44	1.44	1.43	1.43	1.42	1.42	1.42	1.42	1.43	1.43	1.44	

Average = Sum(40)$_{1...12}$ /12= 1.43 (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 1.86 (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 78.37 (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=	86.21	83.07	79.94	76.8	73.67	70.53	70.53	73.67	76.8	79.94	83.07	86.21	

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

Total = Sum(44)$_{1...12}$ = 940.45 (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=	127.84	111.81	115.38	100.59	96.52	83.29	77.18	88.57	89.62	104.45	114.01	123.81	

Total = Sum(45)$_{1...12}$ = 1233.08 (45)

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

(46)m=	19.18	16.77	17.31	15.09	14.48	12.49	11.58	13.28	13.44	15.67	17.1	18.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	178.08	157.18	165.61	149.2	146.75	131.9	127.41	138.8	138.24	154.68	162.62	174.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	178.08	157.18	165.61	149.2	146.75	131.9	127.41	138.8	138.24	154.68	162.62	174.04	

Output from water heater (annual)$_{1...12}$ | 1824.52 | (64)

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

(65)m=	82.69	73.47	78.55	72.34	72.28	66.58	65.85	69.63	68.69	74.91	76.8	81.35	(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=	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	(66)

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

(67)m=	14.46	12.84	10.44	7.91	5.91	4.99	5.39	7.01	9.41	11.94	13.94	14.86	(67)

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

(68)m=	162.16	163.85	159.6	150.58	139.18	128.47	121.32	119.63	123.87	132.9	144.3	155.01	(68)

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

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	(71)

Water heating gains (Table 5)

(72)m=	111.15	109.34	105.58	100.47	97.15	92.48	88.51	93.59	95.4	100.69	106.66	109.35	(72)

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

(73)m=	338.66	336.92	326.52	309.85	293.14	276.84	266.11	271.13	279.58	296.43	315.8	330.11	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x 0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x 0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x 0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x 0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x 0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x 0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
North	0.9x 0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
West	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(80)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	2.16	x	19.64	x	0.76	x	0.7	=	15.64	(80)
West	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)
West	0.9x 0.77	x	2.16	x	38.42	x	0.76	x	0.7	=	30.6	(80)
West	0.9x 0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(80)
West	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x 0.77	x	2.16	x	63.27	x	0.76	x	0.7	=	50.39	(80)
West	0.9x 0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(80)
West	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x 0.77	x	2.16	x	92.28	x	0.76	x	0.7	=	73.49	(80)
West	0.9x 0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(80)
West	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x 0.77	x	2.16	x	113.09	x	0.76	x	0.7	=	90.06	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x	0.77	x	2.16	x	115.77	x	0.76	x	0.7	=	92.19	(80)
West	0.9x	0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x	0.77	x	2.16	x	110.22	x	0.76	x	0.7	=	87.77	(80)
West	0.9x	0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	2.16	x	94.68	x	0.76	x	0.7	=	75.39	(80)
West	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	2.16	x	73.59	x	0.76	x	0.7	=	58.6	(80)
West	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	2.16	x	45.59	x	0.76	x	0.7	=	36.3	(80)
West	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	2.16	x	24.49	x	0.76	x	0.7	=	19.5	(80)
West	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	2.16	x	16.15	x	0.76	x	0.7	=	12.86	(80)

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

(83)m=	108.39	211.14	349.69	519.48	649.17	671.05	636.13	537.32	409.22	250.67	134.88	89.36	(83)

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

(84)m=	447.05	548.06	676.21	829.33	942.31	947.88	902.24	808.45	688.8	547.11	450.68	419.46	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.7	0.52	0.38	0.44	0.71	0.93	0.99	0.99	(86)

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

(87)m=	19.56	19.79	20.17	20.6	20.87	20.97	20.99	20.99	20.9	20.49	19.93	19.51	(87)

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

(88)m=	19.73	19.73	19.73	19.74	19.74	19.75	19.75	19.75	19.75	19.74	19.74	19.74	(88)

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

(89)m=	0.99	0.98	0.94	0.83	0.63	0.42	0.28	0.33	0.61	0.9	0.98	0.99	(89)

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

(90)m=	17.86	18.19	18.73	19.32	19.63	19.73	19.75	19.75	19.68	19.19	18.41	17.8	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.56	18.86	19.33	19.85	20.15	20.25	20.26	20.26	20.19	19.73	19.04	18.51	(92)

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

(93)m=	18.56	18.86	19.33	19.85	20.15	20.25	20.26	20.26	20.19	19.73	19.04	18.51	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.83	0.65	0.46	0.32	0.37	0.65	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	441.86	534.01	631.89	687.81	617.14	437.14	288.4	302.25	445.21	494.84	440.52	415.63	(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=	1149.03	1122.61	1030.31	873.25	672.71	446.91	289.96	305.24	482.89	727.25	953.53	1145.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	526.14	395.54	296.43	133.52	41.34	0	0	0	0	172.92	369.37	543.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2478.49	(98)
Space heating requirement in kWh/m²/year	44.44	(99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2478.49	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2602.41	(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		1824.52	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1915.75	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.18	(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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		255.31	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4773.48	(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	=	937.97	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.45	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	961.42	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				961.42	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	132.51	(379)
Total CO2, kg/year	sum of (376)…(382) =				1093.93	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				19.62	(384)
EI rating (section 14)					85.45	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.08	(1a) x	2.6	(2a) =	130.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.08	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.22	(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			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

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

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Windows Type 4			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Floor			50.083	x	0.13	=	6.51079			(28)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Total area of elements, m²			107.8							(31)
Party wall			11.44	x	0	=	0			(32)
Party wall			23.4	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) = 35.09 (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 12.59 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 47.67 (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=	24.64	24.52	24.4	23.83	23.73	23.24	23.24	23.15	23.43	23.73	23.94	24.17	(38)

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

(39)m=	72.31	72.19	72.07	71.51	71.4	70.91	70.91	70.82	71.1	71.4	71.62	71.84	

Average = Sum(39)$_{1...12}$ /12= 71.51 (39)

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

(40)m=	1.44	1.44	1.44	1.43	1.43	1.42	1.42	1.41	1.42	1.43	1.43	1.43	

Average = Sum(40)$_{1...12}$ /12= 1.43 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.4 (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=	81.84	78.86	75.89	72.91	69.93	66.96	66.96	69.93	72.91	75.89	78.86	81.84	

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

Total = Sum(44)$_{1...12}$ = 892.78 (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=	121.36	106.14	109.53	95.49	91.63	79.07	73.27	84.08	85.08	99.15	108.23	117.53	

Total = Sum(45)$_{1...12}$ = 1170.57 (45)

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

(46)m=	18.2	15.92	16.43	14.32	13.74	11.86	10.99	12.61	12.76	14.87	16.23	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	

Output from water heater (annual)$_{1...12}$ | 1762.02 | (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=	80.54	71.59	76.61	70.64	70.65	65.18	64.55	68.14	67.18	73.15	74.88	79.27	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	(66)

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

(67)m=	13.15	11.68	9.5	7.19	5.37	4.54	4.9	6.37	8.55	10.86	12.67	13.51	(67)

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

(68)m=	147.45	148.98	145.12	136.92	126.55	116.82	110.31	108.78	112.64	120.84	131.21	140.94	(68)

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

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	(71)

Water heating gains (Table 5)

(72)m=	108.25	106.53	102.96	98.11	94.96	90.53	86.76	91.59	93.3	98.33	104	106.54	(72)

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

(73)m=	317.23	315.58	305.97	290.6	275.28	260.27	250.36	255.13	262.88	278.42	296.26	309.38	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x 0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x 0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x 0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x 0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x 0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x 0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
North	0.9x 0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

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

(83)m=	92.75	180.54	299.3	446	559.11	578.86	548.36	461.93	350.62	214.37	115.38	76.49	(83)

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

(84)m=	409.98	496.12	605.27	736.6	834.39	839.12	798.71	717.05	613.5	492.78	411.64	385.88	(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	0.96	0.87	0.71	0.52	0.39	0.45	0.71	0.93	0.99	0.99	(86)

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

(87)m=	19.58	19.8	20.17	20.6	20.87	20.97	20.99	20.99	20.9	20.5	19.95	19.53	(87)

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

(88)m=	19.73	19.73	19.73	19.74	19.74	19.75	19.75	19.75	19.75	19.74	19.74	19.74	(88)

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

(89)m=	0.99	0.98	0.94	0.83	0.64	0.43	0.28	0.33	0.61	0.9	0.98	0.99	(89)

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

(90)m=	17.88	18.21	18.73	19.31	19.63	19.74	19.75	19.75	19.68	19.2	18.43	17.82	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	18.66	18.94	19.39	19.91	20.2	20.31	20.32	20.32	20.25	19.8	19.13	18.61	(92)

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

(93)m=	18.66	18.94	19.39	19.91	20.2	20.31	20.32	20.32	20.25	19.8	19.13	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	0.97	0.94	0.84	0.66	0.47	0.33	0.38	0.65	0.91	0.98	0.99	(94)

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

(95)m=	404.97	483.31	566.54	615.08	554.33	395.14	262.5	274.75	401.35	446.13	402.05	382.12	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	1038.62	1013.68	929.34	786.99	607.14	404.65	264.07	277.72	436.91	656.8	861.58	1035.35	(97)

DER WorkSheet: New dwelling design stage

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

(98)m=	471.44	356.41	269.92	123.77	39.29	0	0	0	0	156.74	330.87	486

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2234.43 (98)

Space heating requirement in kWh/m²/year 44.61 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community heat pump 1 (303a)

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

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

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

Space heating		**kWh/year**	
Annual space heating requirement		2234.43	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2346.15	(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 1762.02

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 1850.12 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 41.96 (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 0 (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) = 0 (331)

Energy for lighting (calculated in Appendix L) 232.15 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 4428.42 (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)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	871.15	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	21.78	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	892.92	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			892.92	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.49	(379)
Total CO2, kg/year	sum of (376)…(382) =			1013.41	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			20.23	(384)
EI rating (section 14)				85.72	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 3

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.19	(1a) x	2.6	(2a) =	182.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.19	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		182.5	(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			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.36 (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

DER WorkSheet: New dwelling design stage

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

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

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	0.57	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	0.57	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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 4			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 5			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Floor			70.193	x	0.13	=	9.12509			(28)
Walls Type1	52.65	23.04	29.61	x	0.15	=	4.44			(29)
Walls Type2	10.27	1.99	8.28	x	0.14	=	1.17			(29)
Walls Type3	5.2	0	5.2	x	0.13	=	0.69			(29)
Total area of elements, m²			138.31							(31)
Party wall			16.9	x	0	=	0			(32)
Party wall			21.84	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) = 48.76 (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 14.41 (36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 63.17 (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=	34.81	34.63	34.45	33.61	33.45	32.72	32.72	32.58	33	33.45	33.77	34.1	(38)

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

(39)m=	97.98	97.79	97.62	96.78	96.62	95.89	95.89	95.75	96.17	96.62	96.94	97.27	

Average = Sum(39)$_{1...12}$ /12= 96.78 (39)

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

(40)m=	1.4	1.39	1.39	1.38	1.38	1.37	1.37	1.36	1.37	1.38	1.38	1.39	

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.66 (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=	96.42	92.92	89.41	85.9	82.4	78.89	78.89	82.4	85.9	89.41	92.92	96.42	

Total = Sum(44)$_{1...12}$ = 1051.88 (44)

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

(45)m=	142.99	125.06	129.05	112.51	107.96	93.16	86.32	99.06	100.24	116.82	127.52	138.48	

Total = Sum(45)$_{1...12}$ = 1379.18 (45)

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

(46)m=	21.45	18.76	19.36	16.88	16.19	13.97	12.95	14.86	15.04	17.52	19.13	20.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	

Output from water heater (annual)$_{1...12}$ | 1970.62 | (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=	87.73	77.88	83.1	76.3	76.08	69.86	68.89	73.12	72.22	79.03	81.29	86.23	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	(66)

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

(67)m=	17.63	15.66	12.73	9.64	7.21	6.08	6.57	8.55	11.47	14.56	17	18.12	(67)

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

(68)m=	197.75	199.8	194.63	183.62	169.72	156.66	147.94	145.89	151.06	162.07	175.96	189.02	(68)

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

(69)m=	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	(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=	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	(71)

Water heating gains (Table 5)

(72)m=	117.92	115.89	111.69	105.97	102.26	97.03	92.59	98.28	100.31	106.22	112.9	115.9	(72)

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

(73)m=	390.06	388.11	375.81	355.99	335.95	316.54	303.87	309.48	319.59	339.61	362.62	379.8	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	52.13	(76)
East	0.9x 0.77	x	2.16	x	19.64	x	0.76	x	0.7	=	31.28	(76)
East	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	101.99	(76)
East	0.9x 0.77	x	2.16	x	38.42	x	0.76	x	0.7	=	61.19	(76)
East	0.9x 0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	167.96	(76)
East	0.9x 0.77	x	2.16	x	63.27	x	0.76	x	0.7	=	100.77	(76)
East	0.9x 0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	244.95	(76)
East	0.9x 0.77	x	2.16	x	92.28	x	0.76	x	0.7	=	146.97	(76)
East	0.9x 0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	300.2	(76)
East	0.9x 0.77	x	2.16	x	113.09	x	0.76	x	0.7	=	180.12	(76)
East	0.9x 0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	307.31	(76)
East	0.9x 0.77	x	2.16	x	115.77	x	0.76	x	0.7	=	184.39	(76)
East	0.9x 0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	292.57	(76)
East	0.9x 0.77	x	2.16	x	110.22	x	0.76	x	0.7	=	175.54	(76)
East	0.9x 0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)
East	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	251.31	(76)
East	0.9x 0.77	x	2.16	x	94.68	x	0.76	x	0.7	=	150.79	(76)
East	0.9x 0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)
East	0.9x 0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	195.34	(76)
East	0.9x 0.77	x	2.16	x	73.59	x	0.76	x	0.7	=	117.2	(76)
East	0.9x 0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x 0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	121.01	(76)
East	0.9x 0.77	x	2.16	x	45.59	x	0.76	x	0.7	=	72.61	(76)
East	0.9x 0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x 0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	65.01	(76)
East	0.9x 0.77	x	2.16	x	24.49	x	0.76	x	0.7	=	39	(76)
East	0.9x 0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x 0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	42.87	(76)
East	0.9x 0.77	x	2.16	x	16.15	x	0.76	x	0.7	=	25.72	(76)
South	0.9x 0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x 0.77	x	1.44	x	46.75	x	0.76	x	0.7	=	24.82	(78)
South	0.9x 0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	101.62	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	1.44	x	76.57	x	0.76	x	0.7	=	40.65	(78)
South	0.9x	0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.76	x	0.7	=	51.78	(78)
South	0.9x	0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.76	x	0.7	=	58.52	(78)
South	0.9x	0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.76	x	0.7	=	60.98	(78)
South	0.9x	0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.76	x	0.7	=	58.69	(78)
South	0.9x	0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.76	x	0.7	=	57.34	(78)
South	0.9x	0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.76	x	0.7	=	55.69	(78)
South	0.9x	0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.76	x	0.7	=	54.09	(78)
South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.76	x	0.7	=	43.84	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.76	x	0.7	=	29.42	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.76	x	0.7	=	21.45	(78)

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

(83)m=	217.21	397.24	601.12	817.22	963.95	973.68	932.13	823.19	677.67	455.99	265.49	182.25	(83)

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

(84)m=	607.26	785.35	976.93	1173.21	1299.9	1290.23	1235.99	1132.67	997.26	795.6	628.11	562.05	(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	0.93	0.81	0.64	0.47	0.34	0.39	0.62	0.89	0.98	0.99	(86)

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

(87)m=	19.68	19.96	20.35	20.72	20.92	20.98	21	20.99	20.95	20.62	20.06	19.62	(87)

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

(88)m=	19.77	19.77	19.77	19.78	19.78	19.79	19.79	19.79	19.79	19.78	19.78	19.77	(88)

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

(89)m=	0.99	0.97	0.91	0.77	0.57	0.38	0.25	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=	18.05	18.46	19	19.49	19.71	19.78	19.79	19.79	19.75	19.39	18.62	17.97	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.85	19.2	19.66	20.1	20.31	20.37	20.38	20.38	20.34	20	19.33	18.78	(92)

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

(93)m=	18.85	19.2	19.66	20.1	20.31	20.37	20.38	20.38	20.34	20	19.33	18.78	(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	0.96	0.9	0.78	0.6	0.42	0.29	0.33	0.57	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	598.41	755.55	883.82	914.68	784.54	545.69	361.51	379.13	572.35	686.62	608.84	555.91	(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=	1425.47	1398.6	1284.94	1083.48	831.44	553.47	362.69	381.26	599.97	907.97	1185.17	1418.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	615.34	432.12	298.44	121.53	34.9	0	0	0	0	164.68	414.95	641.8	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2723.76	(98)
Space heating requirement in kWh/m²/year	38.8	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2723.76	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2859.95	(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		1970.62	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2069.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.29	(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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		311.34	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5240.44	(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	=	1023.28	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.58	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1048.86	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1048.86	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	161.58	(379)
Total CO2, kg/year	sum of (376)…(382) =				1210.45	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.24	(384)
EI rating (section 14)					85.92	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.9	(1a) x	2.6	(2a) =	184.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.9	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		184.35	(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) =	0.11	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.31	(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) =	0.26	(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

0.33	0.33	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.31

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=	0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(24d)

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

(25)m=	0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 5			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Floor			70.903	x	0.13	=	9.21739			(28)
Walls Type1	51.09	17.28	33.81	x	0.15	=	5.07			(29)
Walls Type2	18.59	1.99	16.6	x	0.14	=	2.39			(29)
Walls Type3	12.22	0	12.22	x	0.13	=	1.61			(29)
Total area of elements, m²			152.8							(31)
Party wall			15.34	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) = 43.99 (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 13.67 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 57.66 (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=	33.82	33.69	33.56	32.95	32.83	32.3	32.3	32.21	32.51	32.83	33.06	33.3	(38)

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

(39)m=	91.47	91.34	91.21	90.61	90.49	89.96	89.96	89.86	90.17	90.49	90.72	90.96	

Average = Sum(39)$_{1...12}$ /12= 90.61 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.28 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (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 88.06 (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=	96.87	93.35	89.82	86.3	82.78	79.26	79.26	82.78	86.3	89.82	93.35	96.87	

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

Total = Sum(44)$_{1...12}$ = 1056.74 (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=	143.65	125.64	129.65	113.03	108.46	93.59	86.72	99.52	100.71	117.36	128.11	139.12	

Total = Sum(45)$_{1...12}$ = 1385.55 (45)

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

(46)m=	21.55	18.85	19.45	16.95	16.27	14.04	13.01	14.93	15.11	17.6	19.22	20.87	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	193.88	171.01	179.88	161.64	158.69	142.2	136.96	149.75	149.32	167.59	176.72	189.35	(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=	193.88	171.01	179.88	161.64	158.69	142.2	136.96	149.75	149.32	167.59	176.72	189.35	

Output from water heater (annual)$_{1...12}$ | 1976.99 | (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=	87.95	78.07	83.29	76.47	76.25	70.01	69.02	73.28	72.37	79.21	81.49	86.44	(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=	113.39	113.39	113.39	113.39	113.39	113.39	113.39	113.39	113.39	113.39	113.39	113.39	(66)

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

(67)m=	17.78	15.79	12.84	9.72	7.27	6.13	6.63	8.62	11.56	14.68	17.14	18.27	(67)

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

(68)m=	199.4	201.46	196.25	185.15	171.14	157.97	149.17	147.1	152.32	163.42	177.43	190.6	(68)

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

(69)m=	34.34	34.34	34.34	34.34	34.34	34.34	34.34	34.34	34.34	34.34	34.34	34.34	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-90.71	-90.71	-90.71	-90.71	-90.71	-90.71	-90.71	-90.71	-90.71	-90.71	-90.71	-90.71	(71)

Water heating gains (Table 5)

(72)m=	118.21	116.18	111.95	106.21	102.48	97.23	92.77	98.49	100.52	106.46	113.18	116.19	(72)

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

(73)m=	392.4	390.45	378.06	358.1	337.91	318.35	305.59	311.22	321.42	341.58	364.76	382.07	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.76	x	0.7	=	24.82	(78)
South	0.9x	0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.76	x	0.7	=	40.65	(78)
South	0.9x	0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.76	x	0.7	=	51.78	(78)
South	0.9x	0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.76	x	0.7	=	58.52	(78)
South	0.9x	0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.76	x	0.7	=	60.98	(78)
South	0.9x	0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.76	x	0.7	=	58.69	(78)
South	0.9x	0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.76	x	0.7	=	57.34	(78)
South	0.9x	0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.76	x	0.7	=	55.69	(78)
South	0.9x	0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.76	x	0.7	=	54.09	(78)
South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.76	x	0.7	=	43.84	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.76	x	0.7	=	29.42	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.76	x	0.7	=	21.45	(78)
West	0.9x	0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(80)
West	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x	0.77	x	2.16	x	19.64	x	0.76	x	0.7	=	15.64	(80)
West	0.9x	0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(80)
West	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)
West	0.9x	0.77	x	2.16	x	38.42	x	0.76	x	0.7	=	30.6	(80)
West	0.9x	0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(80)
West	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x	0.77	x	2.16	x	63.27	x	0.76	x	0.7	=	50.39	(80)
West	0.9x	0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(80)
West	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x	0.77	x	2.16	x	92.28	x	0.76	x	0.7	=	73.49	(80)
West	0.9x	0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(80)
West	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x	0.77	x	2.16	x	113.09	x	0.76	x	0.7	=	90.06	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x	0.77	x	2.16	x	115.77	x	0.76	x	0.7	=	92.19	(80)
West	0.9x	0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x	0.77	x	2.16	x	110.22	x	0.76	x	0.7	=	87.77	(80)
West	0.9x	0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	2.16	x	94.68	x	0.76	x	0.7	=	75.39	(80)
West	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	2.16	x	73.59	x	0.76	x	0.7	=	58.6	(80)
West	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	2.16	x	45.59	x	0.76	x	0.7	=	36.3	(80)
West	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	2.16	x	24.49	x	0.76	x	0.7	=	19.5	(80)
West	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	2.16	x	16.15	x	0.76	x	0.7	=	12.86	(80)

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

(83)m=	175.5	315.65	466.76	621.25	723.79	727.84	698.07	622.14	521.39	359.18	213.48	147.95	(83)

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

(84)m=	567.9	706.1	844.82	979.35	1061.69	1046.19	1003.66	933.37	842.81	700.76	578.24	530.02	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.72	0.53	0.39	0.44	0.68	0.92	0.99	1	(86)

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

(87)m=	19.76	20	20.33	20.68	20.89	20.98	21	20.99	20.94	20.62	20.11	19.71	(87)

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

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

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

(89)m=	0.99	0.98	0.93	0.83	0.65	0.45	0.29	0.33	0.59	0.89	0.98	0.99	(89)

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

(90)m=	18.22	18.57	19.04	19.51	19.77	19.85	19.86	19.86	19.82	19.45	18.74	18.15	(90)

fLA = Living area ÷ (4) = 0.54 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	19.05	19.34	19.74	20.14	20.38	20.46	20.48	20.47	20.42	20.08	19.48	18.99	(92)

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

(93)m=	19.05	19.34	19.74	20.14	20.38	20.46	20.48	20.47	20.42	20.08	19.48	18.99	(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	0.84	0.68	0.49	0.35	0.39	0.64	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	561.65	686.93	788.02	820.63	723.23	516.25	347.02	363.28	536.4	626.71	564.83	525.61	(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=	1349.38	1319.07	1207.36	1018.64	785.2	527.3	348.69	366.16	570.22	857.86	1122.83	1345.62	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	586.07	424.8	311.99	142.57	46.11	0	0	0	0	171.98	401.76	610.09	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2695.36	(98)
Space heating requirement in kWh/m²/year	38.01	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2695.36	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2830.13	(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		1976.99	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2075.84	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.06	(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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		313.93	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5219.91	(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	=	1018.48	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.46	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1043.94	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1043.94	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	162.93	(379)
Total CO2, kg/year	sum of (376)…(382) =				1206.87	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.02	(384)
EI rating (section 14)					86.05	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	55.77	(1a) x	2.6	(2a) =	145	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.77	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.34	(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) =	0.29	(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

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

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

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 4			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Floor			1.71	x	0.13	=	0.2223			(28)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Total area of elements, m²			59.43							(31)
Party wall			11.44	x	0	=	0			(32)
Party wall			23.4	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) = 28.8 (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 8.29 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 37.09 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.13	27.01	26.89	26.31	26.21	25.71	25.71	25.61	25.9	26.21	26.42	26.65	(38)

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

(39)m=	64.22	64.1	63.97	63.4	63.29	62.79	62.79	62.7	62.99	63.29	63.51	63.74	

Average = Sum(39)$_{1...12}$ /12= 63.4 (39)

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

(40)m=	1.15	1.15	1.15	1.14	1.13	1.13	1.13	1.12	1.13	1.13	1.14	1.14	

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 1.86 (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 78.37 (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=	86.21	83.07	79.94	76.8	73.67	70.53	70.53	73.67	76.8	79.94	83.07	86.21	

Total = Sum(44)$_{1...12}$ = 940.45 (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=	127.84	111.81	115.38	100.59	96.52	83.29	77.18	88.57	89.62	104.45	114.01	123.81	

Total = Sum(45)$_{1...12}$ = 1233.08 (45)

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

(46)m=	19.18	16.77	17.31	15.09	14.48	12.49	11.58	13.28	13.44	15.67	17.1	18.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	178.08	157.18	165.61	149.2	146.75	131.9	127.41	138.8	138.24	154.68	162.62	174.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	178.08	157.18	165.61	149.2	146.75	131.9	127.41	138.8	138.24	154.68	162.62	174.04	

Output from water heater (annual)$_{1...12}$ | 1824.52 | (64)

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

(65)m=	82.69	73.47	78.55	72.34	72.28	66.58	65.85	69.63	68.69	74.91	76.8	81.35	(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=	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	(66)

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

(67)m=	14.46	12.84	10.44	7.91	5.91	4.99	5.39	7.01	9.41	11.94	13.94	14.86	(67)

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

(68)m=	162.16	163.85	159.6	150.58	139.18	128.47	121.32	119.63	123.87	132.9	144.3	155.01	(68)

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

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	(71)

Water heating gains (Table 5)

(72)m=	111.15	109.34	105.58	100.47	97.15	92.48	88.51	93.59	95.4	100.69	106.66	109.35	(72)

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

(73)m=	338.66	336.92	326.52	309.85	293.14	276.84	266.11	271.13	279.58	296.43	315.8	330.11	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x 0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x 0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x 0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x 0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x 0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x 0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
North	0.9x 0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
West	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(80)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)
West	0.9x 0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(80)
West	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x 0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(80)
West	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x 0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(80)
West	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x 0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(80)
West	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x 0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(80)
West	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x 0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)

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

(83)m=	92.75	180.54	299.3	446	559.11	578.86	548.36	461.93	350.62	214.37	115.38	76.49	(83)

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

(84)m=	431.41	517.46	625.82	755.84	852.25	855.69	814.47	733.06	630.2	510.8	431.18	406.6	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.84	0.65	0.46	0.34	0.39	0.65	0.92	0.99	1	(86)

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

(87)m=	19.92	20.12	20.44	20.78	20.95	20.99	21	21	20.96	20.68	20.23	19.88	(87)

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

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

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

(89)m=	0.99	0.98	0.94	0.8	0.59	0.39	0.26	0.31	0.57	0.89	0.98	0.99	(89)

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

(90)m=	18.53	18.83	19.28	19.74	19.93	19.98	19.98	19.98	19.95	19.63	18.99	18.48	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	19.11	19.36	19.76	20.17	20.35	20.4	20.4	20.4	20.37	20.07	19.51	19.06	(92)

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

(93)m=	19.11	19.36	19.76	20.17	20.35	20.4	20.4	20.4	20.37	20.07	19.51	19.06	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.81	0.62	0.42	0.29	0.34	0.6	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	426.92	504.9	583.64	612.92	525.34	361.35	238.43	250.25	380.48	456.87	421.72	403.34	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	950.94	927.13	848.44	714.42	547.54	364.02	238.74	250.93	394.92	599.22	787.92	947.17	(97)

DER WorkSheet: New dwelling design stage

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

(98)m=	389.88	283.73	197.02	73.08	16.51	0	0	0	0	105.91	263.66	404.61

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1734.39 (98)

Space heating requirement in kWh/m²/year 31.1 (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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		1734.39	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1821.11	(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		1824.52	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1915.75	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.37	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		255.31	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3992.18	(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)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	775.77	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	19.39	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	795.17	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			795.17	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	132.51	(379)
Total CO2, kg/year	sum of (376)…(382) =			927.67	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.63	(384)
EI rating (section 14)				87.66	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.08	(1a) x	2.6	(2a) =	130.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.08	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.22	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3	(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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

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

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 4			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Total area of elements, m²			57.72							(31)
Party wall			11.44	x	0	=	0			(32)
Party wall			23.4	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) = 28.58 (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 8.22 (36)

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

Total fabric heat loss (33) + (36) = 36.8 (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=	24.64	24.52	24.4	23.83	23.73	23.24	23.24	23.15	23.43	23.73	23.94	24.17	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	61.44	61.32	61.2	60.63	60.53	60.04	60.04	59.95	60.23	60.53	60.74	60.97	

Average = Sum(39)$_{1...12}$ /12= 60.63 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.23	1.22	1.22	1.21	1.21	1.2	1.2	1.2	1.2	1.21	1.21	1.22	

Average = Sum(40)$_{1...12}$ /12= 1.21 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.4 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.84	78.86	75.89	72.91	69.93	66.96	66.96	69.93	72.91	75.89	78.86	81.84	

Total = Sum(44)$_{1...12}$ = 892.78 (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=	121.36	106.14	109.53	95.49	91.63	79.07	73.27	84.08	85.08	99.15	108.23	117.53	

Total = Sum(45)$_{1...12}$ = 1170.57 (45)

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

(46)m=	18.2	15.92	16.43	14.32	13.74	11.86	10.99	12.61	12.76	14.87	16.23	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	

Output from water heater (annual)$_{1...12}$ — 1762.02 — (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=	80.54	71.59	76.61	70.64	70.65	65.18	64.55	68.14	67.18	73.15	74.88	79.27	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	(66)

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

(67)m=	13.15	11.68	9.5	7.19	5.37	4.54	4.9	6.37	8.55	10.86	12.67	13.51	(67)

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

(68)m=	147.45	148.98	145.12	136.92	126.55	116.82	110.31	108.78	112.64	120.84	131.21	140.94	(68)

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

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	(71)

Water heating gains (Table 5)

(72)m=	108.25	106.53	102.96	98.11	94.96	90.53	86.76	91.59	93.3	98.33	104	106.54	(72)

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

(73)m=	317.23	315.58	305.97	290.6	275.28	260.27	250.36	255.13	262.88	278.42	296.26	309.38	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x	0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x	0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x	0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x	0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x	0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x	0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x	0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x	0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x	0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x	0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x	0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)
East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)
East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

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

(83)m=	92.75	180.54	299.3	446	559.11	578.86	548.36	461.93	350.62	214.37	115.38	76.49	(83)

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

(84)m=	409.98	496.12	605.27	736.6	834.39	839.12	798.71	717.05	613.5	492.78	411.64	385.88	(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	0.94	0.83	0.64	0.45	0.33	0.38	0.64	0.91	0.98	0.99	(86)

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

(87)m=	19.85	20.07	20.41	20.77	20.94	20.99	21	21	20.96	20.67	20.19	19.81	(87)

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

(88)m=	19.9	19.9	19.9	19.91	19.91	19.92	19.92	19.92	19.92	19.91	19.91	19.91	(88)

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

(89)m=	0.99	0.98	0.93	0.79	0.58	0.38	0.25	0.29	0.55	0.88	0.98	0.99	(89)

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

(90)m=	18.4	18.72	19.2	19.67	19.87	19.92	19.92	19.92	19.89	19.56	18.89	18.35	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.07	19.34	19.76	20.18	20.36	20.41	20.42	20.42	20.38	20.07	19.49	19.02	(92)

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

(93)m=	19.07	19.34	19.76	20.18	20.36	20.41	20.42	20.42	20.38	20.07	19.49	19.02	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.8	0.6	0.41	0.29	0.33	0.59	0.88	0.97	0.99	(94)

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

(95)m=	404.87	481.96	559.02	586.39	502.26	346.09	228.86	240.08	363.62	435.93	401.13	382.14	(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=	907.67	885.74	811.48	683.76	524.4	348.97	229.24	240.87	378.41	573.21	752.47	903.77	(97)

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

(98)m=	374.08	271.34	187.83	70.1	16.47	0	0	0	0	102.14	252.97	388.09	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1663.03	(98)
Space heating requirement in kWh/m²/year		33.21	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1663.03	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1746.18	(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		1762.02	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1850.12	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	35.96	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		232.15	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3828.44	(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	=	746.59	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.66	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	765.26	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			765.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.49	(379)
Total CO2, kg/year	sum of (376)…(382) =			885.74	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.69	(384)
EI rating (section 14)				87.52	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 7

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.19	(1a) x	2.6	(2a) =	182.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.19	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		182.5	(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				4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (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

DER WorkSheet: New dwelling design stage

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

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

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	0.57	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	0.57	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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 4			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 5			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 6			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Walls Type1	52.65	23.04	29.61	x	0.15	=	4.44			(29)
Walls Type2	10.27	1.99	8.28	x	0.14	=	1.17			(29)
Walls Type3	5.2	0	5.2	x	0.13	=	0.69			(29)
Total area of elements, m²			68.12							(31)
Party wall			16.9	x	0	=	0			(32)
Party wall			21.84	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) = 39.63 (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 9.45 (36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 49.08 (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=	34.81	34.63	34.45	33.61	33.45	32.72	32.72	32.58	33	33.45	33.77	34.1	(38)

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

(39)m=	83.89	83.71	83.53	82.69	82.53	81.8	81.8	81.67	82.08	82.53	82.85	83.18	

Average = Sum(39)$_{1...12}$ /12= 82.69 (39)

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

(40)m=	1.2	1.19	1.19	1.18	1.18	1.17	1.17	1.16	1.17	1.18	1.18	1.19	

Average = Sum(40)$_{1...12}$ /12= 1.18 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.66 (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=	96.42	92.92	89.41	85.9	82.4	78.89	78.89	82.4	85.9	89.41	92.92	96.42	

Total = Sum(44)$_{1...12}$ = 1051.88 (44)

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

(45)m=	142.99	125.06	129.05	112.51	107.96	93.16	86.32	99.06	100.24	116.82	127.52	138.48	

Total = Sum(45)$_{1...12}$ = 1379.18 (45)

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

(46)m=	21.45	18.76	19.36	16.88	16.19	13.97	12.95	14.86	15.04	17.52	19.13	20.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	

Output from water heater (annual)$_{1...12}$ | 1970.62 | (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=	87.73	77.88	83.1	76.3	76.08	69.86	68.89	73.12	72.22	79.03	81.29	86.23	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	(66)

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

(67)m=	17.63	15.66	12.73	9.64	7.21	6.08	6.57	8.55	11.47	14.56	17	18.12	(67)

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

(68)m=	197.75	199.8	194.63	183.62	169.72	156.66	147.94	145.89	151.06	162.07	175.96	189.02	(68)

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

(69)m=	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	(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=	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	(71)

Water heating gains (Table 5)

(72)m=	117.92	115.89	111.69	105.97	102.26	97.03	92.59	98.28	100.31	106.22	112.9	115.9	(72)

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

(73)m=	390.06	388.11	375.81	355.99	335.95	316.54	303.87	309.48	319.59	339.61	362.62	379.8	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	2.16	x	19.64	x	0.76	x	0.7	=	31.28	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	2.16	x	38.42	x	0.76	x	0.7	=	61.19	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	2.16	x	63.27	x	0.76	x	0.7	=	100.77	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	2.16	x	92.28	x	0.76	x	0.7	=	146.97	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	2.16	x	113.09	x	0.76	x	0.7	=	180.12	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	2.16	x	115.77	x	0.76	x	0.7	=	184.39	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	2.16	x	110.22	x	0.76	x	0.7	=	175.54	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)
East	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x 0.77	x	2.16	x	94.68	x	0.76	x	0.7	=	150.79	(76)
East	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x 0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)
East	0.9x 0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x 0.77	x	2.16	x	73.59	x	0.76	x	0.7	=	117.2	(76)
East	0.9x 0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x 0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x 0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x 0.77	x	2.16	x	45.59	x	0.76	x	0.7	=	72.61	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	2.16	x	24.49	x	0.76	x	0.7	=	39	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)
East	0.9x	0.77	x	2.16	x	16.15	x	0.76	x	0.7	=	25.72	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)
South	0.9x	0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.76	x	0.7	=	24.82	(78)
South	0.9x	0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.76	x	0.7	=	40.65	(78)
South	0.9x	0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.76	x	0.7	=	51.78	(78)
South	0.9x	0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.76	x	0.7	=	58.52	(78)
South	0.9x	0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.76	x	0.7	=	60.98	(78)
South	0.9x	0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.76	x	0.7	=	58.69	(78)
South	0.9x	0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.76	x	0.7	=	57.34	(78)
South	0.9x	0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.76	x	0.7	=	55.69	(78)
South	0.9x	0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.76	x	0.7	=	54.09	(78)
South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.76	x	0.7	=	43.84	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.76	x	0.7	=	29.42	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.76	x	0.7	=	21.45	(78)

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

(83)m=	217.21	397.24	601.12	817.22	963.95	973.68	932.13	823.19	677.67	455.99	265.49	182.25	(83)

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

(84)m=	607.26	785.35	976.93	1173.21	1299.9	1290.23	1235.99	1132.67	997.26	795.6	628.11	562.05	(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

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.91	0.76	0.57	0.4	0.29	0.33	0.55	0.86	0.98	0.99	(86)

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

(87)m=	19.94	20.22	20.57	20.85	20.97	21	21	21	20.98	20.77	20.28	19.88	(87)

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

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

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

(89)m=	0.99	0.96	0.88	0.71	0.51	0.34	0.22	0.26	0.47	0.82	0.97	0.99	(89)

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

(90)m=	18.54	18.95	19.42	19.79	19.91	19.95	19.95	19.95	19.93	19.71	19.05	18.47	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

(92)m=	19.23	19.57	19.98	20.31	20.43	20.46	20.46	20.46	20.45	20.23	19.66	19.16	(92)

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

(93)m=	19.23	19.57	19.98	20.31	20.43	20.46	20.46	20.46	20.45	20.23	19.66	19.16	(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	0.88	0.73	0.54	0.37	0.26	0.29	0.51	0.83	0.97	0.99	(94)

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

(95)m=	597.94	750.97	863.1	856.64	702.64	477.27	315.86	331.44	510.8	661.22	606.23	555.76	(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=	1252.35	1228.21	1126.38	943.71	720.62	479.47	316.13	331.96	520.96	794.68	1040.22	1244.77	(97)

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

(98)m=	486.88	320.71	195.88	62.69	13.38	0	0	0	0	99.29	312.47	512.62	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2003.93 (98)

Space heating requirement in kWh/m²/year 28.55 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community 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 1.05 (306)

Space heating	**kWh/year**
Annual space heating requirement	2003.93

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2104.12	(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		1970.62	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2069.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.73	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		311.34	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4484.62	(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	=	866.37	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.66	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	888.03	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				888.03	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	161.58	(379)
Total CO2, kg/year	sum of (376)…(382) =				1049.62	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.95	(384)
EI rating (section 14)					87.79	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 8

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.94	(1a) x	2.6	(2a) =	223.44	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		223.44	(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) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(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) =	0.28	(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

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

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=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 5			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Floor			9.892	x	0.13	=	1.28596			(28)
Walls Type1	59.55	23.04	36.51	x	0.15	=	5.48			(29)
Walls Type2	10.27	1.99	8.28	x	0.14	=	1.19			(29)
Walls Type3	12.22	0	12.22	x	0.13	=	1.61			(29)
Total area of elements, m²			91.94							(31)
Party wall			15.34	x	0	=	0			(32)
Party wall			21.84	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) = 42.9 (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 13.74 (36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 56.64 (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	
(38)m=	41.71	41.52	41.33	40.47	40.31	39.55	39.55	39.41	39.84	40.31	40.63	40.98	(38)

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

(39)m=	98.34	98.15	97.97	97.11	96.94	96.19	96.19	96.05	96.48	96.94	97.27	97.61	

Average = Sum(39)$_{1...12}$ /12= 97.1 (39)

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

(40)m=	1.14	1.14	1.14	1.13	1.13	1.12	1.12	1.12	1.12	1.13	1.13	1.14	

Average = Sum(40)$_{1...12}$ /12= 1.13 (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 2.57 (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 95.14 (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=	104.66	100.85	97.04	93.24	89.43	85.63	85.63	89.43	93.24	97.04	100.85	104.66	

Total = Sum(44)$_{1...12}$ = 1141.69 (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=	155.2	135.74	140.07	122.12	117.17	101.11	93.7	107.52	108.8	126.8	138.41	150.3	

Total = Sum(45)$_{1...12}$ = 1496.94 (45)

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

(46)m=	23.28	20.36	21.01	18.32	17.58	15.17	14.05	16.13	16.32	19.02	20.76	22.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	208.22	183.63	193.09	173.43	170.2	152.42	146.72	160.54	160.11	179.82	189.72	203.33	(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=	208.22	183.63	193.09	173.43	170.2	152.42	146.72	160.54	160.11	179.82	189.72	203.33	

Output from water heater (annual)$_{1...12}$ | 2121.24 | (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=	94.02	83.45	88.99	81.65	81.38	74.67	73.57	78.17	77.23	84.58	87.07	92.39	(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=	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	(66)

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

(67)m=	20.63	18.32	14.9	11.28	8.43	7.12	7.69	10	13.42	17.04	19.89	21.2	(67)

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

(68)m=	231.4	233.8	227.75	214.87	198.61	183.33	173.12	170.72	176.77	189.65	205.91	221.19	(68)

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

(69)m=	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	(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=	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	(71)

Water heating gains (Table 5)

(72)m=	126.37	124.18	119.61	113.41	109.38	103.71	98.89	105.06	107.26	113.68	120.93	124.19	(72)

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

(73)m=	439.9	437.79	423.76	401.05	377.91	355.64	341.19	347.27	358.94	381.86	408.22	428.07	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.76	x	0.7	=	24.82	(78)
South	0.9x	0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.76	x	0.7	=	40.65	(78)
South	0.9x	0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.76	x	0.7	=	51.78	(78)
South	0.9x	0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.76	x	0.7	=	58.52	(78)
South	0.9x	0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.76	x	0.7	=	60.98	(78)
South	0.9x	0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.76	x	0.7	=	58.69	(78)
South	0.9x	0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.76	x	0.7	=	57.34	(78)
South	0.9x	0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.76	x	0.7	=	55.69	(78)
South	0.9x	0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.76	x	0.7	=	54.09	(78)
South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.76	x	0.7	=	43.84	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.76	x	0.7	=	29.42	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.76	x	0.7	=	21.45	(78)
West	0.9x	0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(80)
West	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	52.13	(80)
West	0.9x	0.77	x	2.16	x	19.64	x	0.76	x	0.7	=	31.28	(80)
West	0.9x	0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(80)
West	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	101.99	(80)
West	0.9x	0.77	x	2.16	x	38.42	x	0.76	x	0.7	=	61.19	(80)
West	0.9x	0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(80)
West	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	167.96	(80)
West	0.9x	0.77	x	2.16	x	63.27	x	0.76	x	0.7	=	100.77	(80)
West	0.9x	0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(80)
West	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	244.95	(80)
West	0.9x	0.77	x	2.16	x	92.28	x	0.76	x	0.7	=	146.97	(80)
West	0.9x	0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(80)
West	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	300.2	(80)
West	0.9x	0.77	x	2.16	x	113.09	x	0.76	x	0.7	=	180.12	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	307.31	(80)
West	0.9x	0.77	x	2.16	x	115.77	x	0.76	x	0.7	=	184.39	(80)
West	0.9x	0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	292.57	(80)
West	0.9x	0.77	x	2.16	x	110.22	x	0.76	x	0.7	=	175.54	(80)
West	0.9x	0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	251.31	(80)
West	0.9x	0.77	x	2.16	x	94.68	x	0.76	x	0.7	=	150.79	(80)
West	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	195.34	(80)
West	0.9x	0.77	x	2.16	x	73.59	x	0.76	x	0.7	=	117.2	(80)
West	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	121.01	(80)
West	0.9x	0.77	x	2.16	x	45.59	x	0.76	x	0.7	=	72.61	(80)
West	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	65.01	(80)
West	0.9x	0.77	x	2.16	x	24.49	x	0.76	x	0.7	=	39	(80)
West	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	42.87	(80)
West	0.9x	0.77	x	2.16	x	16.15	x	0.76	x	0.7	=	25.72	(80)

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

(83)m=	217.21	397.24	601.12	817.22	963.95	973.68	932.13	823.19	677.67	455.99	265.49	182.25	(83)

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

(84)m=	657.1	835.03	1024.88	1218.27	1341.86	1329.33	1273.31	1170.46	1036.6	837.85	673.71	610.32	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.33	0.38	0.62	0.9	0.99	1	(86)

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

(87)m=	19.92	20.17	20.5	20.81	20.95	20.99	21	21	20.97	20.72	20.25	19.87	(87)

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

(88)m=	19.96	19.97	19.97	19.98	19.98	19.99	19.99	19.99	19.98	19.98	19.97	19.97	(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	0.54	0.87	0.98	0.99	(89)

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

(90)m=	18.54	18.9	19.37	19.77	19.94	19.98	19.98	19.99	19.96	19.69	19.02	18.48	(90)

fLA = Living area ÷ (4) = 0.45 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	19.16	19.47	19.87	20.24	20.39	20.43	20.44	20.44	20.41	20.15	19.57	19.1	(92)

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

(93)m=	19.16	19.47	19.87	20.24	20.39	20.43	20.44	20.44	20.41	20.15	19.57	19.1	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.79	0.6	0.42	0.29	0.33	0.57	0.87	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	650.63	811.17	941.66	963.48	811.6	557.15	368.64	386.9	591.92	733.02	658.26	605.98	(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=	1460.9	1429.69	1309.9	1100.75	842.56	561.03	369.1	387.78	609.05	925.72	1212.85	1454.14	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	602.84	415.65	273.98	98.83	23.04	0	0	0	0	143.37	399.3	631.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2588.04	(98)
Space heating requirement in kWh/m²/year	30.12	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2588.04	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2717.44	(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		2121.24	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2227.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.45	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		364.33	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5309.07	(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	=	1026.53	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.66	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1052.19	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1052.19	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	189.09	(379)
Total CO2, kg/year	sum of (376)…(382) =				1241.28	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.44	(384)
EI rating (section 14)					87.3	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 9

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	55.77	(1a) x	2.6	(2a) =	145	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.77	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.34	(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) =	0.29	(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

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	0.29	0.31	0.32	0.34

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

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 4			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Roof	17.4	0	17.4	x	0.13	=	2.26			(30)
Total area of elements, m²			75.12							(31)
Party wall			11.44	x	0	=	0			(32)
Party wall			23.4	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) = 30.84 (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 11.99 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 42.83 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.13	27.01	26.89	26.31	26.21	25.71	25.71	25.61	25.9	26.21	26.42	26.65	(38)

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

(39)m=	69.96	69.84	69.71	69.14	69.03	68.53	68.53	68.44	68.72	69.03	69.25	69.48	

Average = Sum(39)$_{1...12}$ /12= 69.14 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.24 (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 1.86 (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 78.37 (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=	86.21	83.07	79.94	76.8	73.67	70.53	70.53	73.67	76.8	79.94	83.07	86.21	

Total = Sum(44)$_{1...12}$ = 940.45 (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=	127.84	111.81	115.38	100.59	96.52	83.29	77.18	88.57	89.62	104.45	114.01	123.81	

Total = Sum(45)$_{1...12}$ = 1233.08 (45)

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

(46)m=	19.18	16.77	17.31	15.09	14.48	12.49	11.58	13.28	13.44	15.67	17.1	18.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	178.08	157.18	165.61	149.2	146.75	131.9	127.41	138.8	138.24	154.68	162.62	174.04	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	178.08	157.18	165.61	149.2	146.75	131.9	127.41	138.8	138.24	154.68	162.62	174.04	

Output from water heater (annual)$_{1...12}$ | 1824.52 | (64)

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

(65)m=	82.69	73.47	78.55	72.34	72.28	66.58	65.85	69.63	68.69	74.91	76.8	81.35	(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=	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	92.99	(66)

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

(67)m=	14.46	12.84	10.44	7.91	5.91	4.99	5.39	7.01	9.41	11.94	13.94	14.86	(67)

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

(68)m=	162.16	163.85	159.6	150.58	139.18	128.47	121.32	119.63	123.87	132.9	144.3	155.01	(68)

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

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	-74.39	(71)

Water heating gains (Table 5)

(72)m=	111.15	109.34	105.58	100.47	97.15	92.48	88.51	93.59	95.4	100.69	106.66	109.35	(72)

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

(73)m=	338.66	336.92	326.52	309.85	293.14	276.84	266.11	271.13	279.58	296.43	315.8	330.11	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x 0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x 0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x 0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x 0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x 0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x 0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
North	0.9x 0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
West	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(80)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)
West	0.9x 0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(80)
West	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x 0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(80)
West	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x 0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(80)
West	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x 0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(80)
West	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x 0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(80)
West	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x 0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)

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

(83)m=	92.75	180.54	299.3	446	559.11	578.86	548.36	461.93	350.62	214.37	115.38	76.49	(83)

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

(84)m=	431.41	517.46	625.82	755.84	852.25	855.69	814.47	733.06	630.2	510.8	431.18	406.6	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.86	0.69	0.5	0.37	0.43	0.69	0.93	0.99	1	(86)

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

(87)m=	19.78	19.98	20.32	20.7	20.91	20.99	21	20.99	20.94	20.6	20.11	19.74	(87)

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

(88)m=	19.88	19.88	19.88	19.89	19.89	19.9	19.9	19.9	19.89	19.89	19.89	19.88	(88)

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

(89)m=	0.99	0.98	0.94	0.83	0.63	0.42	0.28	0.33	0.6	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=	18.27	18.57	19.05	19.56	19.82	19.89	19.9	19.9	19.85	19.46	18.77	18.22	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	18.9	19.16	19.58	20.03	20.27	20.34	20.35	20.35	20.3	19.93	19.32	18.85	(92)

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

(93)m=	18.9	19.16	19.58	20.03	20.27	20.34	20.35	20.35	20.3	19.93	19.32	18.85	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.83	0.65	0.45	0.31	0.37	0.64	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	427	505.69	587.95	629.65	555.15	388.29	256.46	269	402.21	462.93	422.28	403.36	(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=	1021.29	995.81	911.65	769.74	591.75	393.59	257.18	270.47	426.2	644.07	846.5	1017.87	(97)

DER WorkSheet: New dwelling design stage

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

(98)m=	442.15	329.36	240.83	100.86	27.23	0	0	0	0	134.77	305.44	457.19

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2037.83 (98)

Space heating requirement in kWh/m²/year 36.54 (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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		2037.83	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2139.73	(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 1824.52

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 1915.75 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 40.55 (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 0 (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) = 0 (331)

Energy for lighting (calculated in Appendix L) 255.31 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 4310.79 (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		250	(367a)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	841.92	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	21.05	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	862.96	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			862.96	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	132.51	(379)
Total CO2, kg/year	sum of (376)…(382) =			995.47	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.85	(384)
EI rating (section 14)				86.76	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.08	(1a) x	2.6	(2a) =	130.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.08	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.22	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3	(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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

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

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Windows Type 4			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Roof	17.4	0	17.4	x	0.13	=	2.26			(30)
Total area of elements, m²			75.12							(31)
Party wall			11.44	x	0	=	0			(32)
Party wall			23.4	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) = 30.84 (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 12.73 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 43.57 (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=	24.64	24.52	24.4	23.83	23.73	23.24	23.24	23.15	23.43	23.73	23.94	24.17	(38)

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

(39)m=	68.21	68.09	67.97	67.4	67.3	66.8	66.8	66.71	66.99	67.3	67.51	67.73	

Average = Sum(39)$_{1...12}$ /12= 67.4 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.35 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.4 (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=	81.84	78.86	75.89	72.91	69.93	66.96	66.96	69.93	72.91	75.89	78.86	81.84	

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

Total = Sum(44)$_{1...12}$ = 892.78 (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=	121.36	106.14	109.53	95.49	91.63	79.07	73.27	84.08	85.08	99.15	108.23	117.53	

Total = Sum(45)$_{1...12}$ = 1170.57 (45)

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

(46)m=	18.2	15.92	16.43	14.32	13.74	11.86	10.99	12.61	12.76	14.87	16.23	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	

Output from water heater (annual)$_{1...12}$ | 1762.02 | (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=	80.54	71.59	76.61	70.64	70.65	65.18	64.55	68.14	67.18	73.15	74.88	79.27	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	(66)

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

(67)m=	13.15	11.68	9.5	7.19	5.37	4.54	4.9	6.37	8.55	10.86	12.67	13.51	(67)

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

(68)m=	147.45	148.98	145.12	136.92	126.55	116.82	110.31	108.78	112.64	120.84	131.21	140.94	(68)

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

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	(71)

Water heating gains (Table 5)

(72)m=	108.25	106.53	102.96	98.11	94.96	90.53	86.76	91.59	93.3	98.33	104	106.54	(72)

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

(73)m=	317.23	315.58	305.97	290.6	275.28	260.27	250.36	255.13	262.88	278.42	296.26	309.38	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x 0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x 0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x 0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x 0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x 0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x 0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
North	0.9x 0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

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

(83)m=	92.75	180.54	299.3	446	559.11	578.86	548.36	461.93	350.62	214.37	115.38	76.49	(83)

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

(84)m=	409.98	496.12	605.27	736.6	834.39	839.12	798.71	717.05	613.5	492.78	411.64	385.88	(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	0.86	0.68	0.5	0.37	0.42	0.69	0.93	0.99	0.99	(86)

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

(87)m=	19.68	19.9	20.26	20.66	20.9	20.98	21	20.99	20.93	20.56	20.04	19.64	(87)

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

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

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

(89)m=	0.99	0.98	0.94	0.82	0.62	0.41	0.27	0.32	0.59	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=	18.07	18.39	18.9	19.45	19.72	19.8	19.81	19.81	19.76	19.33	18.6	18.02	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	18.81	19.09	19.53	20.01	20.27	20.35	20.36	20.36	20.3	19.9	19.26	18.76	(92)

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

(93)m=	18.81	19.09	19.53	20.01	20.27	20.35	20.36	20.36	20.3	19.9	19.26	18.76	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.82	0.64	0.45	0.31	0.37	0.63	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	404.97	482.95	564.31	606.09	536.75	377.54	250.17	262.14	388.58	443.06	401.81	382.16	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	989.96	966.16	885.63	748.82	576.49	383.95	251.15	264.05	415.29	625.88	821.08	986.46	(97)

DER WorkSheet: New dwelling design stage

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

(98)m=	435.23	324.72	239.06	102.76	29.57	0	0	0	0	136.02	301.88	449.6

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2018.84 (98)

Space heating requirement in kWh/m²/year 40.31 (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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		2018.84	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2119.78	(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 1762.02

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 1850.12 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 39.7 (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 0 (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) = 0 (331)

Energy for lighting (calculated in Appendix L) 232.15 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 4202.05 (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)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	824.15	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	20.6	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	844.75	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			844.75	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.49	(379)
Total CO2, kg/year	sum of (376)…(382) =			965.24	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			19.27	(384)
EI rating (section 14)				86.4	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.19	(1a) x	2.6	(2a) =	182.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.19	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		182.5	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36	(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

DER WorkSheet: New dwelling design stage

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

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

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	0.57	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	0.57	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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 4			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 5			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 6			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Walls Type1	52.65	23.04	29.61	x	0.15	=	4.44			(29)
Walls Type2	10.27	1.99	8.28	x	0.14	=	1.17			(29)
Walls Type3	5.2	0	5.2	x	0.13	=	0.69			(29)
Roof	25.7	0	25.7	x	0.13	=	3.34			(30)
Total area of elements, m²			93.82							(31)
Party wall			16.9	x	0	=	0			(32)
Party wall			21.84	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) = 42.97 (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 — 17.32 (36)

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

Total fabric heat loss (33) + (36) = — 60.29 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.81	34.63	34.45	33.61	33.45	32.72	32.72	32.58	33	33.45	33.77	34.1	(38)

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

(39)m=	95.1	94.91	94.74	93.9	93.74	93.01	93.01	92.87	93.29	93.74	94.06	94.39	

Average = Sum(39)$_{1...12}$ /12= 93.9 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.34 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.25 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 87.66 (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=	96.42	92.92	89.41	85.9	82.4	78.89	78.89	82.4	85.9	89.41	92.92	96.42	

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

Total = Sum(44)$_{1...12}$ = 1051.88 (44)

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

(45)m=	142.99	125.06	129.05	112.51	107.96	93.16	86.32	99.06	100.24	116.82	127.52	138.48	

Total = Sum(45)$_{1...12}$ = 1379.18 (45)

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

(46)m=	21.45	18.76	19.36	16.88	16.19	13.97	12.95	14.86	15.04	17.52	19.13	20.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 170 (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): — 1.45 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.87 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)	0.87	(55)

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	

Output from water heater (annual)$_{1...12}$ 1970.62 (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=	87.73	77.88	83.1	76.3	76.08	69.86	68.89	73.12	72.22	79.03	81.29	86.23	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	(66)

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

(67)m=	17.63	15.66	12.73	9.64	7.21	6.08	6.57	8.55	11.47	14.56	17	18.12	(67)

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

(68)m=	197.75	199.8	194.63	183.62	169.72	156.66	147.94	145.89	151.06	162.07	175.96	189.02	(68)

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

(69)m=	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	(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=	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	(71)

Water heating gains (Table 5)

(72)m=	117.92	115.89	111.69	105.97	102.26	97.03	92.59	98.28	100.31	106.22	112.9	115.9	(72)

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

(73)m=	390.06	388.11	375.81	355.99	335.95	316.54	303.87	309.48	319.59	339.61	362.62	379.8	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	2.16	x	19.64	x	0.76	x	0.7	=	31.28	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	2.16	x	38.42	x	0.76	x	0.7	=	61.19	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	2.16	x	63.27	x	0.76	x	0.7	=	100.77	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	2.16	x	92.28	x	0.76	x	0.7	=	146.97	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	2.16	x	113.09	x	0.76	x	0.7	=	180.12	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	2.16	x	115.77	x	0.76	x	0.7	=	184.39	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	2.16	x	110.22	x	0.76	x	0.7	=	175.54	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)
East	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x 0.77	x	2.16	x	94.68	x	0.76	x	0.7	=	150.79	(76)
East	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x 0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)
East	0.9x 0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x 0.77	x	2.16	x	73.59	x	0.76	x	0.7	=	117.2	(76)
East	0.9x 0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x 0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x 0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x 0.77	x	2.16	x	45.59	x	0.76	x	0.7	=	72.61	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	2.16	x	24.49	x	0.76	x	0.7	=	39	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)
East	0.9x	0.77	x	2.16	x	16.15	x	0.76	x	0.7	=	25.72	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)
South	0.9x	0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.76	x	0.7	=	24.82	(78)
South	0.9x	0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.76	x	0.7	=	40.65	(78)
South	0.9x	0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.76	x	0.7	=	51.78	(78)
South	0.9x	0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.76	x	0.7	=	58.52	(78)
South	0.9x	0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.76	x	0.7	=	60.98	(78)
South	0.9x	0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.76	x	0.7	=	58.69	(78)
South	0.9x	0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.76	x	0.7	=	57.34	(78)
South	0.9x	0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.76	x	0.7	=	55.69	(78)
South	0.9x	0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.76	x	0.7	=	54.09	(78)
South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.76	x	0.7	=	43.84	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.76	x	0.7	=	29.42	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.76	x	0.7	=	21.45	(78)

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

(83)m=	217.21	397.24	601.12	817.22	963.95	973.68	932.13	823.19	677.67	455.99	265.49	182.25	(83)

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

(84)m=	607.26	785.35	976.93	1173.21	1299.9	1290.23	1235.99	1132.67	997.26	795.6	628.11	562.05	(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

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.97	0.92	0.8	0.63	0.45	0.33	0.37	0.61	0.89	0.98	0.99	(86)

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

(87)m=	19.73	20.01	20.39	20.75	20.93	20.99	21	21	20.95	20.65	20.11	19.67	(87)

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

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

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

(89)m=	0.99	0.97	0.9	0.76	0.56	0.37	0.24	0.28	0.52	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=	18.15	18.56	19.09	19.55	19.76	19.81	19.82	19.82	19.79	19.46	18.7	18.07	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

(92)m=	18.92	19.28	19.73	20.14	20.33	20.39	20.4	20.4	20.36	20.05	19.39	18.86	(92)

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

(93)m=	18.92	19.28	19.73	20.14	20.33	20.39	20.4	20.4	20.36	20.05	19.39	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	0.96	0.9	0.77	0.59	0.41	0.29	0.33	0.56	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	598.36	754.88	880.56	904.89	769.47	532.34	352.44	369.7	560.92	682.54	608.47	555.91	(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=	1390.73	1364.44	1253.23	1055.58	809.22	538.58	353.35	371.36	584.15	885.38	1156.12	1383.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	589.52	409.62	277.27	108.49	29.57	0	0	0	0	150.91	394.31	615.85	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2575.55 (98)

Space heating requirement in kWh/m²/year 36.69 (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 1.05 (306)

Space heating	**kWh/year**
Annual space heating requirement	2575.55

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2704.33	(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		1970.62	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2069.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.73	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		311.34	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5084.82	(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	=	990.97	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.77	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1015.75	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1015.75	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	161.58	(379)
Total CO2, kg/year	sum of (376)…(382) =				1177.33	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.77	(384)
EI rating (section 14)					86.3	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	85.94	(1a) x	2.6	(2a) =	223.44	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	85.94	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		223.44	(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) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.33	(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) =	0.28	(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

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

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=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 5			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Walls Type1	59.55	23.04	36.51	x	0.15	=	5.48			(29)
Walls Type2	10.27	1.99	8.28	x	0.14	=	1.19			(29)
Walls Type3	12.22	0	12.22	x	0.13	=	1.61			(29)
Roof	30.85	0	30.85	x	0.13	=	4.01			(30)
Total area of elements, m²			112.9							(31)
Party wall			15.34	x	0	=	0			(32)
Party wall			21.84	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) = 45.63 (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 18.75 (36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 64.38 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.71	41.52	41.33	40.47	40.31	39.55	39.55	39.41	39.84	40.31	40.63	40.98	(38)

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

(39)m=	106.08	105.89	105.71	104.84	104.68	103.93	103.93	103.79	104.22	104.68	105.01	105.35	

Average = Sum(39)$_{1...12}$ /12= 104.84 (39)

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

(40)m=	1.23	1.23	1.23	1.22	1.22	1.21	1.21	1.21	1.21	1.22	1.22	1.23	

Average = Sum(40)$_{1...12}$ /12= 1.22 (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 2.57 (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 95.14 (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=	104.66	100.85	97.04	93.24	89.43	85.63	85.63	89.43	93.24	97.04	100.85	104.66	

Total = Sum(44)$_{1...12}$ = 1141.69 (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=	155.2	135.74	140.07	122.12	117.17	101.11	93.7	107.52	108.8	126.8	138.41	150.3	

Total = Sum(45)$_{1...12}$ = 1496.94 (45)

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

(46)m=	23.28	20.36	21.01	18.32	17.58	15.17	14.05	16.13	16.32	19.02	20.76	22.55	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	208.22	183.63	193.09	173.43	170.2	152.42	146.72	160.54	160.11	179.82	189.72	203.33	(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=	208.22	183.63	193.09	173.43	170.2	152.42	146.72	160.54	160.11	179.82	189.72	203.33	

Output from water heater (annual)$_{1...12}$ | 2121.24 | (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=	94.02	83.45	88.99	81.65	81.38	74.67	73.57	78.17	77.23	84.58	87.07	92.39	(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=	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	128.3	(66)

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

(67)m=	20.63	18.32	14.9	11.28	8.43	7.12	7.69	10	13.42	17.04	19.89	21.2	(67)

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

(68)m=	231.4	233.8	227.75	214.87	198.61	183.33	173.12	170.72	176.77	189.65	205.91	221.19	(68)

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

(69)m=	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	35.83	(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=	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	-102.64	(71)

Water heating gains (Table 5)

(72)m=	126.37	124.18	119.61	113.41	109.38	103.71	98.89	105.06	107.26	113.68	120.93	124.19	(72)

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

(73)m=	439.9	437.79	423.76	401.05	377.91	355.64	341.19	347.27	358.94	381.86	408.22	428.07	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	1.44	x	46.75	x	0.76	x	0.7	=	24.82	(78)
South	0.9x	0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	1.44	x	76.57	x	0.76	x	0.7	=	40.65	(78)
South	0.9x	0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	1.44	x	97.53	x	0.76	x	0.7	=	51.78	(78)
South	0.9x	0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	1.44	x	110.23	x	0.76	x	0.7	=	58.52	(78)
South	0.9x	0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	1.44	x	114.87	x	0.76	x	0.7	=	60.98	(78)
South	0.9x	0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	1.44	x	110.55	x	0.76	x	0.7	=	58.69	(78)
South	0.9x	0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	1.44	x	108.01	x	0.76	x	0.7	=	57.34	(78)
South	0.9x	0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	1.44	x	104.89	x	0.76	x	0.7	=	55.69	(78)
South	0.9x	0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	1.44	x	101.89	x	0.76	x	0.7	=	54.09	(78)
South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	1.44	x	82.59	x	0.76	x	0.7	=	43.84	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	1.44	x	55.42	x	0.76	x	0.7	=	29.42	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	1.44	x	40.4	x	0.76	x	0.7	=	21.45	(78)
West	0.9x	0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(80)
West	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	52.13	(80)
West	0.9x	0.77	x	2.16	x	19.64	x	0.76	x	0.7	=	31.28	(80)
West	0.9x	0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(80)
West	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	101.99	(80)
West	0.9x	0.77	x	2.16	x	38.42	x	0.76	x	0.7	=	61.19	(80)
West	0.9x	0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(80)
West	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	167.96	(80)
West	0.9x	0.77	x	2.16	x	63.27	x	0.76	x	0.7	=	100.77	(80)
West	0.9x	0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(80)
West	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	244.95	(80)
West	0.9x	0.77	x	2.16	x	92.28	x	0.76	x	0.7	=	146.97	(80)
West	0.9x	0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(80)
West	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	300.2	(80)
West	0.9x	0.77	x	2.16	x	113.09	x	0.76	x	0.7	=	180.12	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	307.31	(80)
West	0.9x	0.77	x	2.16	x	115.77	x	0.76	x	0.7	=	184.39	(80)
West	0.9x	0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	292.57	(80)
West	0.9x	0.77	x	2.16	x	110.22	x	0.76	x	0.7	=	175.54	(80)
West	0.9x	0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	251.31	(80)
West	0.9x	0.77	x	2.16	x	94.68	x	0.76	x	0.7	=	150.79	(80)
West	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	195.34	(80)
West	0.9x	0.77	x	2.16	x	73.59	x	0.76	x	0.7	=	117.2	(80)
West	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	121.01	(80)
West	0.9x	0.77	x	2.16	x	45.59	x	0.76	x	0.7	=	72.61	(80)
West	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	65.01	(80)
West	0.9x	0.77	x	2.16	x	24.49	x	0.76	x	0.7	=	39	(80)
West	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	42.87	(80)
West	0.9x	0.77	x	2.16	x	16.15	x	0.76	x	0.7	=	25.72	(80)

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

(83)m=	217.21	397.24	601.12	817.22	963.95	973.68	932.13	823.19	677.67	455.99	265.49	182.25	(83)

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

(84)m=	657.1	835.03	1024.88	1218.27	1341.86	1329.33	1273.31	1170.46	1036.6	837.85	673.71	610.32	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.84	0.67	0.49	0.36	0.4	0.65	0.92	0.99	1	(86)

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

(87)m=	19.8	20.05	20.39	20.74	20.93	20.99	21	21	20.95	20.65	20.14	19.75	(87)

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

(88)m=	19.89	19.89	19.9	19.9	19.91	19.91	19.91	19.91	19.91	19.91	19.9	19.9	(88)

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

(89)m=	0.99	0.98	0.93	0.8	0.61	0.41	0.27	0.31	0.57	0.88	0.98	0.99	(89)

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

(90)m=	18.31	18.68	19.17	19.63	19.84	19.91	19.91	19.91	19.88	19.54	18.82	18.25	(90)

fLA = Living area ÷ (4) = 0.45 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.97	19.29	19.71	20.12	20.33	20.39	20.4	20.4	20.36	20.03	19.41	18.92	(92)

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

(93)m=	18.97	19.29	19.71	20.12	20.33	20.39	20.4	20.4	20.36	20.03	19.41	18.92	(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	0.81	0.64	0.45	0.31	0.35	0.6	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	650.75	812.74	949.84	990.23	854.02	594.29	393.59	412.94	624.39	744.01	659.14	605.99	(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=	1556.73	1523.66	1396.77	1176.85	903.07	601.52	394.54	414.72	652.22	987.62	1292.85	1550.37	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	674.05	477.74	332.52	134.37	36.49	0	0	0	0	181.24	456.27	702.62	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2995.3	(98)
Space heating requirement in kWh/m²/year	34.85	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2995.3	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3145.07	(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		2121.24	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2227.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.72	(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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		364.33	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5736.69	(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	=	1115.3	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	27.88	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1143.19	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1143.19	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	189.09	(379)
Total CO2, kg/year	sum of (376)…(382) =				1332.27	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.5	(384)
EI rating (section 14)					86.37	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 13

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	87.79	(1a) x	2.6	(2a) =	228.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.79	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		228.24	(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) =	0.13 (8)

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

Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.33 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used		
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31 (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

DER WorkSheet: New dwelling design stage

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

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.34	0.36

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	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

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

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			7.2	x	1/[1/(1.4)+ 0.04]	=	9.55			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			1.8	x	1/[1/(1.4)+ 0.04]	=	2.39			(27)
Windows Type 4			7.2	x	1/[1/(1.4)+ 0.04]	=	9.55			(27)
Windows Type 5			7.2	x	1/[1/(1.4)+ 0.04]	=	9.55			(27)
Walls Type1	75.02	32.4	42.62	x	0.15	=	6.39			(29)
Walls Type2	5.85	1.99	3.86	x	0.14	=	0.55			(29)
Walls Type3	28.47	0	28.47	x	0.13	=	3.76			(29)
Roof	87.79	0	87.79	x	0.13	=	11.41			(30)
Total area of elements, m²			197.12							(31)
Party wall			16.32	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) = 67.85 (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 23.13 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 90.99 (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=	43.41	43.19	42.97	41.94	41.75	40.85	40.85	40.69	41.2	41.75	42.14	42.55	(38)

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

(39)m=	134.4	134.18	133.96	132.93	132.74	131.84	131.84	131.67	132.18	132.74	133.13	133.53	

Average = Sum(39)$_{1...12}$ /12= 132.93 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.51 (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 2.59 (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 95.81 (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=	105.39	101.56	97.73	93.9	90.06	86.23	86.23	90.06	93.9	97.73	101.56	105.39	

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

Total = Sum(44)$_{1...12}$ = 1149.74 (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=	156.29	136.7	141.06	122.98	118	101.83	94.36	108.27	109.57	127.69	139.38	151.36	

Total = Sum(45)$_{1...12}$ = 1507.49 (45)

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

(46)m=	23.44	20.5	21.16	18.45	17.7	15.27	14.15	16.24	16.44	19.15	20.91	22.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	209.32	184.59	194.08	174.29	171.02	153.14	147.38	161.3	160.88	180.71	190.7	204.39	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	209.32	184.59	194.08	174.29	171.02	153.14	147.38	161.3	160.88	180.71	190.7	204.39	

Output from water heater (annual)$_{1...12}$ | 2131.79 | (64)

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

(65)m=	94.39	83.76	89.32	81.94	81.65	74.91	73.79	78.42	77.48	84.88	87.4	92.75	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	(66)

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

(67)m=	20.95	18.6	15.13	11.45	8.56	7.23	7.81	10.15	13.63	17.3	20.19	21.53	(67)

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

(68)m=	234.94	237.38	231.24	218.16	201.65	186.13	175.77	173.33	179.47	192.55	209.06	224.58	(68)

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

(69)m=	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	(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=	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	(71)

Water heating gains (Table 5)

(72)m=	126.86	124.65	120.05	113.81	109.75	104.04	99.18	105.4	107.61	114.08	121.38	124.66	(72)

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

(73)m=	444.66	442.55	428.33	405.33	381.87	359.31	344.67	350.79	362.62	385.84	412.55	432.68	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	7.2	x	10.63	x	0.76	x	0.7	=	28.23	(74)
North	0.9x 0.77	x	7.2	x	20.32	x	0.76	x	0.7	=	53.94	(74)
North	0.9x 0.77	x	7.2	x	34.53	x	0.76	x	0.7	=	91.66	(74)
North	0.9x 0.77	x	7.2	x	55.46	x	0.76	x	0.7	=	147.23	(74)
North	0.9x 0.77	x	7.2	x	74.72	x	0.76	x	0.7	=	198.33	(74)
North	0.9x 0.77	x	7.2	x	79.99	x	0.76	x	0.7	=	212.32	(74)
North	0.9x 0.77	x	7.2	x	74.68	x	0.76	x	0.7	=	198.23	(74)
North	0.9x 0.77	x	7.2	x	59.25	x	0.76	x	0.7	=	157.27	(74)
North	0.9x 0.77	x	7.2	x	41.52	x	0.76	x	0.7	=	110.2	(74)
North	0.9x 0.77	x	7.2	x	24.19	x	0.76	x	0.7	=	64.21	(74)
North	0.9x 0.77	x	7.2	x	13.12	x	0.76	x	0.7	=	34.82	(74)
North	0.9x 0.77	x	7.2	x	8.86	x	0.76	x	0.7	=	23.53	(74)
South	0.9x 0.77	x	7.2	x	46.75	x	0.76	x	0.7	=	124.1	(78)
South	0.9x 0.77	x	7.2	x	76.57	x	0.76	x	0.7	=	203.25	(78)
South	0.9x 0.77	x	7.2	x	97.53	x	0.76	x	0.7	=	258.9	(78)
South	0.9x 0.77	x	7.2	x	110.23	x	0.76	x	0.7	=	292.61	(78)
South	0.9x 0.77	x	7.2	x	114.87	x	0.76	x	0.7	=	304.92	(78)
South	0.9x 0.77	x	7.2	x	110.55	x	0.76	x	0.7	=	293.45	(78)
South	0.9x 0.77	x	7.2	x	108.01	x	0.76	x	0.7	=	286.71	(78)
South	0.9x 0.77	x	7.2	x	104.89	x	0.76	x	0.7	=	278.44	(78)
South	0.9x 0.77	x	7.2	x	101.89	x	0.76	x	0.7	=	270.45	(78)
South	0.9x 0.77	x	7.2	x	82.59	x	0.76	x	0.7	=	219.22	(78)
South	0.9x 0.77	x	7.2	x	55.42	x	0.76	x	0.7	=	147.1	(78)
South	0.9x 0.77	x	7.2	x	40.4	x	0.76	x	0.7	=	107.24	(78)
West	0.9x 0.77	x	7.2	x	19.64	x	0.76	x	0.7	=	52.13	(80)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	52.13	(80)
West	0.9x 0.77	x	1.8	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	7.2	x	38.42	x	0.76	x	0.7	=	101.99	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	101.99	(80)
West	0.9x 0.77	x	1.8	x	38.42	x	0.76	x	0.7	=	50.99	(80)
West	0.9x 0.77	x	7.2	x	63.27	x	0.76	x	0.7	=	167.96	(80)
West	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	167.96	(80)
West	0.9x 0.77	x	1.8	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x 0.77	x	7.2	x	92.28	x	0.76	x	0.7	=	244.95	(80)
West	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	244.95	(80)
West	0.9x 0.77	x	1.8	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x 0.77	x	7.2	x	113.09	x	0.76	x	0.7	=	300.2	(80)
West	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	300.2	(80)
West	0.9x 0.77	x	1.8	x	113.09	x	0.76	x	0.7	=	150.1	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	7.2	x	115.77	x	0.76	x	0.7	=	307.31	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	307.31	(80)
West	0.9x	0.77	x	1.8	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x	0.77	x	7.2	x	110.22	x	0.76	x	0.7	=	292.57	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	292.57	(80)
West	0.9x	0.77	x	1.8	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x	0.77	x	7.2	x	94.68	x	0.76	x	0.7	=	251.31	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	251.31	(80)
West	0.9x	0.77	x	1.8	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	7.2	x	73.59	x	0.76	x	0.7	=	195.34	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	195.34	(80)
West	0.9x	0.77	x	1.8	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	7.2	x	45.59	x	0.76	x	0.7	=	121.01	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	121.01	(80)
West	0.9x	0.77	x	1.8	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	7.2	x	24.49	x	0.76	x	0.7	=	65.01	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	65.01	(80)
West	0.9x	0.77	x	1.8	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	7.2	x	16.15	x	0.76	x	0.7	=	42.87	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	42.87	(80)
West	0.9x	0.77	x	1.8	x	16.15	x	0.76	x	0.7	=	21.44	(80)

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

(83)m=	282.66	512.15	770.45	1052.23	1253.75	1274.04	1216.37	1063.99	869.01	585.97	344.44	237.95	(83)

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

(84)m=	727.33	954.7	1198.78	1457.56	1635.63	1633.35	1561.04	1414.79	1231.63	971.81	756.99	670.62	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.68	0.5	0.37	0.42	0.67	0.91	0.98	0.99	(86)

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

(87)m=	19.48	19.77	20.18	20.61	20.87	20.97	20.99	20.99	20.91	20.51	19.89	19.42	(87)

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

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

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

(89)m=	0.99	0.97	0.92	0.8	0.6	0.4	0.26	0.3	0.57	0.88	0.98	0.99	(89)

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

(90)m=	17.69	18.12	18.7	19.28	19.57	19.67	19.68	19.68	19.62	19.16	18.3	17.62	(90)

fLA = Living area ÷ (4) = 0.4 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.41	18.79	19.3	19.81	20.1	20.19	20.21	20.21	20.14	19.7	18.94	18.34	(92)

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

(93)m=	18.41	18.79	19.3	19.81	20.1	20.19	20.21	20.21	20.14	19.7	18.94	18.34	(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	0.91	0.8	0.63	0.44	0.3	0.35	0.6	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	717.77	922.1	1096.78	1166.63	1027.19	721.51	473.51	496.89	744.63	854.25	736.36	664.01	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1896.6	1863.27	1714.34	1450.8	1114.45	737.54	476.12	501.59	798.72	1208.29	1576.53	1888.51	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	877.05	632.47	459.47	204.6	64.92	0	0	0	0	263.4	604.92	911.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4017.86 (98)

Space heating requirement in kWh/m²/year 45.77 (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 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 4017.86

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 4218.75 (307a)

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

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

Water heating

Annual water heating requirement 2131.79

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 2238.37 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 64.57 (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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		369.9	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		6827.03	(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	=	1340.5	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	33.51	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1374.01	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1374.01	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	191.98	(379)
Total CO2, kg/year	sum of (376)…(382) =				1565.99	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.84	(384)
EI rating (section 14)					84.2	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 2 - Flat 14

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	87.79	(1a) x	2.6	(2a) =	228.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.79	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		228.24	(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) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(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

DER WorkSheet: New dwelling design stage

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

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.34	0.36

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	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

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

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			7.2	x	1/[1/(1.4)+ 0.04]	=	9.55			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			1.8	x	1/[1/(1.4)+ 0.04]	=	2.39			(27)
Windows Type 4			7.2	x	1/[1/(1.4)+ 0.04]	=	9.55			(27)
Windows Type 5			7.2	x	1/[1/(1.4)+ 0.04]	=	9.55			(27)
Walls Type1	75.02	32.4	42.62	x	0.15	=	6.39			(29)
Walls Type2	5.85	1.99	3.86	x	0.14	=	0.55			(29)
Walls Type3	28.47	0	28.47	x	0.13	=	3.76			(29)
Roof	87.79	0	87.79	x	0.13	=	11.41			(30)
Total area of elements, m²			197.12							(31)
Party wall			16.32	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) = 67.85 (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 23.13 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 90.99 (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=	43.41	43.19	42.97	41.94	41.75	40.85	40.85	40.69	41.2	41.75	42.14	42.55	(38)

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

(39)m=	134.4	134.18	133.96	132.93	132.74	131.84	131.84	131.67	132.18	132.74	133.13	133.53	

Average = Sum(39)$_{1...12}$ /12= 132.93 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.51 (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 2.59 (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 95.81 (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=	105.39	101.56	97.73	93.9	90.06	86.23	86.23	90.06	93.9	97.73	101.56	105.39	

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

Total = Sum(44)$_{1...12}$ = 1149.74 (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=	156.29	136.7	141.06	122.98	118	101.83	94.36	108.27	109.57	127.69	139.38	151.36	

Total = Sum(45)$_{1...12}$ = 1507.49 (45)

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

(46)m=	23.44	20.5	21.16	18.45	17.7	15.27	14.15	16.24	16.44	19.15	20.91	22.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	209.32	184.59	194.08	174.29	171.02	153.14	147.38	161.3	160.88	180.71	190.7	204.39	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	209.32	184.59	194.08	174.29	171.02	153.14	147.38	161.3	160.88	180.71	190.7	204.39	

Output from water heater (annual)$_{1...12}$ | 2131.79 | (64)

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

(65)m=	94.39	83.76	89.32	81.94	81.65	74.91	73.79	78.42	77.48	84.88	87.4	92.75	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	(66)

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

(67)m=	20.95	18.6	15.13	11.45	8.56	7.23	7.81	10.15	13.63	17.3	20.19	21.53	(67)

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

(68)m=	234.94	237.38	231.24	218.16	201.65	186.13	175.77	173.33	179.47	192.55	209.06	224.58	(68)

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

(69)m=	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	(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=	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	(71)

Water heating gains (Table 5)

(72)m=	126.86	124.65	120.05	113.81	109.75	104.04	99.18	105.4	107.61	114.08	121.38	124.66	(72)

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

(73)m=	444.66	442.55	428.33	405.33	381.87	359.31	344.67	350.79	362.62	385.84	412.55	432.68	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	7.2	x	10.63	x	0.76	x	0.7	=	28.23	(74)
North	0.9x 0.77	x	7.2	x	20.32	x	0.76	x	0.7	=	53.94	(74)
North	0.9x 0.77	x	7.2	x	34.53	x	0.76	x	0.7	=	91.66	(74)
North	0.9x 0.77	x	7.2	x	55.46	x	0.76	x	0.7	=	147.23	(74)
North	0.9x 0.77	x	7.2	x	74.72	x	0.76	x	0.7	=	198.33	(74)
North	0.9x 0.77	x	7.2	x	79.99	x	0.76	x	0.7	=	212.32	(74)
North	0.9x 0.77	x	7.2	x	74.68	x	0.76	x	0.7	=	198.23	(74)
North	0.9x 0.77	x	7.2	x	59.25	x	0.76	x	0.7	=	157.27	(74)
North	0.9x 0.77	x	7.2	x	41.52	x	0.76	x	0.7	=	110.2	(74)
North	0.9x 0.77	x	7.2	x	24.19	x	0.76	x	0.7	=	64.21	(74)
North	0.9x 0.77	x	7.2	x	13.12	x	0.76	x	0.7	=	34.82	(74)
North	0.9x 0.77	x	7.2	x	8.86	x	0.76	x	0.7	=	23.53	(74)
East	0.9x 0.77	x	7.2	x	19.64	x	0.76	x	0.7	=	52.13	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	52.13	(76)
East	0.9x 0.77	x	1.8	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	7.2	x	38.42	x	0.76	x	0.7	=	101.99	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	101.99	(76)
East	0.9x 0.77	x	1.8	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	7.2	x	63.27	x	0.76	x	0.7	=	167.96	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	167.96	(76)
East	0.9x 0.77	x	1.8	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	7.2	x	92.28	x	0.76	x	0.7	=	244.95	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	244.95	(76)
East	0.9x 0.77	x	1.8	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	7.2	x	113.09	x	0.76	x	0.7	=	300.2	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	300.2	(76)
East	0.9x 0.77	x	1.8	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	7.2	x	115.77	x	0.76	x	0.7	=	307.31	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	307.31	(76)
East	0.9x 0.77	x	1.8	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	7.2	x	110.22	x	0.76	x	0.7	=	292.57	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	292.57	(76)
East	0.9x 0.77	x	1.8	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	7.2	x	94.68	x	0.76	x	0.7	=	251.31	(76)
East	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	251.31	(76)
East	0.9x 0.77	x	1.8	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x 0.77	x	7.2	x	73.59	x	0.76	x	0.7	=	195.34	(76)
East	0.9x 0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	195.34	(76)
East	0.9x 0.77	x	1.8	x	73.59	x	0.76	x	0.7	=	97.67	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	7.2	x	45.59	x	0.76	x	0.7	=	121.01	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	121.01	(76)
East	0.9x	0.77	x	1.8	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	7.2	x	24.49	x	0.76	x	0.7	=	65.01	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	65.01	(76)
East	0.9x	0.77	x	1.8	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	7.2	x	16.15	x	0.76	x	0.7	=	42.87	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	42.87	(76)
East	0.9x	0.77	x	1.8	x	16.15	x	0.76	x	0.7	=	21.44	(76)
South	0.9x	0.77	x	7.2	x	46.75	x	0.76	x	0.7	=	124.1	(78)
South	0.9x	0.77	x	7.2	x	76.57	x	0.76	x	0.7	=	203.25	(78)
South	0.9x	0.77	x	7.2	x	97.53	x	0.76	x	0.7	=	258.9	(78)
South	0.9x	0.77	x	7.2	x	110.23	x	0.76	x	0.7	=	292.61	(78)
South	0.9x	0.77	x	7.2	x	114.87	x	0.76	x	0.7	=	304.92	(78)
South	0.9x	0.77	x	7.2	x	110.55	x	0.76	x	0.7	=	293.45	(78)
South	0.9x	0.77	x	7.2	x	108.01	x	0.76	x	0.7	=	286.71	(78)
South	0.9x	0.77	x	7.2	x	104.89	x	0.76	x	0.7	=	278.44	(78)
South	0.9x	0.77	x	7.2	x	101.89	x	0.76	x	0.7	=	270.45	(78)
South	0.9x	0.77	x	7.2	x	82.59	x	0.76	x	0.7	=	219.22	(78)
South	0.9x	0.77	x	7.2	x	55.42	x	0.76	x	0.7	=	147.1	(78)
South	0.9x	0.77	x	7.2	x	40.4	x	0.76	x	0.7	=	107.24	(78)

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

(83)m=	282.66	512.15	770.45	1052.23	1253.75	1274.04	1216.37	1063.99	869.01	585.97	344.44	237.95	(83)

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

(84)m=	727.33	954.7	1198.78	1457.56	1635.63	1633.35	1561.04	1414.79	1231.63	971.81	756.99	670.62	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.84	0.68	0.5	0.37	0.42	0.67	0.91	0.98	0.99	(86)

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

(87)m=	19.48	19.77	20.18	20.61	20.87	20.97	20.99	20.99	20.91	20.51	19.89	19.42	(87)

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

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

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

(89)m=	0.99	0.97	0.92	0.8	0.6	0.4	0.26	0.3	0.57	0.88	0.98	0.99	(89)

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

(90)m=	17.69	18.12	18.7	19.28	19.57	19.67	19.68	19.68	19.62	19.16	18.3	17.62	(90)

fLA = Living area ÷ (4) = 0.4 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.41	18.79	19.3	19.81	20.1	20.19	20.21	20.21	20.14	19.7	18.94	18.34	(92)

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

(93)m=	18.41	18.79	19.3	19.81	20.1	20.19	20.21	20.21	20.14	19.7	18.94	18.34	(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	0.91	0.8	0.63	0.44	0.3	0.35	0.6	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	717.77	922.1	1096.78	1166.63	1027.19	721.51	473.51	496.89	744.63	854.25	736.36	664.01	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1896.6	1863.27	1714.34	1450.8	1114.45	737.54	476.12	501.59	798.72	1208.29	1576.53	1888.51	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	877.05	632.47	459.47	204.6	64.92	0	0	0	0	263.4	604.92	911.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4017.86 (98)

Space heating requirement in kWh/m²/year 45.77 (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 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 4017.86

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 4218.75 (307a)

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

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

Water heating

Annual water heating requirement 2131.79

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 2238.37 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 64.57 (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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		369.9	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		6827.03	(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	=	1340.5	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	33.51	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1374.01	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1374.01	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	191.98	(379)
Total CO2, kg/year	sum of (376)…(382) =				1565.99	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.84	(384)
EI rating (section 14)					84.2	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.5	(1a) x	2.6	(2a) =	139.11	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		139.11	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.34	(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) =	0.29	(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

0.37	0.37	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34

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

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

(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			5.76	x1/[1/(1.4)+ 0.04]		=	7.64			(27)
Windows Type 5			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Floor			53.503	x	0.13	=	6.955389			(28)
Walls Type1	50.44	19.44	31	x	0.15	=	4.65			(29)
Walls Type2	24.57	1.99	22.58	x	0.14	=	3.25			(29)
Total area of elements, m²			128.51							(31)
Party wall			20.93	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) = 43.41 (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 18.67 (36)

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

Total fabric heat loss (33) + (36) = 62.09 (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=	26.14	26.02	25.89	25.32	25.22	24.72	24.72	24.63	24.91	25.22	25.43	25.66	(38)

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

(39)m=	88.23	88.1	87.98	87.41	87.31	86.81	86.81	86.72	87	87.31	87.52	87.75	

Average = Sum(39)$_{1...12}$ /12= 87.41 (39)

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

(40)m=	1.65	1.65	1.64	1.63	1.63	1.62	1.62	1.62	1.63	1.63	1.64	1.64	

Average = Sum(40)$_{1...12}$ /12= 1.63 (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 1.79 (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 76.79 (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=	84.47	81.4	78.33	75.26	72.19	69.11	69.11	72.19	75.26	78.33	81.4	84.47	

Total = Sum(44)$_{1...12}$ = 921.51 (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=	125.27	109.56	113.06	98.57	94.58	81.61	75.63	86.78	87.82	102.34	111.72	121.32	

Total = Sum(45)$_{1...12}$ = 1208.25 (45)

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

(46)m=	18.79	16.43	16.96	14.78	14.19	12.24	11.34	13.02	13.17	15.35	16.76	18.2	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	175.5	154.93	163.29	147.18	144.81	130.22	125.86	137.01	136.43	152.58	160.33	171.55	(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=	175.5	154.93	163.29	147.18	144.81	130.22	125.86	137.01	136.43	152.58	160.33	171.55	

Output from water heater (annual)$_{1...12}$ — 1799.69 — (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=	81.84	72.73	77.78	71.66	71.63	66.03	65.33	69.04	68.09	74.22	76.04	80.52	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	89.67	89.67	89.67	89.67	89.67	89.67	89.67	89.67	89.67	89.67	89.67	89.67	(66)

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

(67)m=	13.94	12.38	10.07	7.62	5.7	4.81	5.2	6.75	9.07	11.51	13.44	14.32	(67)

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

(68)m=	156.32	157.94	153.85	145.15	134.17	123.84	116.95	115.32	119.41	128.11	139.1	149.42	(68)

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

(69)m=	31.97	31.97	31.97	31.97	31.97	31.97	31.97	31.97	31.97	31.97	31.97	31.97	(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=	-71.74	-71.74	-71.74	-71.74	-71.74	-71.74	-71.74	-71.74	-71.74	-71.74	-71.74	-71.74	(71)

Water heating gains (Table 5)

(72)m=	110	108.22	104.54	99.53	96.28	91.7	87.81	92.8	94.57	99.75	105.6	108.23	(72)

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

(73)m=	330.15	328.44	318.36	302.21	286.05	270.26	259.85	264.78	272.95	289.28	308.04	321.88	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	6.48	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x	0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x	0.77	x	2.16	x	10.63	x	0.76	x	0.7	=	8.47	(74)
North	0.9x	0.77	x	5.76	x	10.63	x	0.76	x	0.7	=	22.58	(74)
North	0.9x	0.77	x	6.48	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x	0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x	0.77	x	2.16	x	20.32	x	0.76	x	0.7	=	16.18	(74)
North	0.9x	0.77	x	5.76	x	20.32	x	0.76	x	0.7	=	43.15	(74)
North	0.9x	0.77	x	6.48	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x	0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x	0.77	x	2.16	x	34.53	x	0.76	x	0.7	=	27.5	(74)
North	0.9x	0.77	x	5.76	x	34.53	x	0.76	x	0.7	=	73.33	(74)
North	0.9x	0.77	x	6.48	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x	0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x	0.77	x	2.16	x	55.46	x	0.76	x	0.7	=	44.17	(74)
North	0.9x	0.77	x	5.76	x	55.46	x	0.76	x	0.7	=	117.78	(74)
North	0.9x	0.77	x	6.48	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x	0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x	0.77	x	2.16	x	74.72	x	0.76	x	0.7	=	59.5	(74)
North	0.9x	0.77	x	5.76	x	74.72	x	0.76	x	0.7	=	158.66	(74)
North	0.9x	0.77	x	6.48	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x	0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x	0.77	x	2.16	x	79.99	x	0.76	x	0.7	=	63.7	(74)
North	0.9x	0.77	x	5.76	x	79.99	x	0.76	x	0.7	=	169.85	(74)
North	0.9x	0.77	x	6.48	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x	0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x	0.77	x	2.16	x	74.68	x	0.76	x	0.7	=	59.47	(74)
North	0.9x	0.77	x	5.76	x	74.68	x	0.76	x	0.7	=	158.58	(74)
North	0.9x	0.77	x	6.48	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x	0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x	0.77	x	2.16	x	59.25	x	0.76	x	0.7	=	47.18	(74)
North	0.9x	0.77	x	5.76	x	59.25	x	0.76	x	0.7	=	125.81	(74)
North	0.9x	0.77	x	6.48	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x	0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x	0.77	x	2.16	x	41.52	x	0.76	x	0.7	=	33.06	(74)
North	0.9x	0.77	x	5.76	x	41.52	x	0.76	x	0.7	=	88.16	(74)
North	0.9x	0.77	x	6.48	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x	0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x	0.77	x	2.16	x	24.19	x	0.76	x	0.7	=	19.26	(74)
North	0.9x	0.77	x	5.76	x	24.19	x	0.76	x	0.7	=	51.37	(74)
North	0.9x	0.77	x	6.48	x	13.12	x	0.76	x	0.7	=	31.34	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x	0.77	x	2.16	x	13.12	x	0.76	x	0.7	=	10.45	(74)
North	0.9x	0.77	x	5.76	x	13.12	x	0.76	x	0.7	=	27.86	(74)
North	0.9x	0.77	x	6.48	x	8.86	x	0.76	x	0.7	=	21.18	(74)
North	0.9x	0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
North	0.9x	0.77	x	2.16	x	8.86	x	0.76	x	0.7	=	7.06	(74)
North	0.9x	0.77	x	5.76	x	8.86	x	0.76	x	0.7	=	18.82	(74)
West	0.9x	0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(80)
West	0.9x	0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(80)
West	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(80)

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

(83)m=	80.99	155.25	262.74	417.06	555.87	592.26	554.08	443.43	314.58	184.73	100.05	67.4	(83)

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

(84)m=	411.15	483.69	581.1	719.27	841.91	862.51	813.93	708.21	587.53	474.01	408.09	389.28	(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	0.6	0.46	0.53	0.8	0.96	0.99	1	(86)

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

(87)m=	19.29	19.49	19.86	20.35	20.75	20.93	20.98	20.97	20.79	20.27	19.69	19.25	(87)

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

(88)m=	19.58	19.58	19.58	19.59	19.59	19.6	19.6	19.6	19.59	19.59	19.59	19.58	(88)

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

(89)m=	0.99	0.99	0.96	0.88	0.71	0.48	0.32	0.39	0.71	0.94	0.99	0.99	(89)

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

(90)m=	17.36	17.65	18.19	18.88	19.37	19.56	19.59	19.59	19.44	18.79	17.96	17.31	(90)

fLA = Living area ÷ (4) = 0.5 (91)

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

(92)m=	18.32	18.57	19.02	19.62	20.06	20.25	20.29	20.28	20.12	19.53	18.82	18.28	(92)

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

DER WorkSheet: New dwelling design stage

(93)m=	18.32	18.57	19.02	19.62	20.06	20.25	20.29	20.28	20.12	19.53	18.82	18.28	(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	0.98	0.96	0.88	0.73	0.54	0.39	0.46	0.75	0.94	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	406.99	474.64	556.01	635.15	617.19	464.47	314.58	325.89	438.04	443.71	400.81	386.04	(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=	1237.24	1204.26	1101.45	936.72	729.66	490.08	319.96	336.14	523.44	779.25	1025.87	1235.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	617.71	490.31	405.8	217.13	83.68	0	0	0	0	249.64	450.04	631.88	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3146.19 (98)

Space heating requirement in kWh/m²/year 58.8 (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 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 3146.19

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 3303.49 (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 1799.69

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 1889.68 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 51.93 (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 0 (330a)

DER WorkSheet: New dwelling design stage

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		246.11	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5439.29	(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	=	1078.1	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.95	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1105.06	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1105.06	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	127.73	(379)
Total CO2, kg/year	sum of (376)…(382) =				1232.79	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				23.04	(384)
EI rating (section 14)					83.23	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.75	(1a) x	2.6	(2a) =	131.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		131.94	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3	(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

0.38	0.37	0.37	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.34	0.35

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

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 4			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Floor			50.748	x	0.13	=	6.59724			(28)
Walls Type1	51.71	15.12	36.59	x	0.15	=	5.49			(29)
Walls Type2	3.77	1.99	1.78	x	0.14	=	0.26			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Total area of elements, m²			125.21							(31)
Party wall			20.93	x	0	=	0			(32)
Party wall			11.44	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) = 37.68 (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 11.41 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 49.09 (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=	24.93	24.81	24.69	24.12	24.02	23.53	23.53	23.43	23.72	24.02	24.23	24.46	(38)

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

(39)m=	74.02	73.9	73.78	73.22	73.11	72.62	72.62	72.53	72.81	73.11	73.32	73.55	

Average = Sum(39)$_{1...12}$ /12= 73.21 (39)

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

(40)m=	1.46	1.46	1.45	1.44	1.44	1.43	1.43	1.43	1.43	1.44	1.44	1.45	

Average = Sum(40)$_{1...12}$ /12= 1.44 (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 1.71 (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 74.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	82.35	79.36	76.36	73.37	70.37	67.38	67.38	70.37	73.37	76.36	79.36	82.35	

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

Total = Sum(44)$_{1...12}$ = 898.36 (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=	122.12	106.81	110.22	96.09	92.2	79.56	73.73	84.6	85.61	99.77	108.91	118.27	

Total = Sum(45)$_{1...12}$ = 1177.89 (45)

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

(46)m=	18.32	16.02	16.53	14.41	13.83	11.93	11.06	12.69	12.84	14.97	16.34	17.74	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	172.35	152.18	160.45	144.7	142.43	128.17	123.96	134.83	134.22	150.01	157.52	168.5	(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=	172.35	152.18	160.45	144.7	142.43	128.17	123.96	134.83	134.22	150.01	157.52	168.5	

Output from water heater (annual)$_{1...12}$ | 1769.34 | (64)

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

(65)m=	80.79	71.81	76.83	70.84	70.84	65.34	64.7	68.32	67.36	73.36	75.1	79.51	(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=	85.61	85.61	85.61	85.61	85.61	85.61	85.61	85.61	85.61	85.61	85.61	85.61	(66)

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

(67)m=	13.3	11.81	9.61	7.27	5.44	4.59	4.96	6.45	8.65	10.99	12.82	13.67	(67)

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

(68)m=	149.18	150.72	146.82	138.52	128.04	118.18	111.6	110.05	113.95	122.26	132.74	142.59	(68)

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

(69)m=	31.56	31.56	31.56	31.56	31.56	31.56	31.56	31.56	31.56	31.56	31.56	31.56	(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=	-68.49	-68.49	-68.49	-68.49	-68.49	-68.49	-68.49	-68.49	-68.49	-68.49	-68.49	-68.49	(71)

Water heating gains (Table 5)

(72)m=	108.59	106.86	103.27	98.39	95.22	90.76	86.96	91.82	93.55	98.6	104.31	106.87	(72)

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

(73)m=	319.75	318.08	308.38	292.86	277.37	262.21	252.21	257	264.84	280.53	298.55	311.81	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.48	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x 0.77	x	6.48	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x 0.77	x	6.48	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x 0.77	x	6.48	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x 0.77	x	6.48	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x 0.77	x	6.48	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x 0.77	x	6.48	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x 0.77	x	6.48	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x 0.77	x	6.48	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x 0.77	x	6.48	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x 0.77	x	6.48	x	13.12	x	0.76	x	0.7	=	31.34	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x 0.77	x	6.48	x	8.86	x	0.76	x	0.7	=	21.18	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(76)
East	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)
East	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(76)

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

(83)m=	76.01	146.91	245.89	377.59	487.8	512.36	482.32	396.09	291.02	174.6	94.25	62.95	(83)

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

(84)m=	395.76	464.99	554.28	670.45	765.18	774.57	734.52	653.1	555.86	455.13	392.81	374.77	(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	0.76	0.57	0.43	0.5	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=	19.52	19.72	20.07	20.51	20.82	20.96	20.99	20.98	20.86	20.42	19.89	19.49	(87)

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

(88)m=	19.72	19.72	19.72	19.73	19.73	19.74	19.74	19.74	19.74	19.73	19.73	19.73	(88)

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

(89)m=	0.99	0.98	0.96	0.87	0.69	0.47	0.31	0.37	0.67	0.93	0.98	0.99	(89)

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

(90)m=	17.8	18.08	18.58	19.19	19.58	19.72	19.74	19.74	19.64	19.1	18.34	17.75	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	18.58	18.83	19.26	19.79	20.15	20.28	20.31	20.3	20.2	19.7	19.05	18.54	(92)

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

(93)m=	18.58	18.83	19.26	19.79	20.15	20.28	20.31	20.3	20.2	19.7	19.05	18.54	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.87	0.71	0.51	0.36	0.43	0.71	0.93	0.98	0.99	(94)

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

(95)m=	391.64	455.63	527.71	583.92	545.75	398.78	266.83	278.43	393.99	421.47	385.26	371.6	(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=	1057.34	1029.35	941.17	797.28	617.48	412.69	269.28	283.13	444.01	665.52	876.08	1054.67	(97)

DER WorkSheet: New dwelling design stage

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

(98)m=	495.29	385.54	307.62	153.62	53.37	0	0	0	0	181.57	353.39	508.2

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2438.59 (98)

Space heating requirement in kWh/m²/year 48.05 (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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		2438.59	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2560.52	(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 1769.34

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 1857.8 (310a)

Electricity used for heat distribution 0.01 × [(307a)...(307e) + (310a)...(310e)] = 44.18 (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 0 (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) = 0 (331)

Energy for lighting (calculated in Appendix L) 234.87 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 4653.2 (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)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	917.24	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	22.93	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	940.18	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			940.18	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.9	(379)
Total CO2, kg/year	sum of (376)…(382) =			1062.07	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			20.93	(384)
EI rating (section 14)				85.14	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 3

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.08	(1a) x	2.6	(2a) =	130.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.08	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.22	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3	(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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

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

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 4			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Floor			50.083	x	0.13	=	6.51079			(28)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Total area of elements, m²			107.8							(31)
Party wall			23.4	x	0	=	0			(32)
Party wall			11.44	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) = 35.09 (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 10.68 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 45.77 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.64	24.52	24.4	23.83	23.73	23.24	23.24	23.15	23.43	23.73	23.94	24.17	(38)

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

(39)m=	70.41	70.29	70.17	69.6	69.5	69.01	69.01	68.92	69.2	69.5	69.71	69.93	

Average = Sum(39)$_{1...12}$ /12= 69.6 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.39 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.4 (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=	81.84	78.86	75.89	72.91	69.93	66.96	66.96	69.93	72.91	75.89	78.86	81.84	

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

Total = Sum(44)$_{1...12}$ = 892.78 (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=	121.36	106.14	109.53	95.49	91.63	79.07	73.27	84.08	85.08	99.15	108.23	117.53	

Total = Sum(45)$_{1...12}$ = 1170.57 (45)

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

(46)m=	18.2	15.92	16.43	14.32	13.74	11.86	10.99	12.61	12.76	14.87	16.23	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	

Output from water heater (annual)$_{1...12}$ | 1762.02 | (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=	80.54	71.59	76.61	70.64	70.65	65.18	64.55	68.14	67.18	73.15	74.88	79.27	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	(66)

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

(67)m=	13.15	11.68	9.5	7.19	5.37	4.54	4.9	6.37	8.55	10.86	12.67	13.51	(67)

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

(68)m=	147.45	148.98	145.12	136.92	126.55	116.82	110.31	108.78	112.64	120.84	131.21	140.94	(68)

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

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	(71)

Water heating gains (Table 5)

(72)m=	108.25	106.53	102.96	98.11	94.96	90.53	86.76	91.59	93.3	98.33	104	106.54	(72)

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

(73)m=	317.23	315.58	305.97	290.6	275.28	260.27	250.36	255.13	262.88	278.42	296.26	309.38	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(76)
East	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x 0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(76)
East	0.9x 0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x 0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(76)
East	0.9x 0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x 0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(76)
East	0.9x 0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x 0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(76)
East	0.9x 0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)
East	0.9x 0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(76)
South	0.9x 0.77	x	6.48	x	46.75	x	0.76	x	0.7	=	111.69	(78)
South	0.9x 0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x 0.77	x	6.48	x	76.57	x	0.76	x	0.7	=	182.92	(78)
South	0.9x 0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x 0.77	x	6.48	x	97.53	x	0.76	x	0.7	=	233.01	(78)
South	0.9x 0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x 0.77	x	6.48	x	110.23	x	0.76	x	0.7	=	263.35	(78)
South	0.9x 0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x 0.77	x	6.48	x	114.87	x	0.76	x	0.7	=	274.43	(78)
South	0.9x 0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x 0.77	x	6.48	x	110.55	x	0.76	x	0.7	=	264.1	(78)
South	0.9x 0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x 0.77	x	6.48	x	108.01	x	0.76	x	0.7	=	258.04	(78)
South	0.9x 0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x 0.77	x	6.48	x	104.89	x	0.76	x	0.7	=	250.6	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	6.48	x	101.89	x	0.76	x	0.7	=	243.41	(78)
South	0.9x	0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	6.48	x	82.59	x	0.76	x	0.7	=	197.3	(78)
South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	6.48	x	55.42	x	0.76	x	0.7	=	132.39	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	6.48	x	40.4	x	0.76	x	0.7	=	96.51	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	53.62	(78)

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

(83)m=	210.24	355.94	480.03	581.13	637.03	625.94	606.2	565.73	515.37	391.62	251.45	180.14	(83)

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

(84)m=	527.47	671.51	786	871.73	912.31	886.21	856.56	820.86	778.25	670.04	547.71	489.52	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.95	0.9	0.8	0.65	0.49	0.35	0.38	0.58	0.84	0.96	0.99	(86)

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

(87)m=	19.82	20.12	20.44	20.74	20.91	20.98	21	20.99	20.96	20.71	20.21	19.76	(87)

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

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

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

(89)m=	0.98	0.94	0.87	0.75	0.58	0.4	0.26	0.28	0.49	0.79	0.95	0.98	(89)

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

(90)m=	18.25	18.68	19.12	19.5	19.7	19.77	19.78	19.78	19.75	19.49	18.81	18.17	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	18.98	19.34	19.73	20.07	20.26	20.33	20.34	20.34	20.31	20.06	19.46	18.9	(92)

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

(93)m=	18.98	19.34	19.73	20.07	20.26	20.33	20.34	20.34	20.31	20.06	19.46	18.9	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.94	0.87	0.76	0.61	0.44	0.3	0.33	0.53	0.8	0.94	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	512.66	628.2	685.63	665.42	558.68	388.75	257.2	270.12	414.42	539.15	516.8	478.89	(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=	1033.47	1015.19	928.42	777.65	594.74	395.32	258.17	271.58	429.55	657.2	861.3	1028.22	(97)

DER WorkSheet: New dwelling design stage

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

(98)m=	387.48	260.05	180.64	80.8	26.82	0	0	0	0	87.83	248.04	408.7

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1680.36 (98)

Space heating requirement in kWh/m²/year 33.55 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Fraction of heat from Community 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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		1680.36	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1764.38	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement 1762.02

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 1850.12 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 36.14 (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 0 (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) = 0 (331)

Energy for lighting (calculated in Appendix L) 232.15 (332)

Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) = 3846.65 (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)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	750.37	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	18.76	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	769.13	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			769.13	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.49	(379)
Total CO2, kg/year	sum of (376)…(382) =			889.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.76	(384)
EI rating (section 14)				87.46	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.21	(1a) x	2.6	(2a) =	224.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.21	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		224.15	(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) =	0.13 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.33 (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) =		0.28 (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

0.36	0.35	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

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=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 4			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 5			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Floor			86.213	x	0.13	=	11.20769			(28)
Walls Type1	62.14	23.04	39.1	x	0.15	=	5.87			(29)
Walls Type2	23.14	1.99	21.15	x	0.14	=	3.04			(29)
Walls Type3	12.22	0	12.22	x	0.13	=	1.61			(29)
Total area of elements, m²			183.71							(31)
Party wall			21.84	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) = 55.06 (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 17.21 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 72.28 (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	
(38)m=	41.83	41.64	41.45	40.59	40.43	39.67	39.67	39.53	39.96	40.43	40.75	41.1	(38)

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

(39)m=	114.1	113.91	113.73	112.86	112.7	111.95	111.95	111.81	112.24	112.7	113.03	113.37	

Average = Sum(39)$_{1...12}$ /12= 112.86 (39)

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

(40)m=	1.32	1.32	1.32	1.31	1.31	1.3	1.3	1.3	1.3	1.31	1.31	1.32	

Average = Sum(40)$_{1...12}$ /12= 1.31 (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 2.57 (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 95.24 (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=	104.77	100.96	97.15	93.34	89.53	85.72	85.72	89.53	93.34	97.15	100.96	104.77	

Total = Sum(44)$_{1...12}$ = 1142.92 (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=	155.37	135.89	140.22	122.25	117.3	101.22	93.8	107.63	108.92	126.93	138.56	150.47	

Total = Sum(45)$_{1...12}$ = 1498.55 (45)

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

(46)m=	23.31	20.38	21.03	18.34	17.6	15.18	14.07	16.14	16.34	19.04	20.78	22.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	208.39	183.78	193.24	173.56	170.32	152.53	146.82	160.66	160.23	179.96	189.87	203.49	(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=	208.39	183.78	193.24	173.56	170.32	152.53	146.82	160.66	160.23	179.96	189.87	203.49	

Output from water heater (annual)$_{1...12}$ | 2122.85 | (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=	94.08	83.49	89.04	81.7	81.42	74.71	73.61	78.21	77.27	84.62	87.12	92.45	(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=	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	(66)

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

(67)m=	20.68	18.37	14.94	11.31	8.45	7.14	7.71	10.02	13.45	17.08	19.94	21.25	(67)

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

(68)m=	231.94	234.34	228.28	215.37	199.07	183.75	173.52	171.11	177.17	190.09	206.38	221.7	(68)

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

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(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=	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	(71)

Water heating gains (Table 5)

(72)m=	126.45	124.25	119.68	113.47	109.44	103.76	98.93	105.12	107.31	113.74	121	124.26	(72)

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

(73)m=	440.62	438.51	424.45	401.7	378.51	356.2	341.71	347.8	359.49	382.46	408.87	428.77	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	6.48	x	46.75	x	0.76	x	0.7	=	111.69	(78)
South	0.9x 0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	124.1	(78)
South	0.9x 0.77	x	2.16	x	46.75	x	0.76	x	0.7	=	74.46	(78)
South	0.9x 0.77	x	6.48	x	76.57	x	0.76	x	0.7	=	182.92	(78)
South	0.9x 0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	203.25	(78)
South	0.9x 0.77	x	2.16	x	76.57	x	0.76	x	0.7	=	121.95	(78)
South	0.9x 0.77	x	6.48	x	97.53	x	0.76	x	0.7	=	233.01	(78)
South	0.9x 0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	258.9	(78)
South	0.9x 0.77	x	2.16	x	97.53	x	0.76	x	0.7	=	155.34	(78)
South	0.9x 0.77	x	6.48	x	110.23	x	0.76	x	0.7	=	263.35	(78)
South	0.9x 0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	292.61	(78)
South	0.9x 0.77	x	2.16	x	110.23	x	0.76	x	0.7	=	175.57	(78)
South	0.9x 0.77	x	6.48	x	114.87	x	0.76	x	0.7	=	274.43	(78)
South	0.9x 0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	304.92	(78)
South	0.9x 0.77	x	2.16	x	114.87	x	0.76	x	0.7	=	182.95	(78)
South	0.9x 0.77	x	6.48	x	110.55	x	0.76	x	0.7	=	264.1	(78)
South	0.9x 0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	293.45	(78)
South	0.9x 0.77	x	2.16	x	110.55	x	0.76	x	0.7	=	176.07	(78)
South	0.9x 0.77	x	6.48	x	108.01	x	0.76	x	0.7	=	258.04	(78)
South	0.9x 0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	286.71	(78)
South	0.9x 0.77	x	2.16	x	108.01	x	0.76	x	0.7	=	172.03	(78)
South	0.9x 0.77	x	6.48	x	104.89	x	0.76	x	0.7	=	250.6	(78)
South	0.9x 0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	278.44	(78)
South	0.9x 0.77	x	2.16	x	104.89	x	0.76	x	0.7	=	167.06	(78)
South	0.9x 0.77	x	6.48	x	101.89	x	0.76	x	0.7	=	243.41	(78)
South	0.9x 0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	270.45	(78)
South	0.9x 0.77	x	2.16	x	101.89	x	0.76	x	0.7	=	162.27	(78)
South	0.9x 0.77	x	6.48	x	82.59	x	0.76	x	0.7	=	197.3	(78)
South	0.9x 0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	219.22	(78)
South	0.9x 0.77	x	2.16	x	82.59	x	0.76	x	0.7	=	131.53	(78)
South	0.9x 0.77	x	6.48	x	55.42	x	0.76	x	0.7	=	132.39	(78)
South	0.9x 0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	147.1	(78)
South	0.9x 0.77	x	2.16	x	55.42	x	0.76	x	0.7	=	88.26	(78)
South	0.9x 0.77	x	6.48	x	40.4	x	0.76	x	0.7	=	96.51	(78)
South	0.9x 0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	107.24	(78)
South	0.9x 0.77	x	2.16	x	40.4	x	0.76	x	0.7	=	64.34	(78)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(80)
West	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(80)
West	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(80)
West	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(80)

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

(83)m=	346.75	579.51	764.82	903	972.44	948.73	921.58	872.02	812.87	632.76	413.26	298.1	(83)

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

(84)m=	787.36	1018.02	1189.27	1304.7	1350.95	1304.93	1263.3	1219.82	1172.36	1015.22	822.13	726.86	(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	0.84	0.7	0.53	0.39	0.42	0.62	0.87	0.97	0.99	(86)

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

(87)m=	19.81	20.1	20.42	20.71	20.9	20.98	21	20.99	20.95	20.7	20.18	19.75	(87)

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

(88)m=	19.82	19.82	19.83	19.83	19.84	19.84	19.84	19.84	19.84	19.84	19.83	19.83	(88)

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

(89)m=	0.99	0.96	0.9	0.8	0.64	0.44	0.29	0.31	0.53	0.83	0.96	0.99	(89)

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

(90)m=	18.28	18.7	19.14	19.53	19.75	19.83	19.84	19.84	19.81	19.53	18.83	18.2	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.96	19.32	19.71	20.06	20.26	20.34	20.35	20.35	20.32	20.05	19.43	18.89	(92)

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

(93)m=	18.96	19.32	19.71	20.06	20.26	20.34	20.35	20.35	20.32	20.05	19.43	18.89	(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	0.95	0.9	0.8	0.66	0.48	0.33	0.36	0.57	0.84	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	773.09	969.73	1069.91	1049.61	893.81	629.41	418.43	439.32	669.71	851.26	789.55	717.11	(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=	1672.97	1643.21	1502.21	1259.04	964.44	642.51	420.28	442.06	697.86	1064.75	1393.96	1665.17	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	669.51	452.58	321.63	150.79	52.55	0	0	0	0	158.84	435.17	705.36	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2946.42	(98)
Space heating requirement in kWh/m²/year	34.18	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2946.42	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3093.74	(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		2122.85	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2228.99	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.23	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		365.17	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5687.9	(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	=	1105	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	27.62	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1132.62	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1132.62	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	189.52	(379)
Total CO2, kg/year	sum of (376)…(382) =				1322.15	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.34	(384)
EI rating (section 14)					86.5	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.19	(1a) x	2.6	(2a) =	182.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.19	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		182.5	(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			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.36 (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

DER WorkSheet: New dwelling design stage

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

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

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	0.57	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	0.57	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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 5			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Floor			16.13	x	0.13	=	2.0969			(28)
Walls Type1	52.65	23.04	29.61	x	0.15	=	4.44			(29)
Walls Type2	10.27	1.99	8.28	x	0.14	=	1.17			(29)
Walls Type3	5.2	0	5.2	x	0.13	=	0.69			(29)
Total area of elements, m²			84.25							(31)
Party wall			21.84	x	0	=	0			(32)
Party wall			16.9	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) = 41.73 (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 14.92 (36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 56.65 (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=	34.81	34.63	34.45	33.61	33.45	32.72	32.72	32.58	33	33.45	33.77	34.1	(38)

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

(39)m=	91.46	91.28	91.1	90.26	90.1	89.37	89.37	89.24	89.65	90.1	90.42	90.75	

Average = Sum(39)$_{1...12}$ /12= 90.26 (39)

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

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

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 2.25 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.66 (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=	96.42	92.92	89.41	85.9	82.4	78.89	78.89	82.4	85.9	89.41	92.92	96.42	

Total = Sum(44)$_{1...12}$ = 1051.88 (44)

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

(45)m=	142.99	125.06	129.05	112.51	107.96	93.16	86.32	99.06	100.24	116.82	127.52	138.48	

Total = Sum(45)$_{1...12}$ = 1379.18 (45)

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

(46)m=	21.45	18.76	19.36	16.88	16.19	13.97	12.95	14.86	15.04	17.52	19.13	20.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	

Output from water heater (annual)$_{1...12}$ | 1970.62 | (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=	87.73	77.88	83.1	76.3	76.08	69.86	68.89	73.12	72.22	79.03	81.29	86.23	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	(66)

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

(67)m=	17.63	15.66	12.73	9.64	7.21	6.08	6.57	8.55	11.47	14.56	17	18.12	(67)

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

(68)m=	197.75	199.8	194.63	183.62	169.72	156.66	147.94	145.89	151.06	162.07	175.96	189.02	(68)

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

(69)m=	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	(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=	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	(71)

Water heating gains (Table 5)

(72)m=	117.92	115.89	111.69	105.97	102.26	97.03	92.59	98.28	100.31	106.22	112.9	115.9	(72)

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

(73)m=	390.06	388.11	375.81	355.99	335.95	316.54	303.87	309.48	319.59	339.61	362.62	379.8	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.48	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	28.23	(74)
North	0.9x 0.77	x	2.16	x	10.63	x	0.76	x	0.7	=	16.94	(74)
North	0.9x 0.77	x	6.48	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	53.94	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.76	x	0.7	=	32.36	(74)
North	0.9x 0.77	x	6.48	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	91.66	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.76	x	0.7	=	55	(74)
North	0.9x 0.77	x	6.48	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	147.23	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.76	x	0.7	=	88.34	(74)
North	0.9x 0.77	x	6.48	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	198.33	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.76	x	0.7	=	119	(74)
North	0.9x 0.77	x	6.48	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	212.32	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.76	x	0.7	=	127.39	(74)
North	0.9x 0.77	x	6.48	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	198.23	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.76	x	0.7	=	118.94	(74)
North	0.9x 0.77	x	6.48	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	157.27	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.76	x	0.7	=	94.36	(74)
North	0.9x 0.77	x	6.48	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	110.2	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.76	x	0.7	=	66.12	(74)
North	0.9x 0.77	x	6.48	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	64.21	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.76	x	0.7	=	38.53	(74)
North	0.9x 0.77	x	6.48	x	13.12	x	0.76	x	0.7	=	31.34	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	34.82	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.76	x	0.7	=	20.89	(74)
North	0.9x 0.77	x	6.48	x	8.86	x	0.76	x	0.7	=	21.18	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	23.53	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.76	x	0.7	=	14.12	(74)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(80)
West	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(80)
West	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(80)
West	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(80)

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

(83)m=	107.06	206.24	346.72	539.54	705.97	745.91	700.37	569.09	412.25	245.24	132.55	88.84	(83)

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

(84)m=	497.11	594.36	722.53	895.53	1041.92	1062.46	1004.23	878.57	731.84	584.85	495.18	468.64	(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	0.89	0.72	0.52	0.39	0.46	0.75	0.95	0.99	1	(86)

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

(87)m=	19.66	19.85	20.19	20.62	20.89	20.98	21	20.99	20.91	20.5	20	19.62	(87)

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

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

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

(89)m=	0.99	0.99	0.96	0.86	0.66	0.44	0.29	0.35	0.66	0.93	0.99	1	(89)

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

(90)m=	18.07	18.36	18.85	19.43	19.76	19.85	19.86	19.86	19.79	19.3	18.58	18.03	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.85	19.09	19.51	20.02	20.31	20.41	20.42	20.42	20.34	19.89	19.28	18.81	(92)

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

(93)m=	18.85	19.09	19.51	20.02	20.31	20.41	20.42	20.42	20.34	19.89	19.28	18.81	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.86	0.68	0.48	0.34	0.4	0.7	0.93	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	493.58	585.02	691.09	774.39	713.01	509.11	339.77	355.08	510.57	545.88	488.17	466.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1330.8	1295.51	1185.04	1003.28	776.09	518.85	341.28	358.41	559.36	837.34	1101.24	1325.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	622.89	477.45	367.49	164.8	46.93	0	0	0	0	216.85	441.41	639.72	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2977.55	(98)
Space heating requirement in kWh/m²/year	42.42	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2977.55	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3126.42	(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		1970.62	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2069.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	51.96	(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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		311.34	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5506.92	(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	=	1078.6	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.97	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1105.57	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1105.57	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	161.58	(379)
Total CO2, kg/year	sum of (376)…(382) =				1267.15	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				18.05	(384)
EI rating (section 14)					85.26	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.08	(1a) x	2.6	(2a) =	130.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.08	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.22	(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				4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

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

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 4			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Total area of elements, m²			57.72							(31)
Party wall			23.4	x	0	=	0			(32)
Party wall			11.44	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) = 28.58 (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 7.07 (36)

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

Total fabric heat loss (33) + (36) = 35.65 (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=	24.64	24.52	24.4	23.83	23.73	23.24	23.24	23.15	23.43	23.73	23.94	24.17	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	60.29	60.17	60.05	59.48	59.38	58.89	58.89	58.8	59.08	59.38	59.59	59.81	

Average = Sum(39)$_{1...12}$ /12= 59.48 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.2	1.2	1.2	1.19	1.19	1.18	1.18	1.17	1.18	1.19	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 1.69 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.4 (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=	81.84	78.86	75.89	72.91	69.93	66.96	66.96	69.93	72.91	75.89	78.86	81.84	

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

Total = Sum(44)$_{1...12}$ = 892.78 (44)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	121.36	106.14	109.53	95.49	91.63	79.07	73.27	84.08	85.08	99.15	108.23	117.53	

Total = Sum(45)$_{1...12}$ = 1170.57 (45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.2	15.92	16.43	14.32	13.74	11.86	10.99	12.61	12.76	14.87	16.23	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	

Output from water heater (annual)$_{1...12}$ — 1762.02 — (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=	80.54	71.59	76.61	70.64	70.65	65.18	64.55	68.14	67.18	73.15	74.88	79.27	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	(66)

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

(67)m=	13.15	11.68	9.5	7.19	5.37	4.54	4.9	6.37	8.55	10.86	12.67	13.51	(67)

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

(68)m=	147.45	148.98	145.12	136.92	126.55	116.82	110.31	108.78	112.64	120.84	131.21	140.94	(68)

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

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	(71)

Water heating gains (Table 5)

(72)m=	108.25	106.53	102.96	98.11	94.96	90.53	86.76	91.59	93.3	98.33	104	106.54	(72)

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

(73)m=	317.23	315.58	305.97	290.6	275.28	260.27	250.36	255.13	262.88	278.42	296.26	309.38	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	6.48	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x	0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x	0.77	x	6.48	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x	0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x	0.77	x	6.48	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x	0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x	0.77	x	6.48	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x	0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x	0.77	x	6.48	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x	0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x	0.77	x	6.48	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x	0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x	0.77	x	6.48	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x	0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x	0.77	x	6.48	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x	0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x	0.77	x	6.48	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x	0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x	0.77	x	6.48	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x	0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x	0.77	x	6.48	x	13.12	x	0.76	x	0.7	=	31.34	(74)
North	0.9x	0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x	0.77	x	6.48	x	8.86	x	0.76	x	0.7	=	21.18	(74)
North	0.9x	0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
West	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x	0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(80)
West	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)
West	0.9x	0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(80)
West	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(80)
West	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(80)
West	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(80)

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

(83)m=	76.01	146.91	245.89	377.59	487.8	512.36	482.32	396.09	291.02	174.6	94.25	62.95	(83)

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

(84)m=	393.24	462.48	551.86	668.19	763.08	772.63	732.67	651.22	553.9	453.02	390.52	372.34	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.86	0.68	0.48	0.35	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=	19.86	20.05	20.36	20.73	20.93	20.99	21	21	20.95	20.63	20.18	19.82	(87)

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

(88)m=	19.92	19.92	19.92	19.93	19.93	19.94	19.94	19.94	19.94	19.93	19.93	19.92	(88)

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

(89)m=	0.99	0.98	0.94	0.82	0.61	0.4	0.27	0.32	0.6	0.9	0.98	0.99	(89)

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

(90)m=	18.42	18.69	19.15	19.64	19.87	19.93	19.94	19.94	19.9	19.54	18.89	18.37	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.08	19.32	19.71	20.14	20.36	20.42	20.43	20.43	20.38	20.04	19.48	19.04	(92)

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

(93)m=	19.08	19.32	19.71	20.14	20.36	20.42	20.43	20.43	20.38	20.04	19.48	19.04	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.83	0.64	0.44	0.31	0.36	0.64	0.91	0.98	0.99	(94)

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

(95)m=	389.04	452.03	519.17	555.14	487.51	339.31	224.96	235.78	352.39	410.34	382.14	369.19	(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=	891.16	867.55	793.09	668.77	514.34	342.78	225.42	236.8	371.2	560.7	737.9	887.61	(97)

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

(98)m=	373.58	279.23	203.8	81.81	19.96	0	0	0	0	111.87	256.15	385.71	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1712.11	(98)
Space heating requirement in kWh/m²/year		34.19	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1712.11	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1797.72	(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		1762.02	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1850.12	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.48	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		232.15	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3879.98	(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	=	757.29	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.93	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	776.22	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			776.22	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.49	(379)
Total CO2, kg/year	sum of (376)…(382) =			896.71	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.9	(384)
EI rating (section 14)				87.36	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 7

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.08	(1a) x	2.6	(2a) =	130.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.08	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.22	(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				4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.3 (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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

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

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

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 4			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Total area of elements, m²			57.72							(31)
Party wall			23.4	x	0	=	0			(32)
Party wall			11.44	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) = 28.58 (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 7.02 (36)

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

Total fabric heat loss (33) + (36) = 35.6 (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=	24.64	24.52	24.4	23.83	23.73	23.24	23.24	23.15	23.43	23.73	23.94	24.17	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	60.24	60.12	60	59.43	59.33	58.84	58.84	58.75	59.03	59.33	59.54	59.77	

Average = Sum(39)$_{1...12}$ /12= 59.43 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.2	1.2	1.2	1.19	1.18	1.17	1.17	1.17	1.18	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 1.69 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.4 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.84	78.86	75.89	72.91	69.93	66.96	66.96	69.93	72.91	75.89	78.86	81.84	

Total = Sum(44)$_{1...12}$ = 892.78 (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=	121.36	106.14	109.53	95.49	91.63	79.07	73.27	84.08	85.08	99.15	108.23	117.53	

Total = Sum(45)$_{1...12}$ = 1170.57 (45)

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

(46)m=	18.2	15.92	16.43	14.32	13.74	11.86	10.99	12.61	12.76	14.87	16.23	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	

Output from water heater (annual)$_{1...12}$ — 1762.02 — (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=	80.54	71.59	76.61	70.64	70.65	65.18	64.55	68.14	67.18	73.15	74.88	79.27	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	(66)

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

(67)m=	13.15	11.68	9.5	7.19	5.37	4.54	4.9	6.37	8.55	10.86	12.67	13.51	(67)

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

(68)m=	147.45	148.98	145.12	136.92	126.55	116.82	110.31	108.78	112.64	120.84	131.21	140.94	(68)

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

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	(71)

Water heating gains (Table 5)

(72)m=	108.25	106.53	102.96	98.11	94.96	90.53	86.76	91.59	93.3	98.33	104	106.54	(72)

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

(73)m=	317.23	315.58	305.97	290.6	275.28	260.27	250.36	255.13	262.88	278.42	296.26	309.38	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(76)
East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(76)
East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)
East	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(76)
South	0.9x	0.77	x	6.48	x	46.75	x	0.76	x	0.7	=	111.69	(78)
South	0.9x	0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x	0.77	x	6.48	x	76.57	x	0.76	x	0.7	=	182.92	(78)
South	0.9x	0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x	0.77	x	6.48	x	97.53	x	0.76	x	0.7	=	233.01	(78)
South	0.9x	0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x	0.77	x	6.48	x	110.23	x	0.76	x	0.7	=	263.35	(78)
South	0.9x	0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x	0.77	x	6.48	x	114.87	x	0.76	x	0.7	=	274.43	(78)
South	0.9x	0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x	0.77	x	6.48	x	110.55	x	0.76	x	0.7	=	264.1	(78)
South	0.9x	0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x	0.77	x	6.48	x	108.01	x	0.76	x	0.7	=	258.04	(78)
South	0.9x	0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	6.48	x	104.89	x	0.76	x	0.7	=	250.6	(78)
South	0.9x	0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	6.48	x	101.89	x	0.76	x	0.7	=	243.41	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	6.48	x	82.59	x	0.76	x	0.7	=	197.3	(78)
South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	6.48	x	55.42	x	0.76	x	0.7	=	132.39	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	6.48	x	40.4	x	0.76	x	0.7	=	96.51	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	53.62	(78)

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

(83)m=	210.24	355.94	480.03	581.13	637.03	625.94	606.2	565.73	515.37	391.62	251.45	180.14	(83)

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

(84)m=	527.47	671.51	786	871.73	912.31	886.21	856.56	820.86	778.25	670.04	547.71	489.52	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.87	0.74	0.58	0.42	0.3	0.33	0.51	0.79	0.95	0.98	(86)

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

(87)m=	20.09	20.38	20.65	20.87	20.96	20.99	21	21	20.98	20.84	20.43	20.03	(87)

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

(88)m=	19.92	19.92	19.92	19.93	19.93	19.94	19.94	19.94	19.94	19.93	19.93	19.93	(88)

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

(89)m=	0.97	0.93	0.84	0.7	0.52	0.35	0.23	0.25	0.44	0.74	0.94	0.98	(89)

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

(90)m=	18.75	19.15	19.53	19.8	19.9	19.94	19.94	19.94	19.93	19.78	19.24	18.67	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.37	19.72	20.05	20.29	20.39	20.43	20.43	20.43	20.42	20.27	19.79	19.3	(92)

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

(93)m=	19.37	19.72	20.05	20.29	20.39	20.43	20.43	20.43	20.42	20.27	19.79	19.3	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.97	0.92	0.84	0.71	0.55	0.38	0.26	0.29	0.47	0.76	0.93	0.98	(94)

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

(95)m=	510.9	619.73	662.63	620.45	501.6	340.8	225.07	236.36	367.57	509.59	511	477.88	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	907.89	890.88	812.72	676.94	515.73	342.73	225.29	236.72	372.8	573.75	755.62	902.34	(97)

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

(98)m=	295.36	182.21	111.66	40.68	10.51	0	0	0	0	47.74	176.12	315.8	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1180.09	(98)
Space heating requirement in kWh/m²/year		23.56	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1180.09	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1239.1	(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		1762.02	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1850.12	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	30.89	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		232.15	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3321.36	(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	=	641.32	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	16.03	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	657.35	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			657.35	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.49	(379)
Total CO2, kg/year	sum of (376)…(382) =			777.84	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.53	(384)
EI rating (section 14)				89.04	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 8

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.21	(1a) x	2.6	(2a) =	224.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.21	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		224.15	(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) =	0.13 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.33 (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) =		0.28 (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

0.36	0.35	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

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=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 4			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 5			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Walls Type1	59.67	23.04	36.63	x	0.15	=	5.49			(29)
Walls Type2	10.27	1.99	8.28	x	0.14	=	1.17			(29)
Walls Type3	12.22	0	12.22	x	0.13	=	1.61			(29)
Total area of elements, m²			82.16							(31)
Party wall			21.84	x	0	=	0			(32)
Party wall			15.34	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) = 41.61 (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 11.86 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 53.47 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.83	41.64	41.45	40.59	40.43	39.67	39.67	39.53	39.96	40.43	40.75	41.1	(38)

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

(39)m=	95.3	95.11	94.93	94.06	93.9	93.15	93.15	93.01	93.44	93.9	94.23	94.57	

Average = Sum(39)$_{1...12}$ /12= 94.06 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.09 (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 2.57 (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 95.24 (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=	104.77	100.96	97.15	93.34	89.53	85.72	85.72	89.53	93.34	97.15	100.96	104.77	

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

Total = Sum(44)$_{1...12}$ = 1142.92 (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=	155.37	135.89	140.22	122.25	117.3	101.22	93.8	107.63	108.92	126.93	138.56	150.47	

Total = Sum(45)$_{1...12}$ = 1498.55 (45)

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

(46)m=	23.31	20.38	21.03	18.34	17.6	15.18	14.07	16.14	16.34	19.04	20.78	22.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	208.39	183.78	193.24	173.56	170.32	152.53	146.82	160.66	160.23	179.96	189.87	203.49	(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=	208.39	183.78	193.24	173.56	170.32	152.53	146.82	160.66	160.23	179.96	189.87	203.49	

Output from water heater (annual)$_{1...12}$ | 2122.85 | (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=	94.08	83.49	89.04	81.7	81.42	74.71	73.61	78.21	77.27	84.62	87.12	92.45	(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=	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	(66)

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

(67)m=	20.68	18.37	14.94	11.31	8.45	7.14	7.71	10.02	13.45	17.08	19.94	21.25	(67)

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

(68)m=	231.94	234.34	228.28	215.37	199.07	183.75	173.52	171.11	177.17	190.09	206.38	221.7	(68)

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

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(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=	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	(71)

Water heating gains (Table 5)

(72)m=	126.45	124.25	119.68	113.47	109.44	103.76	98.93	105.12	107.31	113.74	121	124.26	(72)

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

(73)m=	440.62	438.51	424.45	401.7	378.51	356.2	341.71	347.8	359.49	382.46	408.87	428.77	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	6.48	x	46.75	x	0.76	x	0.7	=	111.69	(78)
South	0.9x 0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	124.1	(78)
South	0.9x 0.77	x	2.16	x	46.75	x	0.76	x	0.7	=	74.46	(78)
South	0.9x 0.77	x	6.48	x	76.57	x	0.76	x	0.7	=	182.92	(78)
South	0.9x 0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	203.25	(78)
South	0.9x 0.77	x	2.16	x	76.57	x	0.76	x	0.7	=	121.95	(78)
South	0.9x 0.77	x	6.48	x	97.53	x	0.76	x	0.7	=	233.01	(78)
South	0.9x 0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	258.9	(78)
South	0.9x 0.77	x	2.16	x	97.53	x	0.76	x	0.7	=	155.34	(78)
South	0.9x 0.77	x	6.48	x	110.23	x	0.76	x	0.7	=	263.35	(78)
South	0.9x 0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	292.61	(78)
South	0.9x 0.77	x	2.16	x	110.23	x	0.76	x	0.7	=	175.57	(78)
South	0.9x 0.77	x	6.48	x	114.87	x	0.76	x	0.7	=	274.43	(78)
South	0.9x 0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	304.92	(78)
South	0.9x 0.77	x	2.16	x	114.87	x	0.76	x	0.7	=	182.95	(78)
South	0.9x 0.77	x	6.48	x	110.55	x	0.76	x	0.7	=	264.1	(78)
South	0.9x 0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	293.45	(78)
South	0.9x 0.77	x	2.16	x	110.55	x	0.76	x	0.7	=	176.07	(78)
South	0.9x 0.77	x	6.48	x	108.01	x	0.76	x	0.7	=	258.04	(78)
South	0.9x 0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	286.71	(78)
South	0.9x 0.77	x	2.16	x	108.01	x	0.76	x	0.7	=	172.03	(78)
South	0.9x 0.77	x	6.48	x	104.89	x	0.76	x	0.7	=	250.6	(78)
South	0.9x 0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	278.44	(78)
South	0.9x 0.77	x	2.16	x	104.89	x	0.76	x	0.7	=	167.06	(78)
South	0.9x 0.77	x	6.48	x	101.89	x	0.76	x	0.7	=	243.41	(78)
South	0.9x 0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	270.45	(78)
South	0.9x 0.77	x	2.16	x	101.89	x	0.76	x	0.7	=	162.27	(78)
South	0.9x 0.77	x	6.48	x	82.59	x	0.76	x	0.7	=	197.3	(78)
South	0.9x 0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	219.22	(78)
South	0.9x 0.77	x	2.16	x	82.59	x	0.76	x	0.7	=	131.53	(78)
South	0.9x 0.77	x	6.48	x	55.42	x	0.76	x	0.7	=	132.39	(78)
South	0.9x 0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	147.1	(78)
South	0.9x 0.77	x	2.16	x	55.42	x	0.76	x	0.7	=	88.26	(78)
South	0.9x 0.77	x	6.48	x	40.4	x	0.76	x	0.7	=	96.51	(78)
South	0.9x 0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	107.24	(78)
South	0.9x 0.77	x	2.16	x	40.4	x	0.76	x	0.7	=	64.34	(78)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(80)
West	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(80)
West	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(80)
West	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(80)

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

(83)m=	346.75	579.51	764.82	903	972.44	948.73	921.58	872.02	812.87	632.76	413.26	298.1	(83)

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

(84)m=	787.36	1018.02	1189.27	1304.7	1350.95	1304.93	1263.3	1219.82	1172.36	1015.22	822.13	726.86	(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	0.96	0.89	0.78	0.62	0.45	0.32	0.35	0.54	0.82	0.97	0.99	(86)

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

(87)m=	20.11	20.39	20.65	20.86	20.96	20.99	21	21	20.99	20.84	20.43	20.04	(87)

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

(88)m=	20	20	20	20.01	20.01	20.02	20.02	20.02	20.01	20.01	20.01	20	(88)

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

(89)m=	0.98	0.94	0.87	0.73	0.56	0.39	0.25	0.28	0.47	0.78	0.95	0.99	(89)

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

(90)m=	18.83	19.24	19.6	19.87	19.98	20.01	20.02	20.02	20.01	19.86	19.31	18.75	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	19.4	19.75	20.07	20.31	20.42	20.45	20.45	20.45	20.44	20.3	19.81	19.33	(92)

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

(93)m=	19.4	19.75	20.07	20.31	20.42	20.45	20.45	20.45	20.44	20.3	19.81	19.33	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.94	0.87	0.75	0.59	0.42	0.28	0.31	0.5	0.79	0.95	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	771.37	958.28	1035.07	976.24	794.19	541.71	358.6	376.52	584.36	803.04	782.36	716.28	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1438.99	1412.14	1288.05	1073.33	818.48	544.87	358.94	377.04	592.5	910.42	1197.56	1430.55	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	496.71	305	188.21	69.91	18.07	0	0	0	0	79.9	298.95	531.42	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1988.15	(98)
Space heating requirement in kWh/m²/year	23.06	(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	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1988.15	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2087.56	(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		2122.85	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2228.99	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.17	(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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		365.17	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4681.72	(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	=	896.12	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.4	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	918.52	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				918.52	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	189.52	(379)
Total CO2, kg/year	sum of (376)…(382) =				1108.04	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				12.85	(384)
EI rating (section 14)					88.68	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 9

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.19	(1a) x	2.6	(2a) =	182.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.19	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		182.5	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36	(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

DER WorkSheet: New dwelling design stage

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

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

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	0.57	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	0.57	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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 5			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Walls Type1	52.65	23.04	29.61	x	0.15	=	4.44			(29)
Walls Type2	10.27	1.99	8.28	x	0.14	=	1.17			(29)
Walls Type3	5.2	0	5.2	x	0.13	=	0.69			(29)
Roof	25.7	0	25.7	x	0.13	=	3.34			(30)
Total area of elements, m²			93.82							(31)
Party wall			21.84	x	0	=	0			(32)
Party wall			16.9	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) = 42.97 (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 18.19 (36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 61.16 (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=	34.81	34.63	34.45	33.61	33.45	32.72	32.72	32.58	33	33.45	33.77	34.1	(38)

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

(39)m=	95.97	95.79	95.61	94.77	94.61	93.88	93.88	93.75	94.16	94.61	94.93	95.26	

Average = Sum(39)$_{1...12}$ /12= 94.77 (39)

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

(40)m=	1.37	1.36	1.36	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.35	1.36	

Average = Sum(40)$_{1...12}$ /12= 1.35 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.66 (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=	96.42	92.92	89.41	85.9	82.4	78.89	78.89	82.4	85.9	89.41	92.92	96.42	

Total = Sum(44)$_{1...12}$ = 1051.88 (44)

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

(45)m=	142.99	125.06	129.05	112.51	107.96	93.16	86.32	99.06	100.24	116.82	127.52	138.48	

Total = Sum(45)$_{1...12}$ = 1379.18 (45)

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

(46)m=	21.45	18.76	19.36	16.88	16.19	13.97	12.95	14.86	15.04	17.52	19.13	20.77	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	(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=	193.22	170.43	179.28	161.12	158.19	141.77	136.56	149.29	148.85	167.05	176.13	188.71	

Output from water heater (annual)$_{1...12}$ | 1970.62 | (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=	87.73	77.88	83.1	76.3	76.08	69.86	68.89	73.12	72.22	79.03	81.29	86.23	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	112.54	(66)

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

(67)m=	17.63	15.66	12.73	9.64	7.21	6.08	6.57	8.55	11.47	14.56	17	18.12	(67)

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

(68)m=	197.75	199.8	194.63	183.62	169.72	156.66	147.94	145.89	151.06	162.07	175.96	189.02	(68)

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

(69)m=	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	(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=	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	-90.03	(71)

Water heating gains (Table 5)

(72)m=	117.92	115.89	111.69	105.97	102.26	97.03	92.59	98.28	100.31	106.22	112.9	115.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	390.06	388.11	375.81	355.99	335.95	316.54	303.87	309.48	319.59	339.61	362.62	379.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.48	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	28.23	(74)
North	0.9x 0.77	x	2.16	x	10.63	x	0.76	x	0.7	=	16.94	(74)
North	0.9x 0.77	x	6.48	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	53.94	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.76	x	0.7	=	32.36	(74)
North	0.9x 0.77	x	6.48	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	91.66	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.76	x	0.7	=	55	(74)
North	0.9x 0.77	x	6.48	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	147.23	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.76	x	0.7	=	88.34	(74)
North	0.9x 0.77	x	6.48	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	198.33	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.76	x	0.7	=	119	(74)
North	0.9x 0.77	x	6.48	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	212.32	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.76	x	0.7	=	127.39	(74)
North	0.9x 0.77	x	6.48	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	198.23	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.76	x	0.7	=	118.94	(74)
North	0.9x 0.77	x	6.48	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	157.27	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.76	x	0.7	=	94.36	(74)
North	0.9x 0.77	x	6.48	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	110.2	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.76	x	0.7	=	66.12	(74)
North	0.9x 0.77	x	6.48	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	64.21	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.76	x	0.7	=	38.53	(74)
North	0.9x 0.77	x	6.48	x	13.12	x	0.76	x	0.7	=	31.34	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	34.82	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.76	x	0.7	=	20.89	(74)
North	0.9x 0.77	x	6.48	x	8.86	x	0.76	x	0.7	=	21.18	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	23.53	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.76	x	0.7	=	14.12	(74)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(80)
West	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(80)
West	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(80)
West	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	107.06	206.24	346.72	539.54	705.97	745.91	700.37	569.09	412.25	245.24	132.55	88.84	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	497.11	594.36	722.53	895.53	1041.92	1062.46	1004.23	878.57	731.84	584.85	495.18	468.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.74	0.55	0.41	0.48	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.57	19.77	20.12	20.56	20.86	20.97	20.99	20.99	20.88	20.45	19.93	19.54	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.8	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.87	0.67	0.45	0.3	0.36	0.67	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=	17.92	18.21	18.71	19.32	19.68	19.8	19.81	19.81	19.72	19.19	18.45	17.87	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=	18.73	18.98	19.4	19.93	20.26	20.37	20.39	20.39	20.29	19.81	19.18	18.69	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.73	18.98	19.4	19.93	20.26	20.37	20.39	20.39	20.29	19.81	19.18	18.69	(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=	0.99	0.98	0.96	0.87	0.7	0.5	0.35	0.42	0.71	0.94	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	493.54	585.15	692.38	781.67	730.86	528.55	353.73	369.13	522.51	547.81	488.24	466	(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=	1385.11	1348.39	1233.44	1045.32	810.06	542.08	355.99	373.91	583.28	871.55	1146.41	1380.5	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	663.33	512.9	402.55	189.82	58.93	0	0	0	0	240.86	473.88	680.39	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3222.67	(98)
Space heating requirement in kWh/m²/year	45.91	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		3222.67	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3383.8	(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		1970.62	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2069.16	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	54.53	(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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		311.34	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5764.29	(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	=	1132.03	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	28.3	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1160.33	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1160.33	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	161.58	(379)
Total CO2, kg/year	sum of (376)…(382) =				1321.92	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				18.83	(384)
EI rating (section 14)					84.62	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.08	(1a) x	2.6	(2a) =	130.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.08	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.22	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3	(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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

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=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 4			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Roof	17.1	0	17.1	x	0.13	=	2.22			(30)
Total area of elements, m²			74.82							(31)
Party wall			23.4	x	0	=	0			(32)
Party wall			11.44	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) = 30.8 (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 11.79 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 42.59 (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	
(38)m=	24.64	24.52	24.4	23.83	23.73	23.24	23.24	23.15	23.43	23.73	23.94	24.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.23	67.11	66.99	66.42	66.32	65.82	65.82	65.73	66.01	66.32	66.53	66.75	

Average = Sum(39)$_{1...12}$ /12= 66.42 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.34	1.34	1.34	1.33	1.32	1.31	1.31	1.31	1.32	1.32	1.33	1.33	

Average = Sum(40)$_{1...12}$ /12= 1.33 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.4 (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=	81.84	78.86	75.89	72.91	69.93	66.96	66.96	69.93	72.91	75.89	78.86	81.84	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 892.78 (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=	121.36	106.14	109.53	95.49	91.63	79.07	73.27	84.08	85.08	99.15	108.23	117.53	

Total = Sum(45)$_{1...12}$ = 1170.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.2	15.92	16.43	14.32	13.74	11.86	10.99	12.61	12.76	14.87	16.23	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	

Output from water heater (annual)$_{1...12}$ | 1762.02 | (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=	80.54	71.59	76.61	70.64	70.65	65.18	64.55	68.14	67.18	73.15	74.88	79.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.15	11.68	9.5	7.19	5.37	4.54	4.9	6.37	8.55	10.86	12.67	13.51	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.45	148.98	145.12	136.92	126.55	116.82	110.31	108.78	112.64	120.84	131.21	140.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	(71)

Water heating gains (Table 5)

(72)m=	108.25	106.53	102.96	98.11	94.96	90.53	86.76	91.59	93.3	98.33	104	106.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	317.23	315.58	305.97	290.6	275.28	260.27	250.36	255.13	262.88	278.42	296.26	309.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.48	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x 0.77	x	6.48	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x 0.77	x	6.48	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x 0.77	x	6.48	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x 0.77	x	6.48	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x 0.77	x	6.48	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x 0.77	x	6.48	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x 0.77	x	6.48	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x 0.77	x	6.48	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x 0.77	x	6.48	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x 0.77	x	6.48	x	13.12	x	0.76	x	0.7	=	31.34	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x 0.77	x	6.48	x	8.86	x	0.76	x	0.7	=	21.18	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)
West	0.9x 0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(80)
West	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x 0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(80)
West	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x 0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(80)
West	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x 0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(80)
West	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x 0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(80)
West	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x 0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(80)
West	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26		(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67		(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07		(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51		(80)
West	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2		(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5		(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13		(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44		(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	76.01	146.91	245.89	377.59	487.8	512.36	482.32	396.09	291.02	174.6	94.25	62.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	393.24	462.48	551.86	668.19	763.08	772.63	732.67	651.22	553.9	453.02	390.52	372.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.88	0.72	0.53	0.39	0.46	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=	19.67	19.87	20.2	20.61	20.88	20.98	21	20.99	20.91	20.52	20.02	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.81	19.81	19.81	19.82	19.82	19.83	19.83	19.83	19.83	19.82	19.82	19.82	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.65	0.44	0.29	0.34	0.64	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=	18.08	18.36	18.84	19.4	19.72	19.82	19.83	19.83	19.76	19.3	18.59	18.03	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.81	19.06	19.47	19.96	20.26	20.35	20.37	20.36	20.29	19.86	19.25	18.77	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.81	19.06	19.47	19.96	20.26	20.35	20.37	20.36	20.29	19.86	19.25	18.77	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.85	0.68	0.48	0.34	0.4	0.68	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	389.1	452.69	522.84	570.92	519.59	370.81	246.74	258.13	375.26	415.81	382.64	369.19	(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=	975.76	950	868.71	734.69	567.34	378.64	247.97	260.62	408.69	614.37	808.35	972.66	(97)

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	436.48	334.19	257.33	117.92	35.52	0	0	0	0	147.73	306.51	448.98

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2084.66 (98)

Space heating requirement in kWh/m²/year 41.62 (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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		2084.66	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2188.89	(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		1762.02	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1850.12	(310a)
Electricity used for heat distribution	0.01 × [(307a)...(307e) + (310a)...(310e)] =	40.39	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		232.15	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4271.16	(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)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	838.5	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	20.96	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	859.46	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			859.46	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.49	(379)
Total CO2, kg/year	sum of (376)…(382) =			979.95	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			19.57	(384)
EI rating (section 14)				86.19	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.08	(1a) x	2.6	(2a) =	130.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.08	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.22	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.3	(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

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

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=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 4			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Walls Type1	35.88	15.12	20.76	x	0.15	=	3.11			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	18.98	0	18.98	x	0.13	=	2.51			(29)
Roof	17.4	0	17.4	x	0.13	=	2.26			(30)
Total area of elements, m²			75.12							(31)
Party wall			23.4	x	0	=	0			(32)
Party wall			11.44	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) = 30.84 (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 12.95 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 43.79 (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=	24.64	24.52	24.4	23.83	23.73	23.24	23.24	23.15	23.43	23.73	23.94	24.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.43	68.31	68.19	67.63	67.52	67.03	67.03	66.94	67.22	67.52	67.73	67.96	

Average = Sum(39)$_{1...12}$ /12= 67.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.37	1.36	1.36	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.35	1.36	

Average = Sum(40)$_{1...12}$ /12= 1.35 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.4 (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=	81.84	78.86	75.89	72.91	69.93	66.96	66.96	69.93	72.91	75.89	78.86	81.84	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 892.78 (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=	121.36	106.14	109.53	95.49	91.63	79.07	73.27	84.08	85.08	99.15	108.23	117.53	

Total = Sum(45)$_{1...12}$ = 1170.57 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.2	15.92	16.43	14.32	13.74	11.86	10.99	12.61	12.76	14.87	16.23	17.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.6	151.52	159.76	144.1	141.86	127.68	123.5	134.31	133.69	149.38	156.84	167.77	

Output from water heater (annual)$_{1...12}$ | 1762.02 | (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=	80.54	71.59	76.61	70.64	70.65	65.18	64.55	68.14	67.18	73.15	74.88	79.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	84.63	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.15	11.68	9.5	7.19	5.37	4.54	4.9	6.37	8.55	10.86	12.67	13.51	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.45	148.98	145.12	136.92	126.55	116.82	110.31	108.78	112.64	120.84	131.21	140.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	31.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	-67.7	(71)

Water heating gains (Table 5)

(72)m=	108.25	106.53	102.96	98.11	94.96	90.53	86.76	91.59	93.3	98.33	104	106.54	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	317.23	315.58	305.97	290.6	275.28	260.27	250.36	255.13	262.88	278.42	296.26	309.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(76)
East	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x 0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(76)
East	0.9x 0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x 0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(76)
East	0.9x 0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x 0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(76)
East	0.9x 0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x 0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(76)
East	0.9x 0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x 0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(76)
East	0.9x 0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x 0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(76)
East	0.9x 0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x 0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(76)
East	0.9x 0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x 0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(76)
East	0.9x 0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x 0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(76)
East	0.9x 0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x 0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(76)
East	0.9x 0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)
East	0.9x 0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(76)
South	0.9x 0.77	x	6.48	x	46.75	x	0.76	x	0.7	=	111.69	(78)
South	0.9x 0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x 0.77	x	6.48	x	76.57	x	0.76	x	0.7	=	182.92	(78)
South	0.9x 0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x 0.77	x	6.48	x	97.53	x	0.76	x	0.7	=	233.01	(78)
South	0.9x 0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x 0.77	x	6.48	x	110.23	x	0.76	x	0.7	=	263.35	(78)
South	0.9x 0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x 0.77	x	6.48	x	114.87	x	0.76	x	0.7	=	274.43	(78)
South	0.9x 0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x 0.77	x	6.48	x	110.55	x	0.76	x	0.7	=	264.1	(78)
South	0.9x 0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x 0.77	x	6.48	x	108.01	x	0.76	x	0.7	=	258.04	(78)
South	0.9x 0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x 0.77	x	6.48	x	104.89	x	0.76	x	0.7	=	250.6	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x	0.77	x	6.48	x	101.89	x	0.76	x	0.7	=	243.41	(78)
South	0.9x	0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x	0.77	x	6.48	x	82.59	x	0.76	x	0.7	=	197.3	(78)
South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	6.48	x	55.42	x	0.76	x	0.7	=	132.39	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	6.48	x	40.4	x	0.76	x	0.7	=	96.51	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	53.62	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	210.24	355.94	480.03	581.13	637.03	625.94	606.2	565.73	515.37	391.62	251.45	180.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.47	671.51	786	871.73	912.31	886.21	856.56	820.86	778.25	670.04	547.71	489.52	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.95	0.89	0.79	0.64	0.47	0.34	0.37	0.57	0.83	0.96	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.87	20.17	20.48	20.76	20.92	20.98	21	21	20.96	20.74	20.25	19.81	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.8	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.94	0.87	0.74	0.57	0.39	0.25	0.28	0.48	0.78	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.35	18.77	19.2	19.56	19.74	19.8	19.81	19.81	19.79	19.55	18.89	18.26	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.05	19.42	19.79	20.12	20.29	20.35	20.36	20.36	20.33	20.1	19.52	18.98	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.05	19.42	19.79	20.12	20.29	20.35	20.36	20.36	20.33	20.1	19.52	18.98	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.93	0.87	0.76	0.6	0.43	0.29	0.32	0.52	0.8	0.94	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	512.43	626.97	682.14	658.17	548.77	379.91	251.15	263.79	406.04	534.5	515.97	478.77	(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=	1009.54	991.53	906.46	758.55	579.7	385.27	251.91	264.94	418.74	641.4	841.2	1004.23	(97)

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	369.85	244.99	166.89	72.27	23.01	0	0	0	0	79.53	234.17	390.94

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1581.66 (98)

Space heating requirement in kWh/m²/year 31.58 (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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		1581.66	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1660.74	(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		1762.02	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1850.12	(310a)
Electricity used for heat distribution	0.01 × [(307a)...(307e) + (310a)...(310e)] =	35.11	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		232.15	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3743	(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)

DER WorkSheet: New dwelling design stage

CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	728.85	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	18.22	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	747.07	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			747.07	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.49	(379)
Total CO2, kg/year	sum of (376)…(382) =			867.56	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.32	(384)
EI rating (section 14)				87.77	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.21	(1a) x	2.6	(2a) =	224.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.21	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		224.15	(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) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.33 (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) =		0.28 (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

0.36	0.35	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

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=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 4			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 5			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Walls Type1	59.67	23.04	36.63	x	0.15	=	5.49			(29)
Walls Type2	10.27	1.99	8.28	x	0.14	=	1.17			(29)
Walls Type3	12.22	0	12.22	x	0.13	=	1.61			(29)
Roof	31.13	0	31.13	x	0.13	=	4.05			(30)
Total area of elements, m²			113.29							(31)
Party wall			21.84	x	0	=	0			(32)
Party wall			15.34	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) = 45.66 (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 17.5 (36)

DER WorkSheet: New dwelling design stage

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 63.16 (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=	41.83	41.64	41.45	40.59	40.43	39.67	39.67	39.53	39.96	40.43	40.75	41.1	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	104.99	104.8	104.62	103.75	103.59	102.84	102.84	102.7	103.13	103.59	103.92	104.26	

Average = Sum(39)$_{1...12}$ /12= 103.75 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.22	1.22	1.21	1.2	1.2	1.19	1.19	1.19	1.2	1.2	1.21	1.21	

Average = Sum(40)$_{1...12}$ /12= 1.2 (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 2.57 (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 95.24 (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=	104.77	100.96	97.15	93.34	89.53	85.72	85.72	89.53	93.34	97.15	100.96	104.77	

Total = Sum(44)$_{1...12}$ = 1142.92 (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=	155.37	135.89	140.22	122.25	117.3	101.22	93.8	107.63	108.92	126.93	138.56	150.47	

Total = Sum(45)$_{1...12}$ = 1498.55 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.31	20.38	21.03	18.34	17.6	15.18	14.07	16.14	16.34	19.04	20.78	22.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	208.39	183.78	193.24	173.56	170.32	152.53	146.82	160.66	160.23	179.96	189.87	203.49	(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=	208.39	183.78	193.24	173.56	170.32	152.53	146.82	160.66	160.23	179.96	189.87	203.49	

Output from water heater (annual)$_{1...12}$ | 2122.85 | (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=	94.08	83.49	89.04	81.7	81.42	74.71	73.61	78.21	77.27	84.62	87.12	92.45	(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=	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	128.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.68	18.37	14.94	11.31	8.45	7.14	7.71	10.02	13.45	17.08	19.94	21.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	231.94	234.34	228.28	215.37	199.07	183.75	173.52	171.11	177.17	190.09	206.38	221.7	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	35.85	(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=	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	-102.81	(71)

Water heating gains (Table 5)

(72)m=	126.45	124.25	119.68	113.47	109.44	103.76	98.93	105.12	107.31	113.74	121	124.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	440.62	438.51	424.45	401.7	378.51	356.2	341.71	347.8	359.49	382.46	408.87	428.77	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	6.48	x	46.75	x	0.76	x	0.7	=	111.69	(78)
South	0.9x 0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	124.1	(78)
South	0.9x 0.77	x	2.16	x	46.75	x	0.76	x	0.7	=	74.46	(78)
South	0.9x 0.77	x	6.48	x	76.57	x	0.76	x	0.7	=	182.92	(78)
South	0.9x 0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	203.25	(78)
South	0.9x 0.77	x	2.16	x	76.57	x	0.76	x	0.7	=	121.95	(78)
South	0.9x 0.77	x	6.48	x	97.53	x	0.76	x	0.7	=	233.01	(78)
South	0.9x 0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	258.9	(78)
South	0.9x 0.77	x	2.16	x	97.53	x	0.76	x	0.7	=	155.34	(78)
South	0.9x 0.77	x	6.48	x	110.23	x	0.76	x	0.7	=	263.35	(78)
South	0.9x 0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	292.61	(78)
South	0.9x 0.77	x	2.16	x	110.23	x	0.76	x	0.7	=	175.57	(78)
South	0.9x 0.77	x	6.48	x	114.87	x	0.76	x	0.7	=	274.43	(78)
South	0.9x 0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	304.92	(78)
South	0.9x 0.77	x	2.16	x	114.87	x	0.76	x	0.7	=	182.95	(78)
South	0.9x 0.77	x	6.48	x	110.55	x	0.76	x	0.7	=	264.1	(78)
South	0.9x 0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	293.45	(78)
South	0.9x 0.77	x	2.16	x	110.55	x	0.76	x	0.7	=	176.07	(78)
South	0.9x 0.77	x	6.48	x	108.01	x	0.76	x	0.7	=	258.04	(78)
South	0.9x 0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	286.71	(78)
South	0.9x 0.77	x	2.16	x	108.01	x	0.76	x	0.7	=	172.03	(78)
South	0.9x 0.77	x	6.48	x	104.89	x	0.76	x	0.7	=	250.6	(78)
South	0.9x 0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	278.44	(78)
South	0.9x 0.77	x	2.16	x	104.89	x	0.76	x	0.7	=	167.06	(78)
South	0.9x 0.77	x	6.48	x	101.89	x	0.76	x	0.7	=	243.41	(78)
South	0.9x 0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	270.45	(78)
South	0.9x 0.77	x	2.16	x	101.89	x	0.76	x	0.7	=	162.27	(78)
South	0.9x 0.77	x	6.48	x	82.59	x	0.76	x	0.7	=	197.3	(78)
South	0.9x 0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	219.22	(78)
South	0.9x 0.77	x	2.16	x	82.59	x	0.76	x	0.7	=	131.53	(78)
South	0.9x 0.77	x	6.48	x	55.42	x	0.76	x	0.7	=	132.39	(78)
South	0.9x 0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	147.1	(78)
South	0.9x 0.77	x	2.16	x	55.42	x	0.76	x	0.7	=	88.26	(78)
South	0.9x 0.77	x	6.48	x	40.4	x	0.76	x	0.7	=	96.51	(78)
South	0.9x 0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	107.24	(78)
South	0.9x 0.77	x	2.16	x	40.4	x	0.76	x	0.7	=	64.34	(78)
West	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(80)
West	0.9x 0.77	x	1.44	x	19.64	x	0.76	x	0.7	=	10.43	(80)
West	0.9x 0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.44	x	38.42	x	0.76	x	0.7	=	20.4	(80)
West	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(80)
West	0.9x	0.77	x	1.44	x	63.27	x	0.76	x	0.7	=	33.59	(80)
West	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(80)
West	0.9x	0.77	x	1.44	x	92.28	x	0.76	x	0.7	=	48.99	(80)
West	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(80)
West	0.9x	0.77	x	1.44	x	113.09	x	0.76	x	0.7	=	60.04	(80)
West	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(80)
West	0.9x	0.77	x	1.44	x	115.77	x	0.76	x	0.7	=	61.46	(80)
West	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(80)
West	0.9x	0.77	x	1.44	x	110.22	x	0.76	x	0.7	=	58.51	(80)
West	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(80)
West	0.9x	0.77	x	1.44	x	94.68	x	0.76	x	0.7	=	50.26	(80)
West	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(80)
West	0.9x	0.77	x	1.44	x	73.59	x	0.76	x	0.7	=	39.07	(80)
West	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(80)
West	0.9x	0.77	x	1.44	x	45.59	x	0.76	x	0.7	=	24.2	(80)
West	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(80)
West	0.9x	0.77	x	1.44	x	24.49	x	0.76	x	0.7	=	13	(80)
West	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(80)
West	0.9x	0.77	x	1.44	x	16.15	x	0.76	x	0.7	=	8.57	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	346.75	579.51	764.82	903	972.44	948.73	921.58	872.02	812.87	632.76	413.26	298.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	787.36	1018.02	1189.27	1304.7	1350.95	1304.93	1263.3	1219.82	1172.36	1015.22	822.13	726.86	(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	0.96	0.91	0.81	0.67	0.5	0.36	0.38	0.58	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.95	20.24	20.53	20.79	20.93	20.99	21	21	20.97	20.77	20.3	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.91	19.91	19.92	19.92	19.93	19.93	19.93	19.92	19.92	19.92	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.95	0.89	0.77	0.6	0.42	0.27	0.3	0.5	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=	18.55	18.96	19.36	19.7	19.86	19.92	19.93	19.93	19.9	19.69	19.06	18.46	(90)

fLA = Living area ÷ (4) = 0.44 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=	19.17	19.53	19.88	20.18	20.34	20.39	20.4	20.4	20.38	20.17	19.61	19.1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.17	19.53	19.88	20.18	20.34	20.39	20.4	20.4	20.38	20.17	19.61	19.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.95	0.89	0.78	0.63	0.45	0.31	0.34	0.54	0.82	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	772.5	965.36	1056.13	1019.19	849.87	588.68	390.11	409.67	630.96	831.62	786.85	716.85	(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=	1561.19	1532.93	1400.19	1170.68	894.83	595.8	390.99	411.01	647.56	991.39	1300.25	1553.07	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	586.79	381.4	255.98	109.08	33.45	0	0	0	0	118.87	369.65	622.15	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2477.35 (98)

Space heating requirement in kWh/m²/year 28.74 (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 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 2477.35

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 2601.22 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 2122.85

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 2228.99 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 48.3 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		365.17	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5195.38	(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	=	1002.75	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.07	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1027.82	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1027.82	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	189.52	(379)
Total CO2, kg/year	sum of (376)…(382) =				1217.34	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.12	(384)
EI rating (section 14)					87.57	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 13

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	87.79	(1a) x	2.6	(2a) =	228.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.79	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		228.24	(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) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.33 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31 (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

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.34	0.36

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	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56

(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			7.2	x1/[1/(1.4)+ 0.04]		=	9.55			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Windows Type 4			7.2	x1/[1/(1.4)+ 0.04]		=	9.55			(27)
Windows Type 5			7.2	x1/[1/(1.4)+ 0.04]		=	9.55			(27)
Walls Type1	75.02	32.4	42.62	x	0.15	=	6.39			(29)
Walls Type2	5.85	1.99	3.86	x	0.14	=	0.55			(29)
Walls Type3	28.47	0	28.47	x	0.13	=	3.76			(29)
Roof	87.79	0	87.79	x	0.13	=	11.41			(30)
Total area of elements, m²			197.12							(31)
Party wall			16.33	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) = 67.85 (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 23.13 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 90.99 (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=	43.41	43.19	42.97	41.94	41.75	40.85	40.85	40.69	41.2	41.75	42.14	42.55	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	134.4	134.18	133.96	132.93	132.74	131.84	131.84	131.67	132.18	132.74	133.13	133.53	

Average = Sum(39)$_{1...12}$ /12= 132.93 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.53	1.53	1.53	1.51	1.51	1.5	1.5	1.5	1.51	1.51	1.52	1.52	

Average = Sum(40)$_{1...12}$ /12= 1.51 (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 2.59 (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 95.81 (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=	105.39	101.56	97.73	93.9	90.06	86.23	86.23	90.06	93.9	97.73	101.56	105.39	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1149.74 (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=	156.29	136.7	141.06	122.98	118	101.83	94.36	108.27	109.57	127.69	139.38	151.36	

Total = Sum(45)$_{1...12}$ = 1507.49 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.44	20.5	21.16	18.45	17.7	15.27	14.15	16.24	16.44	19.15	20.91	22.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	209.32	184.59	194.08	174.29	171.02	153.14	147.38	161.3	160.88	180.71	190.7	204.39	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	209.32	184.59	194.08	174.29	171.02	153.14	147.38	161.3	160.88	180.71	190.7	204.39	

Output from water heater (annual)$_{1...12}$ | 2131.79 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	94.39	83.76	89.32	81.94	81.65	74.91	73.79	78.42	77.48	84.88	87.4	92.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.95	18.6	15.13	11.45	8.56	7.23	7.81	10.15	13.63	17.3	20.19	21.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	234.94	237.38	231.24	218.16	201.65	186.13	175.77	173.33	179.47	192.55	209.06	224.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	(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=	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	(71)

Water heating gains (Table 5)

(72)m=	126.86	124.65	120.05	113.81	109.75	104.04	99.18	105.4	107.61	114.08	121.38	124.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	444.66	442.55	428.33	405.33	381.87	359.31	344.67	350.79	362.62	385.84	412.55	432.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	28.23	(74)
North	0.9x 0.77	x	1.8	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x 0.77	x	7.2	x	10.63	x	0.76	x	0.7	=	28.23	(74)
North	0.9x 0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	53.94	(74)
North	0.9x 0.77	x	1.8	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x 0.77	x	7.2	x	20.32	x	0.76	x	0.7	=	53.94	(74)
North	0.9x 0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	91.66	(74)
North	0.9x 0.77	x	1.8	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x 0.77	x	7.2	x	34.53	x	0.76	x	0.7	=	91.66	(74)
North	0.9x 0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	147.23	(74)
North	0.9x 0.77	x	1.8	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x 0.77	x	7.2	x	55.46	x	0.76	x	0.7	=	147.23	(74)
North	0.9x 0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	198.33	(74)
North	0.9x 0.77	x	1.8	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x 0.77	x	7.2	x	74.72	x	0.76	x	0.7	=	198.33	(74)
North	0.9x 0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	212.32	(74)
North	0.9x 0.77	x	1.8	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x 0.77	x	7.2	x	79.99	x	0.76	x	0.7	=	212.32	(74)
North	0.9x 0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	198.23	(74)
North	0.9x 0.77	x	1.8	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x 0.77	x	7.2	x	74.68	x	0.76	x	0.7	=	198.23	(74)
North	0.9x 0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	157.27	(74)
North	0.9x 0.77	x	1.8	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x 0.77	x	7.2	x	59.25	x	0.76	x	0.7	=	157.27	(74)
North	0.9x 0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	110.2	(74)
North	0.9x 0.77	x	1.8	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x 0.77	x	7.2	x	41.52	x	0.76	x	0.7	=	110.2	(74)
North	0.9x 0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	64.21	(74)
North	0.9x 0.77	x	1.8	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x 0.77	x	7.2	x	24.19	x	0.76	x	0.7	=	64.21	(74)
North	0.9x 0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	34.82	(74)
North	0.9x 0.77	x	1.8	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x 0.77	x	7.2	x	13.12	x	0.76	x	0.7	=	34.82	(74)
North	0.9x 0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	23.53	(74)
North	0.9x 0.77	x	1.8	x	8.86	x	0.76	x	0.7	=	11.77	(74)
North	0.9x 0.77	x	7.2	x	8.86	x	0.76	x	0.7	=	23.53	(74)
East	0.9x 0.77	x	7.2	x	19.64	x	0.76	x	0.7	=	52.13	(76)
East	0.9x 0.77	x	7.2	x	38.42	x	0.76	x	0.7	=	101.99	(76)
East	0.9x 0.77	x	7.2	x	63.27	x	0.76	x	0.7	=	167.96	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	7.2	x	92.28	x	0.76	x	0.7	=	244.95	(76)
East	0.9x	0.77	x	7.2	x	113.09	x	0.76	x	0.7	=	300.2	(76)
East	0.9x	0.77	x	7.2	x	115.77	x	0.76	x	0.7	=	307.31	(76)
East	0.9x	0.77	x	7.2	x	110.22	x	0.76	x	0.7	=	292.57	(76)
East	0.9x	0.77	x	7.2	x	94.68	x	0.76	x	0.7	=	251.31	(76)
East	0.9x	0.77	x	7.2	x	73.59	x	0.76	x	0.7	=	195.34	(76)
East	0.9x	0.77	x	7.2	x	45.59	x	0.76	x	0.7	=	121.01	(76)
East	0.9x	0.77	x	7.2	x	24.49	x	0.76	x	0.7	=	65.01	(76)
East	0.9x	0.77	x	7.2	x	16.15	x	0.76	x	0.7	=	42.87	(76)
West	0.9x	0.77	x	7.2	x	19.64	x	0.76	x	0.7	=	52.13	(80)
West	0.9x	0.77	x	7.2	x	38.42	x	0.76	x	0.7	=	101.99	(80)
West	0.9x	0.77	x	7.2	x	63.27	x	0.76	x	0.7	=	167.96	(80)
West	0.9x	0.77	x	7.2	x	92.28	x	0.76	x	0.7	=	244.95	(80)
West	0.9x	0.77	x	7.2	x	113.09	x	0.76	x	0.7	=	300.2	(80)
West	0.9x	0.77	x	7.2	x	115.77	x	0.76	x	0.7	=	307.31	(80)
West	0.9x	0.77	x	7.2	x	110.22	x	0.76	x	0.7	=	292.57	(80)
West	0.9x	0.77	x	7.2	x	94.68	x	0.76	x	0.7	=	251.31	(80)
West	0.9x	0.77	x	7.2	x	73.59	x	0.76	x	0.7	=	195.34	(80)
West	0.9x	0.77	x	7.2	x	45.59	x	0.76	x	0.7	=	121.01	(80)
West	0.9x	0.77	x	7.2	x	24.49	x	0.76	x	0.7	=	65.01	(80)
West	0.9x	0.77	x	7.2	x	16.15	x	0.76	x	0.7	=	42.87	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	174.83	338.83	565.06	857.98	1096.23	1145.41	1080.71	895.8	666.19	402.56	217.06	144.57	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	619.5	781.37	993.39	1263.31	1478.1	1504.72	1425.38	1246.59	1028.81	788.4	629.61	577.25	(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	0.89	0.72	0.54	0.4	0.47	0.75	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.37	19.61	20.02	20.51	20.84	20.96	20.99	20.98	20.86	20.37	19.77	19.33	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.66	19.67	19.67	19.68	19.68	19.69	19.69	19.69	19.68	19.68	19.68	19.67	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.95	0.85	0.65	0.44	0.28	0.34	0.65	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.54	17.89	18.47	19.15	19.54	19.67	19.68	19.68	19.59	18.99	18.13	17.48	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=	18.28	18.58	19.09	19.7	20.06	20.19	20.21	20.21	20.1	19.54	18.79	18.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.28	18.58	19.09	19.7	20.06	20.19	20.21	20.21	20.1	19.54	18.79	18.23	(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	0.48	0.33	0.4	0.69	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	614.7	766.81	941.56	1073.63	997.03	715.8	472.34	493.85	707.18	730.91	619.94	573.82	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1878.7	1836.04	1687	1435.13	1109.81	736.73	475.96	501.15	793.02	1186.96	1556.31	1872.97	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	940.42	718.52	554.61	260.28	83.91	0	0	0	0	339.3	674.19	966.57	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	4537.8	(98)
Space heating requirement in kWh/m²/year	51.69	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		4537.8	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	4764.69	(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		2131.79	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2238.37	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	70.03	(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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		369.9	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		7372.97	(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	=	1453.84	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	36.35	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1490.18	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1490.18	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	191.98	(379)
Total CO2, kg/year	sum of (376)…(382) =				1682.16	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				19.16	(384)
EI rating (section 14)					83.02	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 3 - Flat 14

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	87.79	(1a) x	2.6	(2a) =	228.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.79	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		228.24	(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) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.33 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31 (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

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.34	0.36

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	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			7.2	x1/[1/(1.4)+ 0.04]		=	9.55			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Windows Type 4			7.2	x1/[1/(1.4)+ 0.04]		=	9.55			(27)
Windows Type 5			7.2	x1/[1/(1.4)+ 0.04]		=	9.55			(27)
Walls Type1	75.02	32.4	42.62	x	0.15	=	6.39			(29)
Walls Type2	5.85	1.99	3.86	x	0.14	=	0.55			(29)
Walls Type3	28.47	0	28.47	x	0.13	=	3.76			(29)
Roof	87.79	0	87.79	x	0.13	=	11.41			(30)
Total area of elements, m²			197.12							(31)
Party wall			16.33	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) = 67.85 (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 23.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 91.74 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.41	43.19	42.97	41.94	41.75	40.85	40.85	40.69	41.2	41.75	42.14	42.55	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	135.15	134.93	134.71	133.68	133.49	132.59	132.59	132.43	132.94	133.49	133.88	134.29	

Average = Sum(39)$_{1...12}$ /12= 133.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.54	1.54	1.53	1.52	1.52	1.51	1.51	1.51	1.51	1.52	1.53	1.53	

Average = Sum(40)$_{1...12}$ /12= 1.52 (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 2.59 (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 95.81 (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=	105.39	101.56	97.73	93.9	90.06	86.23	86.23	90.06	93.9	97.73	101.56	105.39	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1149.74 (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=	156.29	136.7	141.06	122.98	118	101.83	94.36	108.27	109.57	127.69	139.38	151.36	

Total = Sum(45)$_{1...12}$ = 1507.49 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.44	20.5	21.16	18.45	17.7	15.27	14.15	16.24	16.44	19.15	20.91	22.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	209.32	184.59	194.08	174.29	171.02	153.14	147.38	161.3	160.88	180.71	190.7	204.39	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	209.32	184.59	194.08	174.29	171.02	153.14	147.38	161.3	160.88	180.71	190.7	204.39	

Output from water heater (annual)$_{1...12}$ | 2131.79 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	94.39	83.76	89.32	81.94	81.65	74.91	73.79	78.42	77.48	84.88	87.4	92.75	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	129.71	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.95	18.6	15.13	11.45	8.56	7.23	7.81	10.15	13.63	17.3	20.19	21.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	234.94	237.38	231.24	218.16	201.65	186.13	175.77	173.33	179.47	192.55	209.06	224.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	35.97	(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=	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	-103.77	(71)

Water heating gains (Table 5)

(72)m=	126.86	124.65	120.05	113.81	109.75	104.04	99.18	105.4	107.61	114.08	121.38	124.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	444.66	442.55	428.33	405.33	381.87	359.31	344.67	350.79	362.62	385.84	412.55	432.68	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	7.2	x	19.64	x	0.76	x	0.7	=	52.13	(76)
East	0.9x 0.77	x	7.2	x	38.42	x	0.76	x	0.7	=	101.99	(76)
East	0.9x 0.77	x	7.2	x	63.27	x	0.76	x	0.7	=	167.96	(76)
East	0.9x 0.77	x	7.2	x	92.28	x	0.76	x	0.7	=	244.95	(76)
East	0.9x 0.77	x	7.2	x	113.09	x	0.76	x	0.7	=	300.2	(76)
East	0.9x 0.77	x	7.2	x	115.77	x	0.76	x	0.7	=	307.31	(76)
East	0.9x 0.77	x	7.2	x	110.22	x	0.76	x	0.7	=	292.57	(76)
East	0.9x 0.77	x	7.2	x	94.68	x	0.76	x	0.7	=	251.31	(76)
East	0.9x 0.77	x	7.2	x	73.59	x	0.76	x	0.7	=	195.34	(76)
East	0.9x 0.77	x	7.2	x	45.59	x	0.76	x	0.7	=	121.01	(76)
East	0.9x 0.77	x	7.2	x	24.49	x	0.76	x	0.7	=	65.01	(76)
East	0.9x 0.77	x	7.2	x	16.15	x	0.76	x	0.7	=	42.87	(76)
South	0.9x 0.77	x	3.6	x	46.75	x	0.76	x	0.7	=	124.1	(78)
South	0.9x 0.77	x	1.8	x	46.75	x	0.76	x	0.7	=	62.05	(78)
South	0.9x 0.77	x	7.2	x	46.75	x	0.76	x	0.7	=	124.1	(78)
South	0.9x 0.77	x	3.6	x	76.57	x	0.76	x	0.7	=	203.25	(78)
South	0.9x 0.77	x	1.8	x	76.57	x	0.76	x	0.7	=	101.62	(78)
South	0.9x 0.77	x	7.2	x	76.57	x	0.76	x	0.7	=	203.25	(78)
South	0.9x 0.77	x	3.6	x	97.53	x	0.76	x	0.7	=	258.9	(78)
South	0.9x 0.77	x	1.8	x	97.53	x	0.76	x	0.7	=	129.45	(78)
South	0.9x 0.77	x	7.2	x	97.53	x	0.76	x	0.7	=	258.9	(78)
South	0.9x 0.77	x	3.6	x	110.23	x	0.76	x	0.7	=	292.61	(78)
South	0.9x 0.77	x	1.8	x	110.23	x	0.76	x	0.7	=	146.31	(78)
South	0.9x 0.77	x	7.2	x	110.23	x	0.76	x	0.7	=	292.61	(78)
South	0.9x 0.77	x	3.6	x	114.87	x	0.76	x	0.7	=	304.92	(78)
South	0.9x 0.77	x	1.8	x	114.87	x	0.76	x	0.7	=	152.46	(78)
South	0.9x 0.77	x	7.2	x	114.87	x	0.76	x	0.7	=	304.92	(78)
South	0.9x 0.77	x	3.6	x	110.55	x	0.76	x	0.7	=	293.45	(78)
South	0.9x 0.77	x	1.8	x	110.55	x	0.76	x	0.7	=	146.72	(78)
South	0.9x 0.77	x	7.2	x	110.55	x	0.76	x	0.7	=	293.45	(78)
South	0.9x 0.77	x	3.6	x	108.01	x	0.76	x	0.7	=	286.71	(78)
South	0.9x 0.77	x	1.8	x	108.01	x	0.76	x	0.7	=	143.36	(78)
South	0.9x 0.77	x	7.2	x	108.01	x	0.76	x	0.7	=	286.71	(78)
South	0.9x 0.77	x	3.6	x	104.89	x	0.76	x	0.7	=	278.44	(78)
South	0.9x 0.77	x	1.8	x	104.89	x	0.76	x	0.7	=	139.22	(78)
South	0.9x 0.77	x	7.2	x	104.89	x	0.76	x	0.7	=	278.44	(78)
South	0.9x 0.77	x	3.6	x	101.89	x	0.76	x	0.7	=	270.45	(78)
South	0.9x 0.77	x	1.8	x	101.89	x	0.76	x	0.7	=	135.23	(78)
South	0.9x 0.77	x	7.2	x	101.89	x	0.76	x	0.7	=	270.45	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	3.6	x	82.59	x	0.76	x	0.7	=	219.22	(78)
South	0.9x	0.77	x	1.8	x	82.59	x	0.76	x	0.7	=	109.61	(78)
South	0.9x	0.77	x	7.2	x	82.59	x	0.76	x	0.7	=	219.22	(78)
South	0.9x	0.77	x	3.6	x	55.42	x	0.76	x	0.7	=	147.1	(78)
South	0.9x	0.77	x	1.8	x	55.42	x	0.76	x	0.7	=	73.55	(78)
South	0.9x	0.77	x	7.2	x	55.42	x	0.76	x	0.7	=	147.1	(78)
South	0.9x	0.77	x	3.6	x	40.4	x	0.76	x	0.7	=	107.24	(78)
South	0.9x	0.77	x	1.8	x	40.4	x	0.76	x	0.7	=	53.62	(78)
South	0.9x	0.77	x	7.2	x	40.4	x	0.76	x	0.7	=	107.24	(78)
West	0.9x	0.77	x	7.2	x	19.64	x	0.76	x	0.7	=	52.13	(80)
West	0.9x	0.77	x	7.2	x	38.42	x	0.76	x	0.7	=	101.99	(80)
West	0.9x	0.77	x	7.2	x	63.27	x	0.76	x	0.7	=	167.96	(80)
West	0.9x	0.77	x	7.2	x	92.28	x	0.76	x	0.7	=	244.95	(80)
West	0.9x	0.77	x	7.2	x	113.09	x	0.76	x	0.7	=	300.2	(80)
West	0.9x	0.77	x	7.2	x	115.77	x	0.76	x	0.7	=	307.31	(80)
West	0.9x	0.77	x	7.2	x	110.22	x	0.76	x	0.7	=	292.57	(80)
West	0.9x	0.77	x	7.2	x	94.68	x	0.76	x	0.7	=	251.31	(80)
West	0.9x	0.77	x	7.2	x	73.59	x	0.76	x	0.7	=	195.34	(80)
West	0.9x	0.77	x	7.2	x	45.59	x	0.76	x	0.7	=	121.01	(80)
West	0.9x	0.77	x	7.2	x	24.49	x	0.76	x	0.7	=	65.01	(80)
West	0.9x	0.77	x	7.2	x	16.15	x	0.76	x	0.7	=	42.87	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	414.52	712.09	983.16	1221.44	1362.71	1348.23	1301.93	1198.73	1066.81	790.08	497.77	353.83

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	859.19	1154.64	1411.5	1626.77	1744.58	1707.54	1646.6	1549.52	1429.43	1175.93	910.32	786.51

(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	0.96	0.91	0.8	0.65	0.48	0.35	0.39	0.6	0.86	0.97	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.94	20.33	20.68	20.89	20.97	20.99	20.99	20.94	20.62	20.02	19.52

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.66	19.66	19.66	19.67	19.67	19.68	19.68	19.68	19.68	19.67	19.67	19.67

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.95	0.88	0.75	0.57	0.39	0.25	0.28	0.5	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=	17.86	18.35	18.88	19.35	19.58	19.67	19.68	19.68	19.64	19.3	18.48	17.76

(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=	18.56	18.99	19.47	19.89	20.11	20.19	20.21	20.21	20.16	19.83	19.1	18.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.99	19.47	19.89	20.11	20.19	20.21	20.21	20.16	19.83	19.1	18.47	(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	0.94	0.88	0.76	0.6	0.43	0.29	0.32	0.54	0.82	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	840.13	1087.82	1236.19	1234.08	1047.05	727.22	476.19	500.65	769.55	964.4	868.07	773.51	(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=	1926.67	1901.06	1746.56	1468.51	1122.46	741.57	478.42	504.19	805.93	1232.45	1606.81	1916.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	808.38	546.5	379.72	168.8	56.11	0	0	0	0	199.42	531.89	850.16	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3540.98 (98)

Space heating requirement in kWh/m²/year 40.34 (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 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 3540.98

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 3718.03 (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 2131.79

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 2238.37 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 59.56 (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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		369.9	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		6326.3	(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	=	1236.55	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	30.91	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1267.46	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1267.46	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	191.98	(379)
Total CO2, kg/year	sum of (376)…(382) =				1459.44	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.63	(384)
EI rating (section 14)					85.27	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 1

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.01	(1a) x	2.6	(2a) =	184.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		184.63	(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			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.36 (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

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

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	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			8.64	x1/[1/(1.4)+ 0.04]		=	11.45			(27)
Windows Type 2			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			4.32	x1/[1/(1.4)+ 0.04]		=	5.73			(27)
Floor			71.012	x	0.13	=	9.23156			(28)
Walls Type1	68.31	18.72	49.59	x	0.15	=	7.44			(29)
Walls Type2	17.42	1.99	15.43	x	0.14	=	2.22			(29)
Walls Type3	5.92	0	5.92	x	0.13	=	0.79			(29)
Total area of elements, m²			162.66							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.29 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.22 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 61.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m=	35.17	34.98	34.8	33.96	33.81	33.07	33.07	32.94	33.36	33.81	34.12	34.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.67	96.49	96.31	95.47	95.31	94.58	94.58	94.45	94.86	95.31	95.63	95.96	

Average = Sum(39)$_{1...12}$ /12= 95.47 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.36	1.36	1.36	1.34	1.34	1.33	1.33	1.33	1.34	1.34	1.35	1.35	

Average = Sum(40)$_{1...12}$ /12= 1.34 (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 2.27 (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 88.12 (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=	96.94	93.41	89.89	86.36	82.84	79.31	79.31	82.84	86.36	89.89	93.41	96.94	

Total = Sum(44)$_{1...12}$ = 1057.48 (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=	143.75	125.73	129.74	113.11	108.53	93.65	86.78	99.59	100.78	117.44	128.2	139.22	

Total = Sum(45)$_{1...12}$ = 1386.52 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(57)

DER WorkSheet: New dwelling design stage

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=	193.98	171.1	179.97	161.72	158.76	142.27	137.02	149.82	149.39	167.68	176.81	189.45	(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=	193.98	171.1	179.97	161.72	158.76	142.27	137.02	149.82	149.39	167.68	176.81	189.45	

Output from water heater (annual)$_{1...12}$ | 1977.96 | (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=	87.98	78.1	83.32	76.5	76.27	70.03	69.04	73.3	72.4	79.24	81.52	86.48	(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=	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.8	15.81	12.86	9.73	7.28	6.14	6.64	8.63	11.58	14.7	17.16	18.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.65	201.72	196.5	185.38	171.35	158.17	149.36	147.29	152.51	163.62	177.65	190.84	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	(71)

Water heating gains (Table 5)

(72)m=	118.26	116.22	111.99	106.25	102.52	97.26	92.8	98.52	100.55	106.5	113.22	116.23	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.76	390.81	378.41	358.42	338.2	318.63	305.85	311.49	321.7	341.88	365.09	382.42	(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	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x	0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x	0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x	0.77	x	8.64	x	19.64	x	0.76	x	0.7	=	62.56	(76)
East	0.9x	0.77	x	8.64	x	38.42	x	0.76	x	0.7	=	122.38	(76)
East	0.9x	0.77	x	8.64	x	63.27	x	0.76	x	0.7	=	201.55	(76)
East	0.9x	0.77	x	8.64	x	92.28	x	0.76	x	0.7	=	293.95	(76)
East	0.9x	0.77	x	8.64	x	113.09	x	0.76	x	0.7	=	360.24	(76)
East	0.9x	0.77	x	8.64	x	115.77	x	0.76	x	0.7	=	368.77	(76)
East	0.9x	0.77	x	8.64	x	110.22	x	0.76	x	0.7	=	351.08	(76)
East	0.9x	0.77	x	8.64	x	94.68	x	0.76	x	0.7	=	301.58	(76)
East	0.9x	0.77	x	8.64	x	73.59	x	0.76	x	0.7	=	234.41	(76)
East	0.9x	0.77	x	8.64	x	45.59	x	0.76	x	0.7	=	145.22	(76)
East	0.9x	0.77	x	8.64	x	24.49	x	0.76	x	0.7	=	78.01	(76)
East	0.9x	0.77	x	8.64	x	16.15	x	0.76	x	0.7	=	51.45	(76)
Southeast	0.9x	0.77	x	2.16	x	36.79	x	0.76	x	0.7	=	58.6	(77)
Southeast	0.9x	0.77	x	4.32	x	36.79	x	0.76	x	0.7	=	58.6	(77)
Southeast	0.9x	0.77	x	2.16	x	62.67	x	0.76	x	0.7	=	99.82	(77)
Southeast	0.9x	0.77	x	4.32	x	62.67	x	0.76	x	0.7	=	99.82	(77)
Southeast	0.9x	0.77	x	2.16	x	85.75	x	0.76	x	0.7	=	136.58	(77)
Southeast	0.9x	0.77	x	4.32	x	85.75	x	0.76	x	0.7	=	136.58	(77)
Southeast	0.9x	0.77	x	2.16	x	106.25	x	0.76	x	0.7	=	169.22	(77)
Southeast	0.9x	0.77	x	4.32	x	106.25	x	0.76	x	0.7	=	169.22	(77)
Southeast	0.9x	0.77	x	2.16	x	119.01	x	0.76	x	0.7	=	189.55	(77)
Southeast	0.9x	0.77	x	4.32	x	119.01	x	0.76	x	0.7	=	189.55	(77)
Southeast	0.9x	0.77	x	2.16	x	118.15	x	0.76	x	0.7	=	188.18	(77)
Southeast	0.9x	0.77	x	4.32	x	118.15	x	0.76	x	0.7	=	188.18	(77)
Southeast	0.9x	0.77	x	2.16	x	113.91	x	0.76	x	0.7	=	181.42	(77)
Southeast	0.9x	0.77	x	4.32	x	113.91	x	0.76	x	0.7	=	181.42	(77)
Southeast	0.9x	0.77	x	2.16	x	104.39	x	0.76	x	0.7	=	166.26	(77)
Southeast	0.9x	0.77	x	4.32	x	104.39	x	0.76	x	0.7	=	166.26	(77)
Southeast	0.9x	0.77	x	2.16	x	92.85	x	0.76	x	0.7	=	147.88	(77)
Southeast	0.9x	0.77	x	4.32	x	92.85	x	0.76	x	0.7	=	147.88	(77)
Southeast	0.9x	0.77	x	2.16	x	69.27	x	0.76	x	0.7	=	110.32	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.32	x	69.27	x	0.76	x	0.7	=	110.32	(77)
Southeast 0.9x	0.77	x	2.16	x	44.07	x	0.76	x	0.7	=	70.19	(77)
Southeast 0.9x	0.77	x	4.32	x	44.07	x	0.76	x	0.7	=	70.19	(77)
Southeast 0.9x	0.77	x	2.16	x	31.49	x	0.76	x	0.7	=	50.15	(77)
Southeast 0.9x	0.77	x	4.32	x	31.49	x	0.76	x	0.7	=	50.15	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	185.41	332.81	493.03	661.84	779	787.59	753.57	665.55	552.22	378.7	225.35	156.45	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.17	723.62	871.44	1020.26	1117.2	1106.22	1059.42	977.04	873.91	720.58	590.44	538.87	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.71	0.53	0.39	0.44	0.68	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.68	19.93	20.27	20.65	20.88	20.98	21	20.99	20.93	20.58	20.05	19.63	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.8	19.8	19.81	19.81	19.82	19.82	19.82	19.81	19.81	19.8	19.8	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.82	0.64	0.44	0.29	0.33	0.59	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.07	18.43	18.92	19.43	19.71	19.8	19.81	19.81	19.76	19.36	18.61	18	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.8	19.11	19.54	19.98	20.24	20.33	20.35	20.35	20.29	19.92	19.26	18.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.8	19.11	19.54	19.98	20.24	20.33	20.35	20.35	20.29	19.92	19.26	18.74	(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	0.83	0.67	0.48	0.33	0.38	0.63	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	571.21	702.51	809.71	847.74	748.4	530.8	352.97	369.89	550.52	641.64	575.73	533.94	(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=	1401.54	1371.04	1255.66	1058.28	814.15	542.42	354.74	372.99	587.4	887.85	1163.21	1395.39	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	617.76	449.25	331.79	151.58	48.92	0	0	0	0	183.18	422.99	640.92	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 2846.39 (98)

Space heating requirement in kWh/m²/year 40.08 (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 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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2846.39	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2988.71	(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		1977.96	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2076.86	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.66	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		314.33	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5379.91	(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	=	1051.61	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.29	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1077.9	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)

DER WorkSheet: New dwelling design stage

Total CO2 associated with space and water heating	(373) + (374) + (375) =			1077.9	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	163.14	(379)
Total CO2, kg/year	sum of (376)…(382) =			1241.04	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.48	(384)
EI rating (section 14)				85.67	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 2

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	37.82	(1a) x	2.6	(2a) =	98.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	37.82	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		98.33	(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) =	0.2 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (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

DER WorkSheet: New dwelling design stage

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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			8.64	x	1/[1/(1.4)+ 0.04]	=	11.45			(27)
Windows Type 2			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Floor			37.82	x	0.13	=	4.9166			(28)
Walls Type1	23.4	10.08	13.32	x	0.15	=	2			(29)
Walls Type2	13.65	0	13.65	x	0.14	=	1.96			(29)
Walls Type3	13.91	1.99	11.92	x	0.14	=	1.69			(29)
Total area of elements, m²			88.78							(31)
Party wall			17.16	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) = 26.72 (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 9.83 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.54 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	18.8	18.7	18.6	18.14	18.06	17.66	17.66	17.58	17.81	18.06	18.23	18.41	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	55.34	55.24	55.15	54.69	54.6	54.2	54.2	54.12	54.35	54.6	54.77	54.96	

Average = Sum(39)$_{1...12}$ /12= 54.69 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.46	1.46	1.46	1.45	1.44	1.43	1.43	1.43	1.44	1.44	1.45	1.45

Average = Sum(40)$_{1...12}$ /12= 1.45 (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 1.35 (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) + 66.25 (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=	72.88	70.23	67.58	64.93	62.28	59.63	59.63	62.28	64.93	67.58	70.23	72.88

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 795.06 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	108.08	94.53	97.54	85.04	81.6	70.41	65.25	74.87	75.77	88.3	96.39	104.67

Total = Sum(45)$_{1...12}$ = 1042.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.21	14.18	14.63	12.76	12.24	10.56	9.79	11.23	11.37	13.24	14.46	15.7

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97

(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97

(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)

DER WorkSheet: New dwelling design stage

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=	158.31	139.9	147.78	133.65	131.83	119.03	115.48	125.11	124.38	138.53	145	154.9	(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=	158.31	139.9	147.78	133.65	131.83	119.03	115.48	125.11	124.38	138.53	145	154.9	

Output from water heater (annual)$_{1...12}$ 1633.89 (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=	76.12	67.73	72.62	67.17	67.32	62.3	61.88	65.08	64.08	69.55	70.94	74.99	(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=	67.48	67.48	67.48	67.48	67.48	67.48	67.48	67.48	67.48	67.48	67.48	67.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.35	9.19	7.48	5.66	4.23	3.57	3.86	5.02	6.73	8.55	9.98	10.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	116.09	117.3	114.26	107.8	99.64	91.97	86.85	85.65	88.68	95.14	103.3	110.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	29.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-53.99	-53.99	-53.99	-53.99	-53.99	-53.99	-53.99	-53.99	-53.99	-53.99	-53.99	-53.99	(71)

Water heating gains (Table 5)

(72)m=	102.31	100.78	97.61	93.29	90.48	86.53	83.17	87.47	89	93.48	98.53	100.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	272	270.52	262.59	249.99	237.6	225.32	217.13	221.38	227.66	240.41	255.05	265.64	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x	0.77	x	8.64	x	19.64	x	0.76	x	0.7	=	62.56	(76)
East	0.9x	0.77	x	8.64	x	38.42	x	0.76	x	0.7	=	122.38	(76)
East	0.9x	0.77	x	8.64	x	63.27	x	0.76	x	0.7	=	201.55	(76)
East	0.9x	0.77	x	8.64	x	92.28	x	0.76	x	0.7	=	293.95	(76)
East	0.9x	0.77	x	8.64	x	113.09	x	0.76	x	0.7	=	360.24	(76)
East	0.9x	0.77	x	8.64	x	115.77	x	0.76	x	0.7	=	368.77	(76)
East	0.9x	0.77	x	8.64	x	110.22	x	0.76	x	0.7	=	351.08	(76)
East	0.9x	0.77	x	8.64	x	94.68	x	0.76	x	0.7	=	301.58	(76)
East	0.9x	0.77	x	8.64	x	73.59	x	0.76	x	0.7	=	234.41	(76)
East	0.9x	0.77	x	8.64	x	45.59	x	0.76	x	0.7	=	145.22	(76)
East	0.9x	0.77	x	8.64	x	24.49	x	0.76	x	0.7	=	78.01	(76)
East	0.9x	0.77	x	8.64	x	16.15	x	0.76	x	0.7	=	51.45	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	68.21	133.17	219.88	323.39	399.91	411.23	390.73	333.03	256.45	158.06	84.97	56.15	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	340.21	403.69	482.47	573.38	637.5	636.56	607.86	554.41	484.11	398.47	340.02	321.8	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.71	0.53	0.39	0.44	0.69	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.62	19.84	20.2	20.6	20.87	20.97	20.99	20.99	20.91	20.53	19.99	19.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.72	19.72	19.72	19.73	19.73	19.74	19.74	19.74	19.73	19.73	19.73	19.72	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.82	0.64	0.43	0.28	0.32	0.6	0.89	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.93	18.25	18.76	19.31	19.62	19.72	19.74	19.74	19.67	19.23	18.48	17.88	(90)

fLA = Living area ÷ (4) = 0.79 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.27	19.51	19.9	20.34	20.61	20.71	20.73	20.73	20.65	20.26	19.68	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

(93)m=	19.27	19.51	19.9	20.34	20.61	20.71	20.73	20.73	20.65	20.26	19.68	19.23	(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	0.84	0.69	0.5	0.37	0.42	0.67	0.9	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	335.23	392.14	450.72	482.29	437.47	320.93	221.97	230.81	323.91	359.44	330.9	317.97	(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=	828.65	807.2	738.88	625.42	486.35	331.29	224.06	234.38	356.18	527.33	689.11	825.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	367.1	278.92	214.39	103.06	36.37	0	0	0	0	124.91	257.91	377.9	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1760.54 (98)

Space heating requirement in kWh/m²/year 46.55 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community 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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		1760.54	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1848.57	(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 1633.89

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 1715.59 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 35.64 (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 0 (330a)

DER WorkSheet: New dwelling design stage

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		182.78	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3746.94	(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	=	739.92	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.5	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	758.42	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				758.42	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	94.86	(379)
Total CO2, kg/year	sum of (376)…(382) =				853.28	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				22.56	(384)
EI rating (section 14)					86.19	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 3

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.58	(1a) x	2.6	(2a) =	201.71	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		201.71	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			1	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.4	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 4			4.32	x1/[1/(1.4)+ 0.04]		=	5.73			(27)
Windows Type 5			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Floor			77.581	x	0.13	=	10.08553			(28)
Walls Type1	69.18	22.32	46.86	x	0.15	=	7.03			(29)
Walls Type2	2.99	1.99	1	x	0.14	=	0.14			(29)
Walls Type3	14.44	0	14.44	x	0.13	=	1.93			(29)
Total area of elements, m²			164.19							(31)
Party wall			18.72	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) = 51.56 (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 14.52 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 66.08 (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=	38.91	38.69	38.48	37.47	37.28	36.41	36.41	36.25	36.75	37.28	37.67	38.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	104.99	104.77	104.56	103.55	103.37	102.49	102.49	102.33	102.83	103.37	103.75	104.14	

Average = Sum(39)$_{1...12}$ /12= 103.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.35	1.35	1.35	1.33	1.33	1.32	1.32	1.32	1.33	1.33	1.34	1.34	

Average = Sum(40)$_{1...12}$ /12= 1.33 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.42 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.56 (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=	100.72	97.06	93.4	89.73	86.07	82.41	82.41	86.07	89.73	93.4	97.06	100.72	

Total = Sum(44)$_{1...12}$ = 1098.78 (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=	149.37	130.64	134.81	117.53	112.77	97.31	90.17	103.48	104.71	122.03	133.21	144.65	

Total = Sum(45)$_{1...12}$ = 1440.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.41	19.6	20.22	17.63	16.92	14.6	13.53	15.52	15.71	18.3	19.98	21.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.39	178.53	187.83	168.84	165.79	148.62	143.2	156.5	156.02	175.05	184.52	197.68	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.39	178.53	187.83	168.84	165.79	148.62	143.2	156.5	156.02	175.05	184.52	197.68	

Output from water heater (annual)$_{1...12}$ | 2064.97 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.08	81.75	87.24	80.13	79.91	73.41	72.4	76.82	75.87	82.99	85.34	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.11	16.97	13.8	10.45	7.81	6.59	7.12	9.26	12.43	15.78	18.42	19.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	214.31	216.53	210.93	199	183.94	169.79	160.33	158.11	163.71	175.64	190.7	204.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	(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=	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	(71)

Water heating gains (Table 5)

(72)m=	123.77	121.65	117.26	111.29	107.41	101.95	97.31	103.26	105.37	111.55	118.53	121.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.41	414.39	401.22	379.97	358.39	337.56	324	329.85	340.74	362.2	386.88	405.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	4.32	x	10.63	x	0.76	x	0.7	=	16.94	(74)
North	0.9x 0.77	x	2.16	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x 0.77	x	4.32	x	20.32	x	0.76	x	0.7	=	32.36	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x 0.77	x	4.32	x	34.53	x	0.76	x	0.7	=	55	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x 0.77	x	4.32	x	55.46	x	0.76	x	0.7	=	88.34	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x 0.77	x	4.32	x	74.72	x	0.76	x	0.7	=	119	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x 0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x 0.77	x	4.32	x	79.99	x	0.76	x	0.7	=	127.39	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x 0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x 0.77	x	4.32	x	74.68	x	0.76	x	0.7	=	118.94	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x 0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x 0.77	x	4.32	x	59.25	x	0.76	x	0.7	=	94.36	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x 0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x 0.77	x	4.32	x	41.52	x	0.76	x	0.7	=	66.12	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x 0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x 0.77	x	4.32	x	24.19	x	0.76	x	0.7	=	38.53	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x 0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x 0.77	x	4.32	x	13.12	x	0.76	x	0.7	=	20.89	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.76	x	0.7	=	31.34	(74)
North	0.9x 0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
North	0.9x 0.77	x	4.32	x	8.86	x	0.76	x	0.7	=	14.12	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.76	x	0.7	=	21.18	(74)
East	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)
East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	120.97	234.48	390.96	593.22	757.44	791.17	746.58	619.19	460.82	278.58	150.2	100.02	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	537.39	648.87	792.18	973.19	1115.83	1128.74	1070.58	949.05	801.56	640.78	537.08	505.41	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.75	0.56	0.42	0.49	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.78	20.13	20.56	20.86	20.97	20.99	20.99	20.89	20.46	19.94	19.54	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.8	19.8	19.81	19.82	19.82	19.82	19.83	19.82	19.82	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.87	0.69	0.47	0.31	0.37	0.67	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=	17.93	18.23	18.73	19.33	19.69	19.81	19.82	19.82	19.74	19.21	18.46	17.89	(90)

fLA = Living area ÷ (4) = 0.37 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=	18.55	18.81	19.25	19.79	20.13	20.24	20.26	20.26	20.17	19.68	19.01	18.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.55	18.81	19.25	19.79	20.13	20.24	20.26	20.26	20.17	19.68	19.01	18.5	(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	0.87	0.7	0.5	0.35	0.41	0.7	0.93	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	533.64	638.73	758.23	848.48	785.96	564	372.93	390.26	563.91	598.69	529.63	502.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1495.78	1457.16	1333.28	1127.84	870.89	578.22	375.1	394.71	623.93	938.32	1235.84	1489.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	715.83	549.99	427.84	201.14	63.19	0	0	0	0	252.68	508.47	734.4	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3453.54 (98)

Space heating requirement in kWh/m²/year 44.52 (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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		3453.54	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3626.22	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement 2064.97

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 2168.22 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 57.94 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		337.42	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		6131.85	(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	=	1202.92	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	30.07	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1233	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1233	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	175.12	(379)
Total CO2, kg/year	sum of (376)…(382) =				1408.12	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				18.15	(384)
EI rating (section 14)					84.61	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 4

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.01	(1a) x	2.6	(2a) =	184.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		184.63	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36	(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

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

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	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			8.64	x1/[1/(1.4)+ 0.04]		=	11.45			(27)
Windows Type 2			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			4.32	x1/[1/(1.4)+ 0.04]		=	5.73			(27)
Walls Type1	68.31	18.72	49.59	x	0.15	=	7.44			(29)
Walls Type2	3.77	1.99	1.78	x	0.14	=	0.25			(29)
Walls Type3	5.92	0	5.92	x	0.13	=	0.79			(29)
Total area of elements, m²			78							(31)
Party wall			13.65	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) = 36.09 (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 10.35 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.44 (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=	35.17	34.98	34.8	33.96	33.81	33.07	33.07	32.94	33.36	33.81	34.12	34.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	81.6	81.42	81.24	80.4	80.24	79.51	79.51	79.38	79.79	80.24	80.56	80.89	

Average = Sum(39)$_{1...12}$ /12= 80.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.15	1.14	1.13	1.13	1.12	1.12	1.12	1.12	1.13	1.13	1.14	

Average = Sum(40)$_{1...12}$ /12= 1.13 (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 2.27 (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 88.12 (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=	96.94	93.41	89.89	86.36	82.84	79.31	79.31	82.84	86.36	89.89	93.41	96.94	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1057.48 (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=	143.75	125.73	129.74	113.11	108.53	93.65	86.78	99.59	100.78	117.44	128.2	139.22	

Total = Sum(45)$_{1...12}$ = 1386.52 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(57)

DER WorkSheet: New dwelling design stage

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=	193.98	171.1	179.97	161.72	158.76	142.27	137.02	149.82	149.39	167.68	176.81	189.45	(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=	193.98	171.1	179.97	161.72	158.76	142.27	137.02	149.82	149.39	167.68	176.81	189.45	

Output from water heater (annual)$_{1...12}$ | 1977.96 | (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=	87.98	78.1	83.32	76.5	76.27	70.03	69.04	73.3	72.4	79.24	81.52	86.48	(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=	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.8	15.81	12.86	9.73	7.28	6.14	6.64	8.63	11.58	14.7	17.16	18.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.65	201.72	196.5	185.38	171.35	158.17	149.36	147.29	152.51	163.62	177.65	190.84	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	(71)

Water heating gains (Table 5)

(72)m=	118.26	116.22	111.99	106.25	102.52	97.26	92.8	98.52	100.55	106.5	113.22	116.23	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.76	390.81	378.41	358.42	338.2	318.63	305.85	311.49	321.7	341.88	365.09	382.42	(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	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x	0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x	0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x	0.77	x	8.64	x	19.64	x	0.76	x	0.7	=	62.56	(76)
East	0.9x	0.77	x	8.64	x	38.42	x	0.76	x	0.7	=	122.38	(76)
East	0.9x	0.77	x	8.64	x	63.27	x	0.76	x	0.7	=	201.55	(76)
East	0.9x	0.77	x	8.64	x	92.28	x	0.76	x	0.7	=	293.95	(76)
East	0.9x	0.77	x	8.64	x	113.09	x	0.76	x	0.7	=	360.24	(76)
East	0.9x	0.77	x	8.64	x	115.77	x	0.76	x	0.7	=	368.77	(76)
East	0.9x	0.77	x	8.64	x	110.22	x	0.76	x	0.7	=	351.08	(76)
East	0.9x	0.77	x	8.64	x	94.68	x	0.76	x	0.7	=	301.58	(76)
East	0.9x	0.77	x	8.64	x	73.59	x	0.76	x	0.7	=	234.41	(76)
East	0.9x	0.77	x	8.64	x	45.59	x	0.76	x	0.7	=	145.22	(76)
East	0.9x	0.77	x	8.64	x	24.49	x	0.76	x	0.7	=	78.01	(76)
East	0.9x	0.77	x	8.64	x	16.15	x	0.76	x	0.7	=	51.45	(76)
Southeast	0.9x	0.77	x	2.16	x	36.79	x	0.76	x	0.7	=	58.6	(77)
Southeast	0.9x	0.77	x	4.32	x	36.79	x	0.76	x	0.7	=	58.6	(77)
Southeast	0.9x	0.77	x	2.16	x	62.67	x	0.76	x	0.7	=	99.82	(77)
Southeast	0.9x	0.77	x	4.32	x	62.67	x	0.76	x	0.7	=	99.82	(77)
Southeast	0.9x	0.77	x	2.16	x	85.75	x	0.76	x	0.7	=	136.58	(77)
Southeast	0.9x	0.77	x	4.32	x	85.75	x	0.76	x	0.7	=	136.58	(77)
Southeast	0.9x	0.77	x	2.16	x	106.25	x	0.76	x	0.7	=	169.22	(77)
Southeast	0.9x	0.77	x	4.32	x	106.25	x	0.76	x	0.7	=	169.22	(77)
Southeast	0.9x	0.77	x	2.16	x	119.01	x	0.76	x	0.7	=	189.55	(77)
Southeast	0.9x	0.77	x	4.32	x	119.01	x	0.76	x	0.7	=	189.55	(77)
Southeast	0.9x	0.77	x	2.16	x	118.15	x	0.76	x	0.7	=	188.18	(77)
Southeast	0.9x	0.77	x	4.32	x	118.15	x	0.76	x	0.7	=	188.18	(77)
Southeast	0.9x	0.77	x	2.16	x	113.91	x	0.76	x	0.7	=	181.42	(77)
Southeast	0.9x	0.77	x	4.32	x	113.91	x	0.76	x	0.7	=	181.42	(77)
Southeast	0.9x	0.77	x	2.16	x	104.39	x	0.76	x	0.7	=	166.26	(77)
Southeast	0.9x	0.77	x	4.32	x	104.39	x	0.76	x	0.7	=	166.26	(77)
Southeast	0.9x	0.77	x	2.16	x	92.85	x	0.76	x	0.7	=	147.88	(77)
Southeast	0.9x	0.77	x	4.32	x	92.85	x	0.76	x	0.7	=	147.88	(77)
Southeast	0.9x	0.77	x	2.16	x	69.27	x	0.76	x	0.7	=	110.32	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.32	x	69.27	x	0.76	x	0.7	=	110.32	(77)
Southeast 0.9x	0.77	x	2.16	x	44.07	x	0.76	x	0.7	=	70.19	(77)
Southeast 0.9x	0.77	x	4.32	x	44.07	x	0.76	x	0.7	=	70.19	(77)
Southeast 0.9x	0.77	x	2.16	x	31.49	x	0.76	x	0.7	=	50.15	(77)
Southeast 0.9x	0.77	x	4.32	x	31.49	x	0.76	x	0.7	=	50.15	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	185.41	332.81	493.03	661.84	779	787.59	753.57	665.55	552.22	378.7	225.35	156.45	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.17	723.62	871.44	1020.26	1117.2	1106.22	1059.42	977.04	873.91	720.58	590.44	538.87	(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	0.46	0.33	0.37	0.61	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.2	20.52	20.81	20.95	20.99	21	21	20.97	20.74	20.28	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.97	19.97	19.98	19.98	19.98	19.99	19.98	19.98	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.77	0.58	0.39	0.25	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=	18.59	18.95	19.39	19.78	19.94	19.98	19.98	19.99	19.96	19.71	19.08	18.53	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.21	19.52	19.9	20.25	20.4	20.44	20.45	20.45	20.42	20.18	19.62	19.16	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.21	19.52	19.9	20.25	20.4	20.44	20.45	20.45	20.42	20.18	19.62	19.16	(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	0.91	0.79	0.6	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=	570.9	699.27	794.98	801.75	672.8	461.26	305.37	320.41	491.21	620.97	573.7	533.86	(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=	1216.91	1190.05	1088.64	912.44	698.07	464.4	305.74	321.11	504.46	768.69	1008.99	1209.95	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	480.64	329.8	218.49	79.7	18.8	0	0	0	0	109.9	313.41	503.01	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 2053.75 (98)

Space heating requirement in kWh/m²/year 28.92 (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 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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2053.75	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2156.44	(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		1977.96	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2076.86	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.33	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		314.33	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4547.63	(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				250	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	878.83	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.97	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	900.8	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)

DER WorkSheet: New dwelling design stage

Total CO2 associated with space and water heating	(373) + (374) + (375) =			900.8	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	163.14	(379)
Total CO2, kg/year	sum of (376)…(382) =			1063.94	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.98	(384)
EI rating (section 14)				87.71	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.98	(1a) x	2.6	(2a) =	129.95	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		129.95	(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				4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.27 (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

0.35	0.34	0.34	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32

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=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			8.64	x	1/[1/(1.4)+ 0.04]	=	11.45			(27)
Windows Type 2			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Floor			12.16	x	0.13	=	1.5808			(28)
Walls Type1	28.34	13.68	14.66	x	0.15	=	2.2			(29)
Walls Type2	18.85	1.99	16.86	x	0.14	=	2.39			(29)
Total area of elements, m²			59.35							(31)
Party wall			17.16	x	0	=	0			(32)
Party wall			13.65	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) = 27.09 (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 11.29 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.38 (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=	24.06	23.96	23.86	23.39	23.31	22.9	22.9	22.82	23.05	23.31	23.48	23.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	62.44	62.34	62.24	61.77	61.68	61.27	61.27	61.2	61.43	61.68	61.86	62.04	

Average = Sum(39)$_{1...12}$ /12= 61.77 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.25	1.25	1.25	1.24	1.23	1.23	1.23	1.22	1.23	1.23	1.24	1.24	

Average = Sum(40)$_{1...12}$ /12= 1.24 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.33 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.76	78.79	75.81	72.84	69.87	66.89	66.89	69.87	72.84	75.81	78.79	81.76	

Total = Sum(44)$_{1...12}$ = 891.91 (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=	121.25	106.04	109.43	95.4	91.54	78.99	73.2	83.99	85	99.06	108.13	117.42	

Total = Sum(45)$_{1...12}$ = 1169.44 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.19	15.91	16.41	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(57)

DER WorkSheet: New dwelling design stage

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=	171.48	151.41	159.66	144.01	141.77	127.6	123.43	134.23	133.61	149.29	156.74	167.65	(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=	171.48	151.41	159.66	144.01	141.77	127.6	123.43	134.23	133.61	149.29	156.74	167.65	

Output from water heater (annual)$_{1...12}$ | 1760.88 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	80.5	71.56	76.57	70.61	70.62	65.15	64.52	68.11	67.15	73.12	74.84	79.23	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.12	11.65	9.48	7.18	5.36	4.53	4.89	6.36	8.54	10.84	12.65	13.49	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.18	148.71	144.86	136.67	126.32	116.6	110.11	108.58	112.43	120.62	130.97	140.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	(71)

Water heating gains (Table 5)

(72)m=	108.2	106.48	102.92	98.07	94.92	90.49	86.73	91.55	93.27	98.28	103.95	106.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	316.85	315.19	305.6	290.25	274.95	259.97	250.07	254.84	262.58	278.09	295.91	309.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x	0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x	0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x	0.77	x	8.64	x	19.64	x	0.76	x	0.7	=	62.56	(76)
East	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	8.64	x	38.42	x	0.76	x	0.7	=	122.38	(76)
East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	8.64	x	63.27	x	0.76	x	0.7	=	201.55	(76)
East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	8.64	x	92.28	x	0.76	x	0.7	=	293.95	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	8.64	x	113.09	x	0.76	x	0.7	=	360.24	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	8.64	x	115.77	x	0.76	x	0.7	=	368.77	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	8.64	x	110.22	x	0.76	x	0.7	=	351.08	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	8.64	x	94.68	x	0.76	x	0.7	=	301.58	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	8.64	x	73.59	x	0.76	x	0.7	=	234.41	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	8.64	x	45.59	x	0.76	x	0.7	=	145.22	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	8.64	x	24.49	x	0.76	x	0.7	=	78.01	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	8.64	x	16.15	x	0.76	x	0.7	=	51.45	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	94.27	184.16	303.86	445.87	550.01	564.89	537.02	458.69	354.12	218.57	117.47	77.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	411.12	499.35	609.46	736.12	824.96	824.86	787.09	713.52	616.7	496.66	413.38	386.6	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.83	0.65	0.47	0.34	0.39	0.65	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	20.05	20.39	20.75	20.93	20.99	21	21	20.95	20.65	20.16	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.88	19.88	19.88	19.89	19.89	19.9	19.9	19.9	19.9	19.89	19.89	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.79	0.59	0.39	0.26	0.3	0.56	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.35	18.67	19.16	19.63	19.84	19.89	19.9	19.9	19.87	19.52	18.84	18.29	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.03	19.3	19.72	20.14	20.34	20.39	20.4	20.4	20.36	20.04	19.45	18.97	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.03	19.3	19.72	20.14	20.34	20.39	20.4	20.4	20.36	20.04	19.45	18.97	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.8	0.61	0.43	0.3	0.34	0.6	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	405.92	484.88	562.73	589.65	507.13	351.38	232.42	243.86	368.39	439.41	402.73	382.8	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	919.5	897.85	822.97	694.4	532.86	355.01	232.91	244.83	384.73	582.22	763.64	916.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	382.1	277.52	193.61	75.42	19.14	0	0	0	0	106.25	259.85	397.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1711.04 (98)

Space heating requirement in kWh/m²/year 34.23 (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 1.05 (306)

Space heating	**kWh/year**
Annual space heating requirement	1711.04

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1796.59	(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		1760.88	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1848.93	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	36.46	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		231.73	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3877.24	(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	=	756.81	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	18.92	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	775.73	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				775.73	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	120.27	(379)
Total CO2, kg/year	sum of (376)…(382) =				896	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.93	(384)
EI rating (section 14)					87.36	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.58	(1a) x	2.6	(2a) =	201.71	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		201.71	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.4	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 4			4.32	x	1/[1/(1.4)+ 0.04]	=	5.73			(27)
Windows Type 5			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Walls Type1	69.18	22.32	46.86	x	0.15	=	7.03			(29)
Walls Type2	2.99	1.99	1	x	0.14	=	0.14			(29)
Walls Type3	14.44	0	14.44	x	0.13	=	1.93			(29)
Total area of elements, m²			86.61							(31)
Party wall			18.72	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) = 41.48 (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 10.56 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 52.04 (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=	38.91	38.69	38.48	37.47	37.28	36.41	36.41	36.25	36.75	37.28	37.67	38.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.95	90.73	90.52	89.51	89.32	88.45	88.45	88.28	88.78	89.32	89.7	90.1	

Average = Sum(39)$_{1...12}$ /12= 89.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.16	1.16	

Average = Sum(40)$_{1...12}$ /12= 1.15 (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 2.42 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.56 (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=	100.72	97.06	93.4	89.73	86.07	82.41	82.41	86.07	89.73	93.4	97.06	100.72	

Total = Sum(44)$_{1...12}$ = 1098.78 (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=	149.37	130.64	134.81	117.53	112.77	97.31	90.17	103.48	104.71	122.03	133.21	144.65	

Total = Sum(45)$_{1...12}$ = 1440.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.41	19.6	20.22	17.63	16.92	14.6	13.53	15.52	15.71	18.3	19.98	21.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.39	178.53	187.83	168.84	165.79	148.62	143.2	156.5	156.02	175.05	184.52	197.68	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.39	178.53	187.83	168.84	165.79	148.62	143.2	156.5	156.02	175.05	184.52	197.68	

Output from water heater (annual)$_{1...12}$ — 2064.97 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.08	81.75	87.24	80.13	79.91	73.41	72.4	76.82	75.87	82.99	85.34	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.11	16.97	13.8	10.45	7.81	6.59	7.12	9.26	12.43	15.78	18.42	19.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	214.31	216.53	210.93	199	183.94	169.79	160.33	158.11	163.71	175.64	190.7	204.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	(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=	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	(71)

Water heating gains (Table 5)

(72)m=	123.77	121.65	117.26	111.29	107.41	101.95	97.31	103.26	105.37	111.55	118.53	121.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.41	414.39	401.22	379.97	358.39	337.56	324	329.85	340.74	362.2	386.88	405.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x	0.77	x	4.32	x	10.63	x	0.76	x	0.7	=	16.94	(74)
North	0.9x	0.77	x	2.16	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x	0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x	0.77	x	4.32	x	20.32	x	0.76	x	0.7	=	32.36	(74)
North	0.9x	0.77	x	2.16	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x	0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x	0.77	x	4.32	x	34.53	x	0.76	x	0.7	=	55	(74)
North	0.9x	0.77	x	2.16	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x	0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x	0.77	x	4.32	x	55.46	x	0.76	x	0.7	=	88.34	(74)
North	0.9x	0.77	x	2.16	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x	0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x	0.77	x	4.32	x	74.72	x	0.76	x	0.7	=	119	(74)
North	0.9x	0.77	x	2.16	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	4.32	x	79.99	x	0.76	x	0.7	=	127.39	(74)
North	0.9x	0.77	x	2.16	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	4.32	x	74.68	x	0.76	x	0.7	=	118.94	(74)
North	0.9x	0.77	x	2.16	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	4.32	x	59.25	x	0.76	x	0.7	=	94.36	(74)
North	0.9x	0.77	x	2.16	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	4.32	x	41.52	x	0.76	x	0.7	=	66.12	(74)
North	0.9x	0.77	x	2.16	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	4.32	x	24.19	x	0.76	x	0.7	=	38.53	(74)
North	0.9x	0.77	x	2.16	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	4.32	x	13.12	x	0.76	x	0.7	=	20.89	(74)
North	0.9x	0.77	x	2.16	x	13.12	x	0.76	x	0.7	=	31.34	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
North	0.9x	0.77	x	4.32	x	8.86	x	0.76	x	0.7	=	14.12	(74)
North	0.9x	0.77	x	2.16	x	8.86	x	0.76	x	0.7	=	21.18	(74)
East	0.9x	0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)
East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	120.97	234.48	390.96	593.22	757.44	791.17	746.58	619.19	460.82	278.58	150.2	100.02

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	537.39	648.87	792.18	973.19	1115.83	1128.74	1070.58	949.05	801.56	640.78	537.08	505.41

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.97	0.87	0.69	0.49	0.36	0.42	0.71	0.95	0.99	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	20.01	20.34	20.72	20.93	20.99	21	21	20.94	20.61	20.14	19.78

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.94	19.95	19.96	19.96	19.97	19.97	19.97	19.96	19.96	19.96	19.95

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.62	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=	18.37	18.66	19.13	19.65	19.9	19.96	19.97	19.97	19.93	19.53	18.85	18.33

(90)

fLA = Living area ÷ (4) = 0.37 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.91	19.17	19.58	20.05	20.28	20.35	20.35	20.35	20.31	19.93	19.33	18.87

(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.91	19.17	19.58	20.05	20.28	20.35	20.35	20.35	20.31	19.93	19.33	18.87	(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	0.84	0.65	0.45	0.31	0.37	0.65	0.92	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	533.75	638.16	753.05	821.44	726.02	503.24	331.29	347.55	521.97	590.98	529.29	502.81	(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=	1328.98	1294.55	1184.3	998.19	766.73	508.2	331.91	348.93	550.96	833.43	1097.28	1322	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	591.65	441.1	320.85	127.26	30.29	0	0	0	0	180.39	408.95	609.48	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2709.96	(98)
Space heating requirement in kWh/m²/year	34.93	(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	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2709.96	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2845.46	(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		2064.97	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2168.22	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.14	(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		0	(330a)

DER WorkSheet: New dwelling design stage

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		337.42	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5351.09	(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	=	1040.84	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.02	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1066.86	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1066.86	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	175.12	(379)
Total CO2, kg/year	sum of (376)…(382) =				1241.98	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.01	(384)
EI rating (section 14)					86.42	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 7

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.01	(1a) x	2.6	(2a) =	184.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		184.63	(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		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.36	(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

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

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	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			8.64	x1/[1/(1.4)+ 0.04]		=	11.45			(27)
Windows Type 2			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			4.32	x1/[1/(1.4)+ 0.04]		=	5.73			(27)
Walls Type1	68.31	18.72	49.59	x	0.15	=	7.44			(29)
Walls Type2	3.77	1.99	1.78	x	0.14	=	0.25			(29)
Walls Type3	5.92	0	5.92	x	0.13	=	0.79			(29)
Total area of elements, m²			78							(31)
Party wall			13.65	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) = 36.09 (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 8.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.76 (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=	35.17	34.98	34.8	33.96	33.81	33.07	33.07	32.94	33.36	33.81	34.12	34.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.92	79.74	79.56	78.72	78.56	77.83	77.83	77.7	78.11	78.56	78.88	79.21	

Average = Sum(39)$_{1...12}$ /12= 78.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.12	1.12	1.11	1.11	1.1	1.1	1.09	1.1	1.11	1.11	1.12	

Average = Sum(40)$_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (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 88.12 (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=	96.94	93.41	89.89	86.36	82.84	79.31	79.31	82.84	86.36	89.89	93.41	96.94	

Total = Sum(44)$_{1...12}$ = 1057.48 (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=	143.75	125.73	129.74	113.11	108.53	93.65	86.78	99.59	100.78	117.44	128.2	139.22	

Total = Sum(45)$_{1...12}$ = 1386.52 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(57)

DER WorkSheet: New dwelling design stage

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=	193.98	171.1	179.97	161.72	158.76	142.27	137.02	149.82	149.39	167.68	176.81	189.45	(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=	193.98	171.1	179.97	161.72	158.76	142.27	137.02	149.82	149.39	167.68	176.81	189.45	

Output from water heater (annual)$_{1...12}$ | 1977.96 | (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=	87.98	78.1	83.32	76.5	76.27	70.03	69.04	73.3	72.4	79.24	81.52	86.48	(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=	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.8	15.81	12.86	9.73	7.28	6.14	6.64	8.63	11.58	14.7	17.16	18.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.65	201.72	196.5	185.38	171.35	158.17	149.36	147.29	152.51	163.62	177.65	190.84	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	(71)

Water heating gains (Table 5)

(72)m=	118.26	116.22	111.99	106.25	102.52	97.26	92.8	98.52	100.55	106.5	113.22	116.23	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.76	390.81	378.41	358.42	338.2	318.63	305.85	311.49	321.7	341.88	365.09	382.42	(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	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x	0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x	0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x	0.77	x	8.64	x	19.64	x	0.76	x	0.7	=	62.56	(76)
East	0.9x	0.77	x	8.64	x	38.42	x	0.76	x	0.7	=	122.38	(76)
East	0.9x	0.77	x	8.64	x	63.27	x	0.76	x	0.7	=	201.55	(76)
East	0.9x	0.77	x	8.64	x	92.28	x	0.76	x	0.7	=	293.95	(76)
East	0.9x	0.77	x	8.64	x	113.09	x	0.76	x	0.7	=	360.24	(76)
East	0.9x	0.77	x	8.64	x	115.77	x	0.76	x	0.7	=	368.77	(76)
East	0.9x	0.77	x	8.64	x	110.22	x	0.76	x	0.7	=	351.08	(76)
East	0.9x	0.77	x	8.64	x	94.68	x	0.76	x	0.7	=	301.58	(76)
East	0.9x	0.77	x	8.64	x	73.59	x	0.76	x	0.7	=	234.41	(76)
East	0.9x	0.77	x	8.64	x	45.59	x	0.76	x	0.7	=	145.22	(76)
East	0.9x	0.77	x	8.64	x	24.49	x	0.76	x	0.7	=	78.01	(76)
East	0.9x	0.77	x	8.64	x	16.15	x	0.76	x	0.7	=	51.45	(76)
Southeast	0.9x	0.77	x	2.16	x	36.79	x	0.76	x	0.7	=	58.6	(77)
Southeast	0.9x	0.77	x	4.32	x	36.79	x	0.76	x	0.7	=	58.6	(77)
Southeast	0.9x	0.77	x	2.16	x	62.67	x	0.76	x	0.7	=	99.82	(77)
Southeast	0.9x	0.77	x	4.32	x	62.67	x	0.76	x	0.7	=	99.82	(77)
Southeast	0.9x	0.77	x	2.16	x	85.75	x	0.76	x	0.7	=	136.58	(77)
Southeast	0.9x	0.77	x	4.32	x	85.75	x	0.76	x	0.7	=	136.58	(77)
Southeast	0.9x	0.77	x	2.16	x	106.25	x	0.76	x	0.7	=	169.22	(77)
Southeast	0.9x	0.77	x	4.32	x	106.25	x	0.76	x	0.7	=	169.22	(77)
Southeast	0.9x	0.77	x	2.16	x	119.01	x	0.76	x	0.7	=	189.55	(77)
Southeast	0.9x	0.77	x	4.32	x	119.01	x	0.76	x	0.7	=	189.55	(77)
Southeast	0.9x	0.77	x	2.16	x	118.15	x	0.76	x	0.7	=	188.18	(77)
Southeast	0.9x	0.77	x	4.32	x	118.15	x	0.76	x	0.7	=	188.18	(77)
Southeast	0.9x	0.77	x	2.16	x	113.91	x	0.76	x	0.7	=	181.42	(77)
Southeast	0.9x	0.77	x	4.32	x	113.91	x	0.76	x	0.7	=	181.42	(77)
Southeast	0.9x	0.77	x	2.16	x	104.39	x	0.76	x	0.7	=	166.26	(77)
Southeast	0.9x	0.77	x	4.32	x	104.39	x	0.76	x	0.7	=	166.26	(77)
Southeast	0.9x	0.77	x	2.16	x	92.85	x	0.76	x	0.7	=	147.88	(77)
Southeast	0.9x	0.77	x	4.32	x	92.85	x	0.76	x	0.7	=	147.88	(77)
Southeast	0.9x	0.77	x	2.16	x	69.27	x	0.76	x	0.7	=	110.32	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.32	x	69.27	x	0.76	x	0.7	=	110.32	(77)
Southeast 0.9x	0.77	x	2.16	x	44.07	x	0.76	x	0.7	=	70.19	(77)
Southeast 0.9x	0.77	x	4.32	x	44.07	x	0.76	x	0.7	=	70.19	(77)
Southeast 0.9x	0.77	x	2.16	x	31.49	x	0.76	x	0.7	=	50.15	(77)
Southeast 0.9x	0.77	x	4.32	x	31.49	x	0.76	x	0.7	=	50.15	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	185.41	332.81	493.03	661.84	779	787.59	753.57	665.55	552.22	378.7	225.35	156.45	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.17	723.62	871.44	1020.26	1117.2	1106.22	1059.42	977.04	873.91	720.58	590.44	538.87	(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	0.81	0.63	0.45	0.32	0.36	0.6	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.99	20.23	20.54	20.83	20.96	20.99	21	21	20.98	20.76	20.31	19.94	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	20	20	20	20.01	20	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.77	0.57	0.38	0.25	0.29	0.52	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=	18.65	19.01	19.44	19.82	19.96	20	20	20.01	19.99	19.75	19.13	18.59	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.56	19.94	20.28	20.42	20.45	20.46	20.46	20.44	20.21	19.67	19.21	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.26	19.56	19.94	20.28	20.42	20.45	20.46	20.46	20.44	20.21	19.67	19.21	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.91	0.78	0.59	0.41	0.28	0.32	0.55	0.86	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	570.81	698.69	792.53	794.75	662.7	452.87	299.81	314.58	483.46	617.65	573.32	533.82	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1195.72	1169.25	1069.38	895.55	684.7	455.48	300.11	315.15	494.89	754.88	991.25	1188.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	464.93	316.21	205.98	72.58	16.37	0	0	0	0	102.1	300.9	487.2	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 1966.27 (98)

Space heating requirement in kWh/m²/year 27.69 (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 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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		1966.27	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2064.58	(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		1977.96	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2076.86	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.41	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		314.33	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4455.78	(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	=	859.76	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.49	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	881.26	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)

DER WorkSheet: New dwelling design stage

Total CO2 associated with space and water heating	(373) + (374) + (375) =			881.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	163.14	(379)
Total CO2, kg/year	sum of (376)…(382) =			1044.4	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.71	(384)
EI rating (section 14)				87.94	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 8

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.98	(1a) x	2.6	(2a) =	129.95	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		129.95	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.27	(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

0.35	0.34	0.34	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32

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=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			8.64	x1/[1/(1.4)+ 0.04]		=	11.45			(27)
Windows Type 2			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Walls Type1	28.34	13.68	14.66	x	0.15	=	2.2			(29)
Walls Type2	18.85	1.99	16.86	x	0.14	=	2.39			(29)
Total area of elements, m²			47.19							(31)
Party wall			17.16	x	0	=	0			(32)
Party wall			13.65	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) = 25.51 (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 6.51 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.02 (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=	24.06	23.96	23.86	23.39	23.31	22.9	22.9	22.82	23.05	23.31	23.48	23.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	56.09	55.98	55.88	55.41	55.33	54.92	54.92	54.84	55.08	55.33	55.5	55.69	

Average = Sum(39)$_{1...12}$ /12= 55.41 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.12	1.12	1.12	1.11	1.11	1.1	1.1	1.1	1.1	1.11	1.11	1.11

Average = Sum(40)$_{1...12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 74.33 (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=	81.76	78.79	75.81	72.84	69.87	66.89	66.89	69.87	72.84	75.81	78.79	81.76

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 891.91 (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=	121.25	106.04	109.43	95.4	91.54	78.99	73.2	83.99	85	99.06	108.13	117.42

Total = Sum(45)$_{1...12}$ = 1169.44 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.19	15.91	16.41	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.61

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97

(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97

(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)

DER WorkSheet: New dwelling design stage

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=	171.48	151.41	159.66	144.01	141.77	127.6	123.43	134.23	133.61	149.29	156.74	167.65	(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=	171.48	151.41	159.66	144.01	141.77	127.6	123.43	134.23	133.61	149.29	156.74	167.65	

Output from water heater (annual)$_{1...12}$ 1760.88 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	80.5	71.56	76.57	70.61	70.62	65.15	64.52	68.11	67.15	73.12	74.84	79.23	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.12	11.65	9.48	7.18	5.36	4.53	4.89	6.36	8.54	10.84	12.65	13.49	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.18	148.71	144.86	136.67	126.32	116.6	110.11	108.58	112.43	120.62	130.97	140.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	(71)

Water heating gains (Table 5)

(72)m=	108.2	106.48	102.92	98.07	94.92	90.49	86.73	91.55	93.27	98.28	103.95	106.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	316.85	315.19	305.6	290.25	274.95	259.97	250.07	254.84	262.58	278.09	295.91	309.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x	0.77	x	8.64	x	19.64	x	0.76	x	0.7	=	62.56	(76)
East	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	8.64	x	38.42	x	0.76	x	0.7	=	122.38	(76)
East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	8.64	x	63.27	x	0.76	x	0.7	=	201.55	(76)
East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	8.64	x	92.28	x	0.76	x	0.7	=	293.95	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	8.64	x	113.09	x	0.76	x	0.7	=	360.24	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	8.64	x	115.77	x	0.76	x	0.7	=	368.77	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	8.64	x	110.22	x	0.76	x	0.7	=	351.08	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	8.64	x	94.68	x	0.76	x	0.7	=	301.58	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	8.64	x	73.59	x	0.76	x	0.7	=	234.41	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	8.64	x	45.59	x	0.76	x	0.7	=	145.22	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	8.64	x	24.49	x	0.76	x	0.7	=	78.01	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	8.64	x	16.15	x	0.76	x	0.7	=	51.45	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	94.27	184.16	303.86	445.87	550.01	564.89	537.02	458.69	354.12	218.57	117.47	77.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	411.12	499.35	609.46	736.12	824.96	824.86	787.09	713.52	616.7	496.66	413.38	386.6	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.8	0.6	0.42	0.31	0.35	0.6	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	20.22	20.54	20.84	20.97	21	21	21	20.98	20.75	20.31	19.96	(87)

DER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.99	19.99	20	20	20	20	20	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.75	0.54	0.36	0.24	0.28	0.52	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=	18.67	18.99	19.44	19.83	19.97	20	20	20	19.98	19.73	19.13	18.62	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.28	19.55	19.94	20.29	20.42	20.45	20.46	20.46	20.44	20.2	19.67	19.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.28	19.55	19.94	20.29	20.42	20.45	20.46	20.46	20.44	20.2	19.67	19.23	(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	0.91	0.77	0.57	0.39	0.27	0.31	0.55	0.86	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	405.67	483.3	555.17	565.03	469.75	320.08	211.7	222.2	340.97	429.58	401.64	382.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	840.21	820.27	751.19	631.26	482.68	321.53	211.86	222.55	349.05	531.05	697.45	836.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	323.3	226.45	145.84	47.69	9.62	0	0	0	0	75.49	212.98	337.98	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1379.35 (98)

Space heating requirement in kWh/m²/year 27.6 (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 1.05 (306)

Space heating		**kWh/year**	
Annual space heating requirement		1379.35	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1448.32	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

DER WorkSheet: New dwelling design stage

Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1760.88	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1848.93	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	32.97	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		231.73	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		3528.97	(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	=	684.51	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	17.11	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	701.62	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				701.62	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	120.27	(379)
Total CO2, kg/year	sum of (376)…(382) =				821.89	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.44	(384)
EI rating (section 14)					88.4	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 9

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.58	(1a) x	2.6	(2a) =	201.71	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		201.71	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.35 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.4	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x	1/[1/(1.4)+ 0.04]	=	8.59			(27)
Windows Type 2			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 4			4.32	x	1/[1/(1.4)+ 0.04]	=	5.73			(27)
Windows Type 5			2.16	x	1/[1/(1.4)+ 0.04]	=	2.86			(27)
Walls Type1	69.18	22.32	46.86	x	0.15	=	7.03			(29)
Walls Type2	2.99	1.99	1	x	0.14	=	0.14			(29)
Walls Type3	14.44	0	14.44	x	0.13	=	1.93			(29)
Total area of elements, m²			86.61							(31)
Party wall			18.72	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) = 41.48 (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 10.56 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 52.04 (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=	38.91	38.69	38.48	37.47	37.28	36.41	36.41	36.25	36.75	37.28	37.67	38.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.95	90.73	90.52	89.51	89.32	88.45	88.45	88.28	88.78	89.32	89.7	90.1	

Average = Sum(39)$_{1...12}$ /12= 89.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.16	1.16	

Average = Sum(40)$_{1...12}$ /12= 1.15 (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 2.42 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.56 (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=	100.72	97.06	93.4	89.73	86.07	82.41	82.41	86.07	89.73	93.4	97.06	100.72	

Total = Sum(44)$_{1...12}$ = 1098.78 (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=	149.37	130.64	134.81	117.53	112.77	97.31	90.17	103.48	104.71	122.03	133.21	144.65	

Total = Sum(45)$_{1...12}$ = 1440.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.41	19.6	20.22	17.63	16.92	14.6	13.53	15.52	15.71	18.3	19.98	21.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.39	178.53	187.83	168.84	165.79	148.62	143.2	156.5	156.02	175.05	184.52	197.68	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.39	178.53	187.83	168.84	165.79	148.62	143.2	156.5	156.02	175.05	184.52	197.68	

Output from water heater (annual)$_{1...12}$ — 2064.97 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.08	81.75	87.24	80.13	79.91	73.41	72.4	76.82	75.87	82.99	85.34	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.11	16.97	13.8	10.45	7.81	6.59	7.12	9.26	12.43	15.78	18.42	19.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	214.31	216.53	210.93	199	183.94	169.79	160.33	158.11	163.71	175.64	190.7	204.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	(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=	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	(71)

Water heating gains (Table 5)

(72)m=	123.77	121.65	117.26	111.29	107.41	101.95	97.31	103.26	105.37	111.55	118.53	121.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.41	414.39	401.22	379.97	358.39	337.56	324	329.85	340.74	362.2	386.88	405.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x	0.77	x	4.32	x	10.63	x	0.76	x	0.7	=	16.94	(74)
North	0.9x	0.77	x	2.16	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x	0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x	0.77	x	4.32	x	20.32	x	0.76	x	0.7	=	32.36	(74)
North	0.9x	0.77	x	2.16	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x	0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x	0.77	x	4.32	x	34.53	x	0.76	x	0.7	=	55	(74)
North	0.9x	0.77	x	2.16	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x	0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x	0.77	x	4.32	x	55.46	x	0.76	x	0.7	=	88.34	(74)
North	0.9x	0.77	x	2.16	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x	0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x	0.77	x	4.32	x	74.72	x	0.76	x	0.7	=	119	(74)
North	0.9x	0.77	x	2.16	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	4.32	x	79.99	x	0.76	x	0.7	=	127.39	(74)
North	0.9x	0.77	x	2.16	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	4.32	x	74.68	x	0.76	x	0.7	=	118.94	(74)
North	0.9x	0.77	x	2.16	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	4.32	x	59.25	x	0.76	x	0.7	=	94.36	(74)
North	0.9x	0.77	x	2.16	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	4.32	x	41.52	x	0.76	x	0.7	=	66.12	(74)
North	0.9x	0.77	x	2.16	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	4.32	x	24.19	x	0.76	x	0.7	=	38.53	(74)
North	0.9x	0.77	x	2.16	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	4.32	x	13.12	x	0.76	x	0.7	=	20.89	(74)
North	0.9x	0.77	x	2.16	x	13.12	x	0.76	x	0.7	=	31.34	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
North	0.9x	0.77	x	4.32	x	8.86	x	0.76	x	0.7	=	14.12	(74)
North	0.9x	0.77	x	2.16	x	8.86	x	0.76	x	0.7	=	21.18	(74)
East	0.9x	0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)
East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	120.97	234.48	390.96	593.22	757.44	791.17	746.58	619.19	460.82	278.58	150.2	100.02

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	537.39	648.87	792.18	973.19	1115.83	1128.74	1070.58	949.05	801.56	640.78	537.08	505.41

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.97	0.87	0.69	0.49	0.36	0.42	0.71	0.95	0.99	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	20.01	20.34	20.72	20.93	20.99	21	21	20.94	20.61	20.14	19.78

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.94	19.95	19.96	19.96	19.97	19.97	19.97	19.96	19.96	19.96	19.95

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.84	0.63	0.42	0.28	0.33	0.62	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=	18.37	18.66	19.13	19.65	19.9	19.96	19.97	19.97	19.93	19.53	18.85	18.33

(90)

fLA = Living area ÷ (4) = 0.37 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.91	19.17	19.58	20.05	20.28	20.35	20.35	20.35	20.31	19.93	19.33	18.87

(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.91	19.17	19.58	20.05	20.28	20.35	20.35	20.35	20.31	19.93	19.33	18.87	(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	0.84	0.65	0.45	0.31	0.37	0.65	0.92	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	533.75	638.16	753.05	821.44	726.02	503.24	331.29	347.55	521.97	590.98	529.29	502.81	(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=	1328.98	1294.55	1184.3	998.19	766.73	508.2	331.91	348.93	550.96	833.43	1097.28	1322	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	591.65	441.1	320.85	127.26	30.29	0	0	0	0	180.39	408.95	609.48	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2709.96	(98)
Space heating requirement in kWh/m²/year	34.93	(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	1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2709.96	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2845.46	(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		2064.97	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2168.22	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.14	(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		0	(330a)

DER WorkSheet: New dwelling design stage

warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		337.42	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5351.09	(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	=	1040.84	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.02	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1066.86	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1066.86	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	175.12	(379)
Total CO2, kg/year	sum of (376)…(382) =				1241.98	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.01	(384)
EI rating (section 14)					86.42	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 10

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.01	(1a) x	2.6	(2a) =	184.63	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		184.63	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36	(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

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36

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	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			8.64	x1/[1/(1.4)+ 0.04]		=	11.45			(27)
Windows Type 2			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 3			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Windows Type 4			4.32	x1/[1/(1.4)+ 0.04]		=	5.73			(27)
Walls Type1	68.31	18.72	49.59	x	0.15	=	7.44			(29)
Walls Type2	3.77	1.99	1.78	x	0.14	=	0.25			(29)
Walls Type3	5.92	0	5.92	x	0.13	=	0.79			(29)
Roof	14.94	0	14.94	x	0.13	=	1.94			(30)
Total area of elements, m²			92.94							(31)
Party wall			13.65	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) = 38.03 (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 14.35 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 52.38 (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=	35.17	34.98	34.8	33.96	33.81	33.07	33.07	32.94	33.36	33.81	34.12	34.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	87.55	87.36	87.18	86.34	86.19	85.45	85.45	85.32	85.74	86.19	86.5	86.84	

Average = Sum(39)$_{1...12}$ /12= 86.34 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.23	1.23	1.22	1.21	1.2	1.2	1.2	1.21	1.21	1.22	1.22	

Average = Sum(40)$_{1...12}$ /12= 1.22 (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 2.27 (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 88.12 (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=	96.94	93.41	89.89	86.36	82.84	79.31	79.31	82.84	86.36	89.89	93.41	96.94	

Total = Sum(44)$_{1...12}$ = 1057.48 (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=	143.75	125.73	129.74	113.11	108.53	93.65	86.78	99.59	100.78	117.44	128.2	139.22	

Total = Sum(45)$_{1...12}$ = 1386.52 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	193.98	171.1	179.97	161.72	158.76	142.27	137.02	149.82	149.39	167.68	176.81	189.45	(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=	193.98	171.1	179.97	161.72	158.76	142.27	137.02	149.82	149.39	167.68	176.81	189.45	

Output from water heater (annual)$_{1...12}$ — 1977.96 — (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=	87.98	78.1	83.32	76.5	76.27	70.03	69.04	73.3	72.4	79.24	81.52	86.48	(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=	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	113.52	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.8	15.81	12.86	9.73	7.28	6.14	6.64	8.63	11.58	14.7	17.16	18.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.65	201.72	196.5	185.38	171.35	158.17	149.36	147.29	152.51	163.62	177.65	190.84	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	-90.82	(71)

Water heating gains (Table 5)

(72)m=	118.26	116.22	111.99	106.25	102.52	97.26	92.8	98.52	100.55	106.5	113.22	116.23	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	392.76	390.81	378.41	358.42	338.2	318.63	305.85	311.49	321.7	341.88	365.09	382.42	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x	0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x	0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x	0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x	0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x	0.77	x	8.64	x	19.64	x	0.76	x	0.7	=	62.56	(76)
East	0.9x	0.77	x	8.64	x	38.42	x	0.76	x	0.7	=	122.38	(76)
East	0.9x	0.77	x	8.64	x	63.27	x	0.76	x	0.7	=	201.55	(76)
East	0.9x	0.77	x	8.64	x	92.28	x	0.76	x	0.7	=	293.95	(76)
East	0.9x	0.77	x	8.64	x	113.09	x	0.76	x	0.7	=	360.24	(76)
East	0.9x	0.77	x	8.64	x	115.77	x	0.76	x	0.7	=	368.77	(76)
East	0.9x	0.77	x	8.64	x	110.22	x	0.76	x	0.7	=	351.08	(76)
East	0.9x	0.77	x	8.64	x	94.68	x	0.76	x	0.7	=	301.58	(76)
East	0.9x	0.77	x	8.64	x	73.59	x	0.76	x	0.7	=	234.41	(76)
East	0.9x	0.77	x	8.64	x	45.59	x	0.76	x	0.7	=	145.22	(76)
East	0.9x	0.77	x	8.64	x	24.49	x	0.76	x	0.7	=	78.01	(76)
East	0.9x	0.77	x	8.64	x	16.15	x	0.76	x	0.7	=	51.45	(76)
Southeast	0.9x	0.77	x	2.16	x	36.79	x	0.76	x	0.7	=	58.6	(77)
Southeast	0.9x	0.77	x	4.32	x	36.79	x	0.76	x	0.7	=	58.6	(77)
Southeast	0.9x	0.77	x	2.16	x	62.67	x	0.76	x	0.7	=	99.82	(77)
Southeast	0.9x	0.77	x	4.32	x	62.67	x	0.76	x	0.7	=	99.82	(77)
Southeast	0.9x	0.77	x	2.16	x	85.75	x	0.76	x	0.7	=	136.58	(77)
Southeast	0.9x	0.77	x	4.32	x	85.75	x	0.76	x	0.7	=	136.58	(77)
Southeast	0.9x	0.77	x	2.16	x	106.25	x	0.76	x	0.7	=	169.22	(77)
Southeast	0.9x	0.77	x	4.32	x	106.25	x	0.76	x	0.7	=	169.22	(77)
Southeast	0.9x	0.77	x	2.16	x	119.01	x	0.76	x	0.7	=	189.55	(77)
Southeast	0.9x	0.77	x	4.32	x	119.01	x	0.76	x	0.7	=	189.55	(77)
Southeast	0.9x	0.77	x	2.16	x	118.15	x	0.76	x	0.7	=	188.18	(77)
Southeast	0.9x	0.77	x	4.32	x	118.15	x	0.76	x	0.7	=	188.18	(77)
Southeast	0.9x	0.77	x	2.16	x	113.91	x	0.76	x	0.7	=	181.42	(77)
Southeast	0.9x	0.77	x	4.32	x	113.91	x	0.76	x	0.7	=	181.42	(77)
Southeast	0.9x	0.77	x	2.16	x	104.39	x	0.76	x	0.7	=	166.26	(77)
Southeast	0.9x	0.77	x	4.32	x	104.39	x	0.76	x	0.7	=	166.26	(77)
Southeast	0.9x	0.77	x	2.16	x	92.85	x	0.76	x	0.7	=	147.88	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.32	x	92.85	x	0.76	x	0.7	=	147.88	(77)
Southeast 0.9x	0.77	x	2.16	x	69.27	x	0.76	x	0.7	=	110.32	(77)
Southeast 0.9x	0.77	x	4.32	x	69.27	x	0.76	x	0.7	=	110.32	(77)
Southeast 0.9x	0.77	x	2.16	x	44.07	x	0.76	x	0.7	=	70.19	(77)
Southeast 0.9x	0.77	x	4.32	x	44.07	x	0.76	x	0.7	=	70.19	(77)
Southeast 0.9x	0.77	x	2.16	x	31.49	x	0.76	x	0.7	=	50.15	(77)
Southeast 0.9x	0.77	x	4.32	x	31.49	x	0.76	x	0.7	=	50.15	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	185.41	332.81	493.03	661.84	779	787.59	753.57	665.55	552.22	378.7	225.35	156.45	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	578.17	723.62	871.44	1020.26	1117.2	1106.22	1059.42	977.04	873.91	720.58	590.44	538.87	(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	0.84	0.67	0.49	0.35	0.4	0.64	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.84	20.09	20.42	20.75	20.93	20.99	21	21	20.96	20.68	20.19	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.9	19.9	19.91	19.91	19.92	19.92	19.92	19.91	19.91	19.91	19.9	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.61	0.41	0.27	0.31	0.55	0.87	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.38	18.74	19.2	19.64	19.85	19.91	19.92	19.92	19.89	19.57	18.89	18.32	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.05	19.35	19.76	20.15	20.34	20.4	20.41	20.41	20.37	20.08	19.48	18.99	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.05	19.35	19.76	20.15	20.34	20.4	20.41	20.41	20.37	20.08	19.48	18.99	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.81	0.63	0.44	0.31	0.35	0.59	0.88	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	571.1	700.91	802.1	823.12	705.78	489.98	324.65	340.55	516.78	630.83	574.74	533.94	(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=	1290.86	1262.59	1155.7	971.14	744.68	495.61	325.38	341.91	537.79	816.66	1070.83	1284.23	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	535.51	377.45	263.07	106.58	28.94	0	0	0	0	138.26	357.18	558.21	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2365.21	(98)
Space heating requirement in kWh/m²/year		33.31	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2365.21	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2483.47	(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		1977.96	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2076.86	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.6	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		314.33	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4874.67	(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	=	946.73	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.67	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	970.39	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			970.39	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	163.14	(379)
Total CO2, kg/year	sum of (376)…(382) =			1133.53	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.96	(384)
EI rating (section 14)				86.91	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 11

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	49.98	(1a) x	2.6	(2a) =	129.95	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.98	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		129.95	(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			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.27	(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

0.35	0.34	0.34	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32

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=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			8.64	x	1/[1/(1.4)+ 0.04]	=	11.45			(27)
Windows Type 2			1.44	x	1/[1/(1.4)+ 0.04]	=	1.91			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Walls Type1	28.34	13.68	14.66	x	0.15	=	2.2			(29)
Walls Type2	18.85	1.99	16.86	x	0.14	=	2.39			(29)
Roof	69.71	0	69.71	x	0.13	=	9.06			(30)
Total area of elements, m²			116.9							(31)
Party wall			17.16	x	0	=	0			(32)
Party wall			13.65	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) = 34.57 (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 9.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.22 (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=	24.06	23.96	23.86	23.39	23.31	22.9	22.9	22.82	23.05	23.31	23.48	23.67	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.28	68.18	68.08	67.61	67.53	67.12	67.12	67.04	67.27	67.53	67.7	67.89	

Average = Sum(39)$_{1...12}$ /12= 67.61 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.37	1.36	1.36	1.35	1.35	1.34	1.34	1.34	1.35	1.35	1.35	1.36	

Average = Sum(40)$_{1...12}$ /12= 1.35 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.33 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.76	78.79	75.81	72.84	69.87	66.89	66.89	69.87	72.84	75.81	78.79	81.76	

Total = Sum(44)$_{1...12}$ = 891.91 (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=	121.25	106.04	109.43	95.4	91.54	78.99	73.2	83.99	85	99.06	108.13	117.42	

Total = Sum(45)$_{1...12}$ = 1169.44 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.19	15.91	16.41	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.61	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 170 (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): 1.45 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.87 (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) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(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=	26.97	24.36	26.97	26.1	26.97	26.1	26.97	26.97	26.1	26.97	26.1	26.97	(57)

DER WorkSheet: New dwelling design stage

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=	171.48	151.41	159.66	144.01	141.77	127.6	123.43	134.23	133.61	149.29	156.74	167.65	(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=	171.48	151.41	159.66	144.01	141.77	127.6	123.43	134.23	133.61	149.29	156.74	167.65	

Output from water heater (annual)$_{1...12}$ | 1760.88 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	80.5	71.56	76.57	70.61	70.62	65.15	64.52	68.11	67.15	73.12	74.84	79.23	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	84.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.12	11.65	9.48	7.18	5.36	4.53	4.89	6.36	8.54	10.84	12.65	13.49	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.18	148.71	144.86	136.67	126.32	116.6	110.11	108.58	112.43	120.62	130.97	140.69	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	-67.58	(71)

Water heating gains (Table 5)

(72)m=	108.2	106.48	102.92	98.07	94.92	90.49	86.73	91.55	93.27	98.28	103.95	106.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	316.85	315.19	305.6	290.25	274.95	259.97	250.07	254.84	262.58	278.09	295.91	309.01	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x	0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x	0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
East	0.9x	0.77	x	8.64	x	19.64	x	0.76	x	0.7	=	62.56	(76)
East	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	8.64	x	38.42	x	0.76	x	0.7	=	122.38	(76)
East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	8.64	x	63.27	x	0.76	x	0.7	=	201.55	(76)
East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	8.64	x	92.28	x	0.76	x	0.7	=	293.95	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	8.64	x	113.09	x	0.76	x	0.7	=	360.24	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	8.64	x	115.77	x	0.76	x	0.7	=	368.77	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	8.64	x	110.22	x	0.76	x	0.7	=	351.08	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	8.64	x	94.68	x	0.76	x	0.7	=	301.58	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	8.64	x	73.59	x	0.76	x	0.7	=	234.41	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	8.64	x	45.59	x	0.76	x	0.7	=	145.22	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	8.64	x	24.49	x	0.76	x	0.7	=	78.01	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	8.64	x	16.15	x	0.76	x	0.7	=	51.45	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	94.27	184.16	303.86	445.87	550.01	564.89	537.02	458.69	354.12	218.57	117.47	77.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	411.12	499.35	609.46	736.12	824.96	824.86	787.09	713.52	616.7	496.66	413.38	386.6	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.95	0.86	0.69	0.51	0.37	0.43	0.69	0.93	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.68	19.9	20.26	20.66	20.89	20.98	21	20.99	20.92	20.56	20.03	19.63	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.8	19.8	19.8	19.8	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.82	0.62	0.42	0.27	0.32	0.59	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.07	18.39	18.9	19.44	19.71	19.8	19.81	19.81	19.75	19.33	18.59	18.01	(90)

fLA = Living area ÷ (4) =	0.46	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.8	19.08	19.52	20	20.25	20.34	20.35	20.35	20.29	19.89	19.25	18.75	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.8	19.08	19.52	20	20.25	20.34	20.35	20.35	20.29	19.89	19.25	18.75	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.82	0.65	0.46	0.32	0.37	0.63	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	406	485.73	567.27	606.01	535.77	377.98	250.61	262.68	389.57	445.49	403.3	382.81	(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=	990.29	967.05	886.77	750.26	577.53	385.02	251.69	264.7	416.39	627.49	822.61	987.69	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	434.71	323.45	237.71	103.86	31.07	0	0	0	0	135.41	301.9	450.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2018.15	(98)
Space heating requirement in kWh/m²/year	40.38	(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	1.05	(306)

Space heating	**kWh/year**
Annual space heating requirement	2018.15

DER WorkSheet: New dwelling design stage

Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2119.06	(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		1760.88	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1848.93	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	39.68	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		231.73	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		4199.71	(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	=	823.75	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.59	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	844.35	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				844.35	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	120.27	(379)
Total CO2, kg/year	sum of (376)…(382) =				964.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				19.3	(384)
EI rating (section 14)					86.39	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 12

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.58	(1a) x	2.6	(2a) =	201.71	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.58	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		201.71	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.4	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.99	x	1.4	=	2.786			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 4			4.32	x1/[1/(1.4)+ 0.04]		=	5.73			(27)
Windows Type 5			2.16	x1/[1/(1.4)+ 0.04]		=	2.86			(27)
Walls Type1	69.18	22.32	46.86	x	0.15	=	7.03			(29)
Walls Type2	2.99	1.99	1	x	0.14	=	0.14			(29)
Walls Type3	14.44	0	14.44	x	0.13	=	1.93			(29)
Roof	19.38	0	19.38	x	0.13	=	2.52			(30)
Total area of elements, m²			105.98							(31)
Party wall			18.72	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) = 43.99 (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 13.21 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 57.2 (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=	38.91	38.69	38.48	37.47	37.28	36.41	36.41	36.25	36.75	37.28	37.67	38.06	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.9	95.68	94.67	94.49	93.61	93.61	93.45	93.95	94.49	94.87	95.27	

Average = Sum(39)$_{1...12}$ /12= 94.67 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.24	1.24	1.23	1.22	1.22	1.21	1.21	1.2	1.21	1.22	1.22	1.23	

Average = Sum(40)$_{1...12}$ /12= 1.22 (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 2.42 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 91.56 (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=	100.72	97.06	93.4	89.73	86.07	82.41	82.41	86.07	89.73	93.4	97.06	100.72	

Total = Sum(44)$_{1...12}$ = 1098.78 (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=	149.37	130.64	134.81	117.53	112.77	97.31	90.17	103.48	104.71	122.03	133.21	144.65	

Total = Sum(45)$_{1...12}$ = 1440.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.41	19.6	20.22	17.63	16.92	14.6	13.53	15.52	15.71	18.3	19.98	21.7	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.39	178.53	187.83	168.84	165.79	148.62	143.2	156.5	156.02	175.05	184.52	197.68	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.39	178.53	187.83	168.84	165.79	148.62	143.2	156.5	156.02	175.05	184.52	197.68	

Output from water heater (annual)$_{1...12}$ | 2064.97 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.08	81.75	87.24	80.13	79.91	73.41	72.4	76.82	75.87	82.99	85.34	90.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	120.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.11	16.97	13.8	10.45	7.81	6.59	7.12	9.26	12.43	15.78	18.42	19.64	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	214.31	216.53	210.93	199	183.94	169.79	160.33	158.11	163.71	175.64	190.7	204.85	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	35.08	(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=	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	-96.61	(71)

Water heating gains (Table 5)

(72)m=	123.77	121.65	117.26	111.29	107.41	101.95	97.31	103.26	105.37	111.55	118.53	121.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	416.41	414.39	401.22	379.97	358.39	337.56	324	329.85	340.74	362.2	386.88	405.38	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	1.44	x	10.63	x	0.76	x	0.7	=	5.65	(74)
North	0.9x 0.77	x	4.32	x	10.63	x	0.76	x	0.7	=	16.94	(74)
North	0.9x 0.77	x	2.16	x	10.63	x	0.76	x	0.7	=	25.4	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.76	x	0.7	=	10.79	(74)
North	0.9x 0.77	x	4.32	x	20.32	x	0.76	x	0.7	=	32.36	(74)
North	0.9x 0.77	x	2.16	x	20.32	x	0.76	x	0.7	=	48.55	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.76	x	0.7	=	18.33	(74)
North	0.9x 0.77	x	4.32	x	34.53	x	0.76	x	0.7	=	55	(74)
North	0.9x 0.77	x	2.16	x	34.53	x	0.76	x	0.7	=	82.49	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.76	x	0.7	=	29.45	(74)
North	0.9x 0.77	x	4.32	x	55.46	x	0.76	x	0.7	=	88.34	(74)
North	0.9x 0.77	x	2.16	x	55.46	x	0.76	x	0.7	=	132.51	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.76	x	0.7	=	39.67	(74)
North	0.9x 0.77	x	4.32	x	74.72	x	0.76	x	0.7	=	119	(74)
North	0.9x 0.77	x	2.16	x	74.72	x	0.76	x	0.7	=	178.5	(74)
North	0.9x 0.77	x	1.44	x	79.99	x	0.76	x	0.7	=	42.46	(74)
North	0.9x 0.77	x	4.32	x	79.99	x	0.76	x	0.7	=	127.39	(74)
North	0.9x 0.77	x	2.16	x	79.99	x	0.76	x	0.7	=	191.09	(74)
North	0.9x 0.77	x	1.44	x	74.68	x	0.76	x	0.7	=	39.65	(74)
North	0.9x 0.77	x	4.32	x	74.68	x	0.76	x	0.7	=	118.94	(74)
North	0.9x 0.77	x	2.16	x	74.68	x	0.76	x	0.7	=	178.4	(74)
North	0.9x 0.77	x	1.44	x	59.25	x	0.76	x	0.7	=	31.45	(74)
North	0.9x 0.77	x	4.32	x	59.25	x	0.76	x	0.7	=	94.36	(74)
North	0.9x 0.77	x	2.16	x	59.25	x	0.76	x	0.7	=	141.54	(74)
North	0.9x 0.77	x	1.44	x	41.52	x	0.76	x	0.7	=	22.04	(74)
North	0.9x 0.77	x	4.32	x	41.52	x	0.76	x	0.7	=	66.12	(74)
North	0.9x 0.77	x	2.16	x	41.52	x	0.76	x	0.7	=	99.18	(74)
North	0.9x 0.77	x	1.44	x	24.19	x	0.76	x	0.7	=	12.84	(74)
North	0.9x 0.77	x	4.32	x	24.19	x	0.76	x	0.7	=	38.53	(74)
North	0.9x 0.77	x	2.16	x	24.19	x	0.76	x	0.7	=	57.79	(74)
North	0.9x 0.77	x	1.44	x	13.12	x	0.76	x	0.7	=	6.96	(74)
North	0.9x 0.77	x	4.32	x	13.12	x	0.76	x	0.7	=	20.89	(74)
North	0.9x 0.77	x	2.16	x	13.12	x	0.76	x	0.7	=	31.34	(74)
North	0.9x 0.77	x	1.44	x	8.86	x	0.76	x	0.7	=	4.71	(74)
North	0.9x 0.77	x	4.32	x	8.86	x	0.76	x	0.7	=	14.12	(74)
North	0.9x 0.77	x	2.16	x	8.86	x	0.76	x	0.7	=	21.18	(74)
East	0.9x 0.77	x	6.48	x	19.64	x	0.76	x	0.7	=	46.92	(76)
East	0.9x 0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x 0.77	x	6.48	x	38.42	x	0.76	x	0.7	=	91.79	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	6.48	x	63.27	x	0.76	x	0.7	=	151.16	(76)
East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	6.48	x	92.28	x	0.76	x	0.7	=	220.46	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	6.48	x	113.09	x	0.76	x	0.7	=	270.18	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	6.48	x	115.77	x	0.76	x	0.7	=	276.58	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	6.48	x	110.22	x	0.76	x	0.7	=	263.31	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	6.48	x	94.68	x	0.76	x	0.7	=	226.18	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	6.48	x	73.59	x	0.76	x	0.7	=	175.81	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	6.48	x	45.59	x	0.76	x	0.7	=	108.91	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	6.48	x	24.49	x	0.76	x	0.7	=	58.5	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	6.48	x	16.15	x	0.76	x	0.7	=	38.59	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	21.44	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	120.97	234.48	390.96	593.22	757.44	791.17	746.58	619.19	460.82	278.58	150.2	100.02	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	537.39	648.87	792.18	973.19	1115.83	1128.74	1070.58	949.05	801.56	640.78	537.08	505.41	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.89	0.72	0.52	0.38	0.45	0.73	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.73	19.93	20.26	20.66	20.91	20.98	21	20.99	20.92	20.55	20.06	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.89	19.89	19.9	19.91	19.91	19.91	19.92	19.91	19.91	19.9	19.9	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.65	0.44	0.29	0.34	0.64	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=	18.21	18.5	18.98	19.54	19.82	19.91	19.91	19.91	19.86	19.41	18.71	18.16	(90)

fLA = Living area ÷ (4) = 0.37 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=	18.77	19.03	19.46	19.96	20.23	20.31	20.32	20.32	20.26	19.84	19.21	18.73	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.77	19.03	19.46	19.96	20.23	20.31	20.32	20.32	20.26	19.84	19.21	18.73	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.86	0.67	0.47	0.32	0.38	0.67	0.93	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	533.73	638.45	755.39	833.16	750.49	526.69	347.05	363.84	539.13	594.42	529.48	502.78	(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=	1391.22	1355.24	1239.97	1046.78	805.75	534.34	348.07	366.07	578.36	872.72	1149.03	1384.6	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	637.97	481.68	360.52	153.81	41.11	0	0	0	0	207.06	446.08	656.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2984.31	(98)
Space heating requirement in kWh/m²/year	38.47	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		2984.31	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3133.53	(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		2064.97	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2168.22	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	53.02	(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)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		337.42	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		5639.16	(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	=	1100.64	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	27.52	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1128.16	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1128.16	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	175.12	(379)
Total CO2, kg/year	sum of (376)…(382) =				1303.28	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.8	(384)
EI rating (section 14)					85.75	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 13

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	88.96	(1a) x	2.6	(2a) =	231.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	88.96	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		231.29	(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							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) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(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) =	0.28	(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

0.36	0.35	0.34	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33

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=

0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55

(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			7.2	x1/[1/(1.4)+ 0.04]		=	9.55			(27)
Windows Type 2			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 3			3.6	x1/[1/(1.4)+ 0.04]		=	4.77			(27)
Windows Type 4			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Walls Type1	71.27	21.6	49.67	x	0.15	=	7.45			(29)
Walls Type2	9.1	1.99	7.11	x	0.14	=	1.01			(29)
Walls Type3	11.9	0	11.9	x	0.13	=	1.59			(29)
Roof	88.96	0	88.96	x	0.13	=	11.56			(30)
Total area of elements, m²			181.23							(31)
Party wall			16.76	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) = 53.03 (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 21.39 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 74.42 (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=	43.04	42.85	42.66	41.79	41.63	40.87	40.87	40.73	41.16	41.63	41.96	42.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	117.46	117.27	117.09	116.21	116.05	115.29	115.29	115.15	115.59	116.05	116.38	116.73	

Average = Sum(39)$_{1...12}$ /12= 116.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.32	1.32	1.32	1.31	1.3	1.3	1.3	1.29	1.3	1.3	1.31	1.31	

Average = Sum(40)$_{1...12}$ /12= 1.31 (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 2.61 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.22 (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=	105.84	101.99	98.14	94.29	90.44	86.59	86.59	90.44	94.29	98.14	101.99	105.84	

Total = Sum(44)$_{1...12}$ = 1154.59 (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=	156.95	137.27	141.65	123.5	118.5	102.25	94.75	108.73	110.03	128.23	139.97	152	

Total = Sum(45)$_{1...12}$ = 1513.85 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.54	20.59	21.25	18.52	17.77	15.34	14.21	16.31	16.5	19.23	21	22.8	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	209.98	185.16	194.68	174.81	171.52	153.57	147.78	161.75	161.34	181.25	191.28	205.02	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	209.98	185.16	194.68	174.81	171.52	153.57	147.78	161.75	161.34	181.25	191.28	205.02	

Output from water heater (annual)$_{1...12}$ — 2138.14 — (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=	94.61	83.96	89.52	82.11	81.82	75.05	73.92	78.57	77.63	85.05	87.59	92.96	(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=	130.56	130.56	130.56	130.56	130.56	130.56	130.56	130.56	130.56	130.56	130.56	130.56	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.14	18.78	15.27	11.56	8.64	7.3	7.88	10.25	13.75	17.46	20.38	21.73	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	237.15	239.61	233.41	220.21	203.54	187.88	177.41	174.95	181.15	194.36	211.02	226.68	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.06	36.06	36.06	36.06	36.06	36.06	36.06	36.06	36.06	36.06	36.06	36.06	(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=	-104.45	-104.45	-104.45	-104.45	-104.45	-104.45	-104.45	-104.45	-104.45	-104.45	-104.45	-104.45	(71)

Water heating gains (Table 5)

(72)m=	127.16	124.93	120.32	114.04	109.97	104.24	99.36	105.61	107.83	114.32	121.65	124.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	447.61	445.49	431.17	407.98	384.32	361.58	346.83	352.98	364.9	388.31	415.23	435.53	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	52.13	(76)
East	0.9x	0.77	x	1.8	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	101.99	(76)
East	0.9x	0.77	x	1.8	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	167.96	(76)
East	0.9x	0.77	x	1.8	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	244.95	(76)
East	0.9x	0.77	x	1.8	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	300.2	(76)
East	0.9x	0.77	x	1.8	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	307.31	(76)
East	0.9x	0.77	x	1.8	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	292.57	(76)
East	0.9x	0.77	x	1.8	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	251.31	(76)
East	0.9x	0.77	x	1.8	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	195.34	(76)
East	0.9x	0.77	x	1.8	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	121.01	(76)
East	0.9x	0.77	x	1.8	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	65.01	(76)
East	0.9x	0.77	x	1.8	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	42.87	(76)
East	0.9x	0.77	x	1.8	x	16.15	x	0.76	x	0.7	=	21.44	(76)
Southeast	0.9x	0.77	x	7.2	x	36.79	x	0.76	x	0.7	=	97.67	(77)
Southeast	0.9x	0.77	x	3.6	x	36.79	x	0.76	x	0.7	=	48.83	(77)
Southeast	0.9x	0.77	x	7.2	x	62.67	x	0.76	x	0.7	=	166.36	(77)
Southeast	0.9x	0.77	x	3.6	x	62.67	x	0.76	x	0.7	=	83.18	(77)
Southeast	0.9x	0.77	x	7.2	x	85.75	x	0.76	x	0.7	=	227.63	(77)
Southeast	0.9x	0.77	x	3.6	x	85.75	x	0.76	x	0.7	=	113.81	(77)
Southeast	0.9x	0.77	x	7.2	x	106.25	x	0.76	x	0.7	=	282.04	(77)
Southeast	0.9x	0.77	x	3.6	x	106.25	x	0.76	x	0.7	=	141.02	(77)
Southeast	0.9x	0.77	x	7.2	x	119.01	x	0.76	x	0.7	=	315.91	(77)
Southeast	0.9x	0.77	x	3.6	x	119.01	x	0.76	x	0.7	=	157.95	(77)
Southeast	0.9x	0.77	x	7.2	x	118.15	x	0.76	x	0.7	=	313.63	(77)
Southeast	0.9x	0.77	x	3.6	x	118.15	x	0.76	x	0.7	=	156.81	(77)
Southeast	0.9x	0.77	x	7.2	x	113.91	x	0.76	x	0.7	=	302.37	(77)
Southeast	0.9x	0.77	x	3.6	x	113.91	x	0.76	x	0.7	=	151.18	(77)
Southeast	0.9x	0.77	x	7.2	x	104.39	x	0.76	x	0.7	=	277.1	(77)
Southeast	0.9x	0.77	x	3.6	x	104.39	x	0.76	x	0.7	=	138.55	(77)
Southeast	0.9x	0.77	x	7.2	x	92.85	x	0.76	x	0.7	=	246.47	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	3.6	x	92.85	x	0.76	x	0.7	=	123.24	(77)
Southeast 0.9x	0.77	x	7.2	x	69.27	x	0.76	x	0.7	=	183.87	(77)
Southeast 0.9x	0.77	x	3.6	x	69.27	x	0.76	x	0.7	=	91.93	(77)
Southeast 0.9x	0.77	x	7.2	x	44.07	x	0.76	x	0.7	=	116.98	(77)
Southeast 0.9x	0.77	x	3.6	x	44.07	x	0.76	x	0.7	=	58.49	(77)
Southeast 0.9x	0.77	x	7.2	x	31.49	x	0.76	x	0.7	=	83.58	(77)
Southeast 0.9x	0.77	x	3.6	x	31.49	x	0.76	x	0.7	=	41.79	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	224.7	402.53	593.38	790.49	924.17	931.4	892.41	792.62	662.72	457.33	272.98	189.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	672.32	848.02	1024.54	1198.47	1308.49	1292.98	1239.23	1145.6	1027.62	845.63	688.21	625.21	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.73	0.55	0.41	0.45	0.7	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.68	19.92	20.26	20.64	20.88	20.97	20.99	20.99	20.92	20.57	20.04	19.63	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.83	19.83	19.84	19.84	19.84	19.84	19.85	19.84	19.84	19.83	19.83	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.84	0.67	0.46	0.3	0.34	0.61	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=	18.09	18.45	18.94	19.44	19.73	19.83	19.84	19.84	19.79	19.37	18.62	18.03	(90)

fLA = Living area ÷ (4) = 0.41 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.74	19.05	19.48	19.93	20.2	20.3	20.31	20.31	20.25	19.86	19.2	18.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.74	19.05	19.48	19.93	20.2	20.3	20.31	20.31	20.25	19.86	19.2	18.68	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.94	0.85	0.69	0.5	0.34	0.39	0.65	0.9	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	666.01	827.46	961.12	1014.08	901.6	641.98	426.09	446.77	664.38	763.33	674.31	620.83	(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=	1696.23	1659.56	1519.86	1282.18	986.45	656.94	428.27	450.61	711.29	1074.95	1408.61	1690.42	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	766.48	559.17	415.7	193.04	63.13	0	0	0	0	231.85	528.7	795.78	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3553.84	(98)
Space heating requirement in kWh/m²/year		39.95	(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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		3553.84	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3731.54	(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		2138.14	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2245.05	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	59.77	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		373.37	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		6349.96	(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	=	1240.74	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	31.02	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1271.76	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1271.76	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	193.78	(379)
Total CO2, kg/year	sum of (376)…(382) =			1465.54	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.47	(384)
EI rating (section 14)				85.34	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.41

Property Address: Building 4 - Flat 14

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.92	(1a) x	2.6	(2a) =	205.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.92	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		205.2	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29	(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

0.38	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35

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=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(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			1.99	x	1.4	=	2.786			(26)
Windows Type 1			7.2	x	1/[1/(1.4)+ 0.04]	=	9.55			(27)
Windows Type 2			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 3			3.6	x	1/[1/(1.4)+ 0.04]	=	4.77			(27)
Windows Type 4			1.8	x	1/[1/(1.4)+ 0.04]	=	2.39			(27)
Walls Type1	63.55	21.6	41.95	x	0.15	=	6.29			(29)
Walls Type2	2.86	1.99	0.87	x	0.14	=	0.12			(29)
Walls Type3	22.63	0	22.63	x	0.13	=	3.02			(29)
Roof	78.92	0	78.92	x	0.13	=	10.26			(30)
Total area of elements, m²			167.96							(31)
Party wall			18.36	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) = 51.12 (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 20.79 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 71.91 (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=	38.62	38.44	38.26	37.41	37.25	36.5	36.5	36.37	36.79	37.25	37.57	37.91	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.54	110.35	110.17	109.32	109.16	108.42	108.42	108.28	108.7	109.16	109.48	109.82	

Average = Sum(39)$_{1...12}$ /12= 109.32 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.4	1.4	1.4	1.39	1.38	1.37	1.37	1.37	1.38	1.38	1.39	1.39	

Average = Sum(40)$_{1...12}$ /12= 1.39 (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 2.44 (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 92.2 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.42	97.73	94.04	90.36	86.67	82.98	82.98	86.67	90.36	94.04	97.73	101.42	

Total = Sum(44)$_{1...12}$ = 1106.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150.4	131.54	135.74	118.34	113.55	97.99	90.8	104.19	105.44	122.88	134.13	145.66	

Total = Sum(45)$_{1...12}$ = 1450.66 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.56	19.73	20.36	17.75	17.03	14.7	13.62	15.63	15.82	18.43	20.12	21.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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): 1.6 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.96 (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) 0.96 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	29.76	26.88	29.76	28.8	29.76	28.8	29.76	29.76	28.8	29.76	28.8	29.76	(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=	203.42	179.43	188.76	169.65	166.57	149.3	143.82	157.22	156.75	175.9	185.44	198.68	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	203.42	179.43	188.76	169.65	166.57	149.3	143.82	157.22	156.75	175.9	185.44	198.68	

Output from water heater (annual)$_{1...12}$ — 2074.95 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.43	82.05	87.55	80.4	80.17	73.63	72.61	77.06	76.11	83.27	85.65	90.85	(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=	122.1	122.1	122.1	122.1	122.1	122.1	122.1	122.1	122.1	122.1	122.1	122.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.36	17.2	13.99	10.59	7.91	6.68	7.22	9.38	12.6	15.99	18.67	19.9	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	217.17	219.43	213.75	201.66	186.4	172.05	162.47	160.22	165.9	177.99	193.25	207.59	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.21	35.21	35.21	35.21	35.21	35.21	35.21	35.21	35.21	35.21	35.21	35.21	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.68	-97.68	-97.68	-97.68	-97.68	-97.68	-97.68	-97.68	-97.68	-97.68	-97.68	-97.68	(71)

Water heating gains (Table 5)

(72)m=	124.23	122.1	117.68	111.66	107.76	102.26	97.59	103.58	105.7	111.93	118.96	122.11	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	420.39	418.35	405.04	383.54	361.7	340.63	326.91	332.81	343.83	365.54	390.5	409.23	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	7.2	x	10.63	x	0.76	x	0.7	=	28.23	(74)
North	0.9x	0.77	x	3.6	x	10.63	x	0.76	x	0.7	=	14.11	(74)
North	0.9x	0.77	x	7.2	x	20.32	x	0.76	x	0.7	=	53.94	(74)
North	0.9x	0.77	x	3.6	x	20.32	x	0.76	x	0.7	=	26.97	(74)
North	0.9x	0.77	x	7.2	x	34.53	x	0.76	x	0.7	=	91.66	(74)
North	0.9x	0.77	x	3.6	x	34.53	x	0.76	x	0.7	=	45.83	(74)
North	0.9x	0.77	x	7.2	x	55.46	x	0.76	x	0.7	=	147.23	(74)
North	0.9x	0.77	x	3.6	x	55.46	x	0.76	x	0.7	=	73.61	(74)
North	0.9x	0.77	x	7.2	x	74.72	x	0.76	x	0.7	=	198.33	(74)
North	0.9x	0.77	x	3.6	x	74.72	x	0.76	x	0.7	=	99.17	(74)
North	0.9x	0.77	x	7.2	x	79.99	x	0.76	x	0.7	=	212.32	(74)
North	0.9x	0.77	x	3.6	x	79.99	x	0.76	x	0.7	=	106.16	(74)
North	0.9x	0.77	x	7.2	x	74.68	x	0.76	x	0.7	=	198.23	(74)
North	0.9x	0.77	x	3.6	x	74.68	x	0.76	x	0.7	=	99.11	(74)
North	0.9x	0.77	x	7.2	x	59.25	x	0.76	x	0.7	=	157.27	(74)
North	0.9x	0.77	x	3.6	x	59.25	x	0.76	x	0.7	=	78.63	(74)
North	0.9x	0.77	x	7.2	x	41.52	x	0.76	x	0.7	=	110.2	(74)
North	0.9x	0.77	x	3.6	x	41.52	x	0.76	x	0.7	=	55.1	(74)
North	0.9x	0.77	x	7.2	x	24.19	x	0.76	x	0.7	=	64.21	(74)
North	0.9x	0.77	x	3.6	x	24.19	x	0.76	x	0.7	=	32.11	(74)
North	0.9x	0.77	x	7.2	x	13.12	x	0.76	x	0.7	=	34.82	(74)
North	0.9x	0.77	x	3.6	x	13.12	x	0.76	x	0.7	=	17.41	(74)
North	0.9x	0.77	x	7.2	x	8.86	x	0.76	x	0.7	=	23.53	(74)
North	0.9x	0.77	x	3.6	x	8.86	x	0.76	x	0.7	=	11.77	(74)
East	0.9x	0.77	x	3.6	x	19.64	x	0.76	x	0.7	=	52.13	(76)
East	0.9x	0.77	x	1.8	x	19.64	x	0.76	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	3.6	x	38.42	x	0.76	x	0.7	=	101.99	(76)
East	0.9x	0.77	x	1.8	x	38.42	x	0.76	x	0.7	=	50.99	(76)
East	0.9x	0.77	x	3.6	x	63.27	x	0.76	x	0.7	=	167.96	(76)
East	0.9x	0.77	x	1.8	x	63.27	x	0.76	x	0.7	=	83.98	(76)
East	0.9x	0.77	x	3.6	x	92.28	x	0.76	x	0.7	=	244.95	(76)
East	0.9x	0.77	x	1.8	x	92.28	x	0.76	x	0.7	=	122.48	(76)
East	0.9x	0.77	x	3.6	x	113.09	x	0.76	x	0.7	=	300.2	(76)
East	0.9x	0.77	x	1.8	x	113.09	x	0.76	x	0.7	=	150.1	(76)
East	0.9x	0.77	x	3.6	x	115.77	x	0.76	x	0.7	=	307.31	(76)
East	0.9x	0.77	x	1.8	x	115.77	x	0.76	x	0.7	=	153.65	(76)
East	0.9x	0.77	x	3.6	x	110.22	x	0.76	x	0.7	=	292.57	(76)
East	0.9x	0.77	x	1.8	x	110.22	x	0.76	x	0.7	=	146.29	(76)
East	0.9x	0.77	x	3.6	x	94.68	x	0.76	x	0.7	=	251.31	(76)
East	0.9x	0.77	x	1.8	x	94.68	x	0.76	x	0.7	=	125.66	(76)
East	0.9x	0.77	x	3.6	x	73.59	x	0.76	x	0.7	=	195.34	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	1.8	x	73.59	x	0.76	x	0.7	=	97.67	(76)
East	0.9x	0.77	x	3.6	x	45.59	x	0.76	x	0.7	=	121.01	(76)
East	0.9x	0.77	x	1.8	x	45.59	x	0.76	x	0.7	=	60.51	(76)
East	0.9x	0.77	x	3.6	x	24.49	x	0.76	x	0.7	=	65.01	(76)
East	0.9x	0.77	x	1.8	x	24.49	x	0.76	x	0.7	=	32.5	(76)
East	0.9x	0.77	x	3.6	x	16.15	x	0.76	x	0.7	=	42.87	(76)
East	0.9x	0.77	x	1.8	x	16.15	x	0.76	x	0.7	=	21.44	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	120.54	233.89	389.42	588.27	747.8	779.44	736.2	612.87	458.32	277.84	149.74	99.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	540.94	652.24	794.46	971.82	1109.5	1120.07	1063.11	945.68	802.15	643.38	540.24	508.83	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.44	0.51	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.51	19.71	20.06	20.5	20.82	20.96	20.99	20.98	20.86	20.41	19.88	19.48	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.77	19.77	19.78	19.78	19.78	19.78	19.78	19.78	19.77	19.77	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.71	0.49	0.32	0.38	0.69	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=	17.81	18.1	18.61	19.22	19.62	19.76	19.78	19.78	19.68	19.12	18.35	17.76	(90)

fLA = Living area ÷ (4) = 0.36 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.42	18.68	19.13	19.68	20.05	20.19	20.21	20.21	20.1	19.58	18.89	18.37	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.42	18.68	19.13	19.68	20.05	20.19	20.21	20.21	20.1	19.58	18.89	18.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.88	0.73	0.52	0.37	0.43	0.72	0.94	0.99	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	537.23	642.45	762.49	857.14	805.05	586.24	388.6	406.26	578.63	603.74	533	506.12	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1560.75	1520.65	1391.27	1178.69	911.42	605.95	391.77	412.51	652.54	980.08	1291.3	1556.63	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	761.5	590.16	467.81	231.52	79.14	0	0	0	0	280	545.98	781.58	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3737.68	(98)
Space heating requirement in kWh/m²/year		47.36	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community 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		1.05	(306)

Space heating		**kWh/year**	
Annual space heating requirement		3737.68	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3924.56	(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		2074.95	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2178.7	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	61.03	(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		0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		341.92	(332)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =		6445.19	(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	=	1267.04	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	31.68	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1298.71	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1298.71	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	177.46	(379)
Total CO2, kg/year	sum of (376)…(382) =			1476.17	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.7	(384)
EI rating (section 14)				84.04	(385)