

Berkeley Homes
Kenavon Drive

Energy Statement Addendum for Kenavon Drive

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1 Introduction

MLM have been commissioned by Berkeley Homes to undertake an Energy Statement addendum to be read in conjunction with the initial energy strategy issued at planning to accompany the Section 73 (Minor Material Amendment) Application for the re-development of the site at Kenavon Drive, Reading.

The development consists of the demolition of existing buildings and erection of 787 new build residential units and commercial unit (total of 1,444 m²), associated landscaping and ancillary works.

The proposed development is located in the Reading Borough Council. The Reading Borough Council is the Regional and Local Bodies that set the Planning Policy Context, referencing to National Standards and Regulations.

The proposed development is required by the Reading Borough Council to make carbon emission reductions in accordance with the Policy CS1 of the Core Strategy of Reading Borough Council and achieve at least 20% CO₂ emissions reduction against Building Regulation Part L 2013 through the use of low and zero carbon technologies.

The aim of this report is to assess feasible carbon emissions reductions through the implementation of efficient energy measures, the use of an on-site Combined Heat and Power (CHP) system and finally the use of zero carbon technologies.

This report demonstrates how the design has followed the Reading Borough Council's Energy Hierarchy by reducing energy demand of the development. Measures proposed include passive design, energy efficiency measures, generating heat in a clean and efficient system and by using on-site renewable energy systems to further reduce the overall carbon emissions of the development.

The methodology applied follows the guidance set out by the Reading Borough Council for developing energy strategies as detailed in the in Policy CS1 of the Core Strategy of Reading Borough Council January 2008, with alteration adopted 27th January 2015.

The energy consumption figures for the proposed development are based on SAP modelling data produced under Building Regulations Part L1A 2013 software compliant for the residential part of the scheme. The energy consumption figures, for the communal part of the scheme are based on SBEM Benchmark in line with Building Regulations Part L2A 2013 Compliant Software.

The proposed Sustainability Principles and Engineering Concepts incorporate the requirements and guidelines of the relevant British Standards, CIBSE Guides and DfE Building Bulletins.

2 Executive Summary

The proposed development will implement significant energy efficiency measures, a Combined Heat and Power System, Air Source Heat Pumps system to achieve the required carbon emission reductions by the Local Authority. The strategy detailed within this report follows the Reading Borough Councils' Energy Hierarchy and achieves a 32.74% improvement in CO₂ emissions over Building Regulations 2013 minimum requirements.

The carbon emissions baseline for the scheme has been identified at 738,969kg CO₂/yr. for space heating, domestic hot water, lighting and auxiliary (regulated emissions).

The following strategy has been implemented site wide:

- 'Be Lean': Energy efficiency measures to improve the building fabric and services includes: High performance U-Values (0.17 for external walls, 0.11 for roof, 0.13 for the ground floor, 0.00 for partition walls and 1.4 for windows (double glazed) in W/m²K, good air tightness (maximum of 3m³/m²/hr at 50Pa)).
- 'Be Clean': A CHP has been deemed feasible for the scheme and will provide approximately 60% of the heating and hot water demand for the residential units only.
- 'Be Green': Air Source Heat Pumps system has been identified as suitable for the proposed scheme (for the commercial units only). Other zero carbon technologies are assessed within this report.

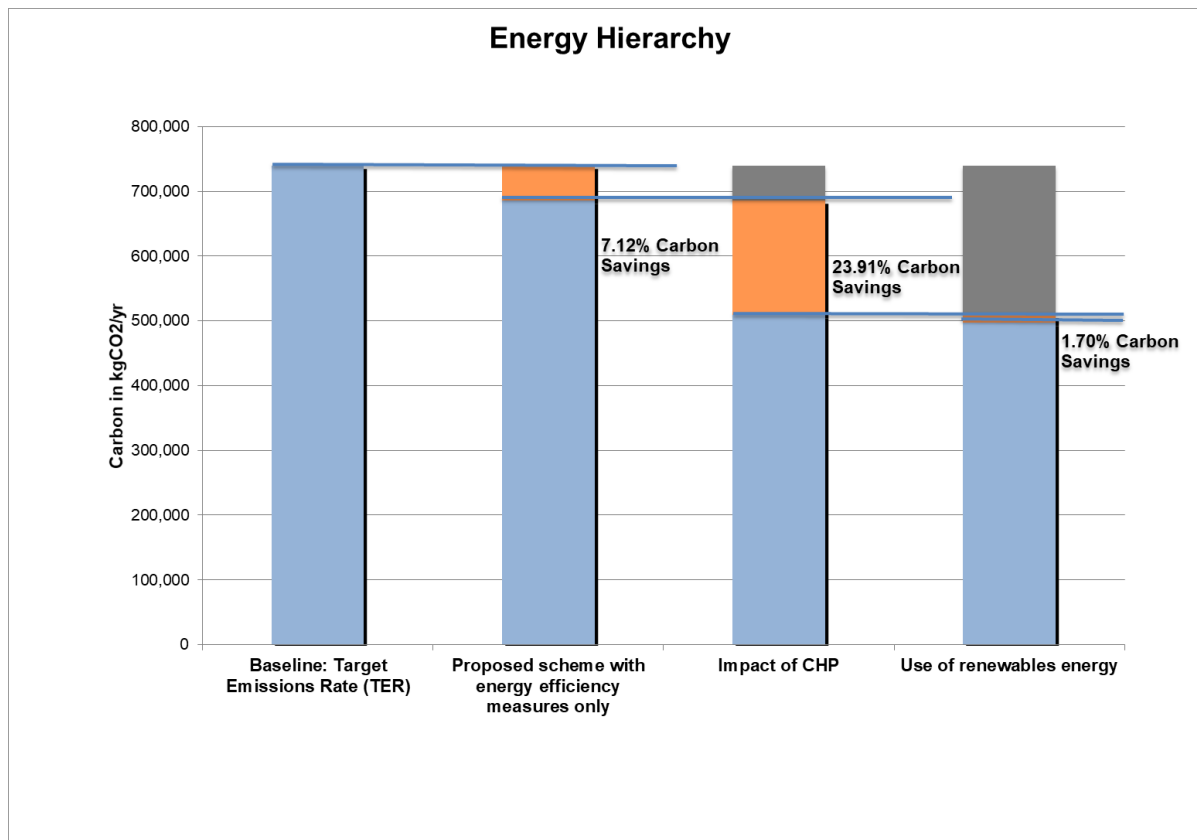
The energy efficiency measures included within this report represent current best practice and the use of a low and zero carbon technology.

The figures set out below demonstrate that the scheme will comfortably comply with Reading Borough Council's energy standards. The exact figures (which will be a minimum of 20% over 2013 Building Regulations) are expected to be finalised and agreed by way of an appropriately worded planning condition.

The conclusions of the assessment can be summarised by the following table based on sample modelling:

	Carbon Dioxide Emissions (Tonnes/Annum)	Incremental CO ₂ Emissions Reduction (%)	Cumulative CO ₂ Emissions Reduction (%)
Step 1 – Baseline	738.97	-	-
Step 2 – 'Be Lean'	686.37	7.12	
Step 3 – 'Be Clean'	509.70	23.91	-
Step 4 – 'Be Green'	497.01	1.72	32.74

The following graph illustrates the carbon savings for each stage of the Energy Hierarchy against the previous stage.



3 Planning Requirement

This energy statement has been designed to adhere to the National, Regional and Local Policies. The proposed development is located within the Reading Borough Council area and is therefore requested to implement the Energy Hierarchy from the Policy CS1 of the Core Strategy of Reading Borough Council January 2008, with alteration adopted on 27 January 2015.

3.1 Baseline Model

The baseline has been taken from the Target Emission Rate (TER) worksheet of the SBEM and SAP Models. Following the Reading Borough Council Guidance, the baseline has been created with a gas boiler.

3.2 'Be Lean'

Implementation of energy efficient 'Be Lean' measures specific to the scheme is encouraged at the earliest Design Stage of a development and aims to reduce the energy demand. Measures typically include passive design: both Architectural and building fabric measures, and active design: energy efficient services. It is possible to exceed Building Regulations Requirements (Part L 2013) through reduced energy demand ('Be Lean') measures alone.

3.3 'Be Clean'

3.3.1 Decentralised Energy Networks Section

The Local Authority require developers to prioritise connection to existing or planned decentralised energy networks where feasible.

3.4 Decentralised Energy in Development Proposals

The use of the 'clean' energy supply refers to the energy efficiency of heating, cooling and power systems. Planning applications should demonstrate how the heating, cooling and power systems have been selected to minimise carbon emissions:

- The proposed development should evaluate the feasibility of the use of Combined Heat and Power (CHP) systems. Where a new CHP system is appropriate, opportunities to extend the system beyond the site boundary to adjacent sites should be examined.
- Major developments should select energy systems in accordance with the following hierarchy:
 - Connection to existing heating or cooling networks;
 - Site wide CHP network;
 - Communal heating and cooling.
- Where future network opportunities are identified, proposals should be designed to connect to these networks.

Cooling

Where design measures and the use of natural and/or mechanical ventilation will not guarantee occupant comfort, a cooling strategy should be specified.

Where appropriate, the cooling strategy should investigate opportunities to improve efficiency through the use of locally available sources such as ground cooling, river/dock water-cooling.

3.5 'Be Green' Section

The use of renewable energy in developments is encouraged at the 'Be Green' stage. Each renewable energy technology are technically feasible in Reading and each should be considered in the Energy Statement.

All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets.

Figure 2 provides a graphical representation of the Energy Hierarchy.

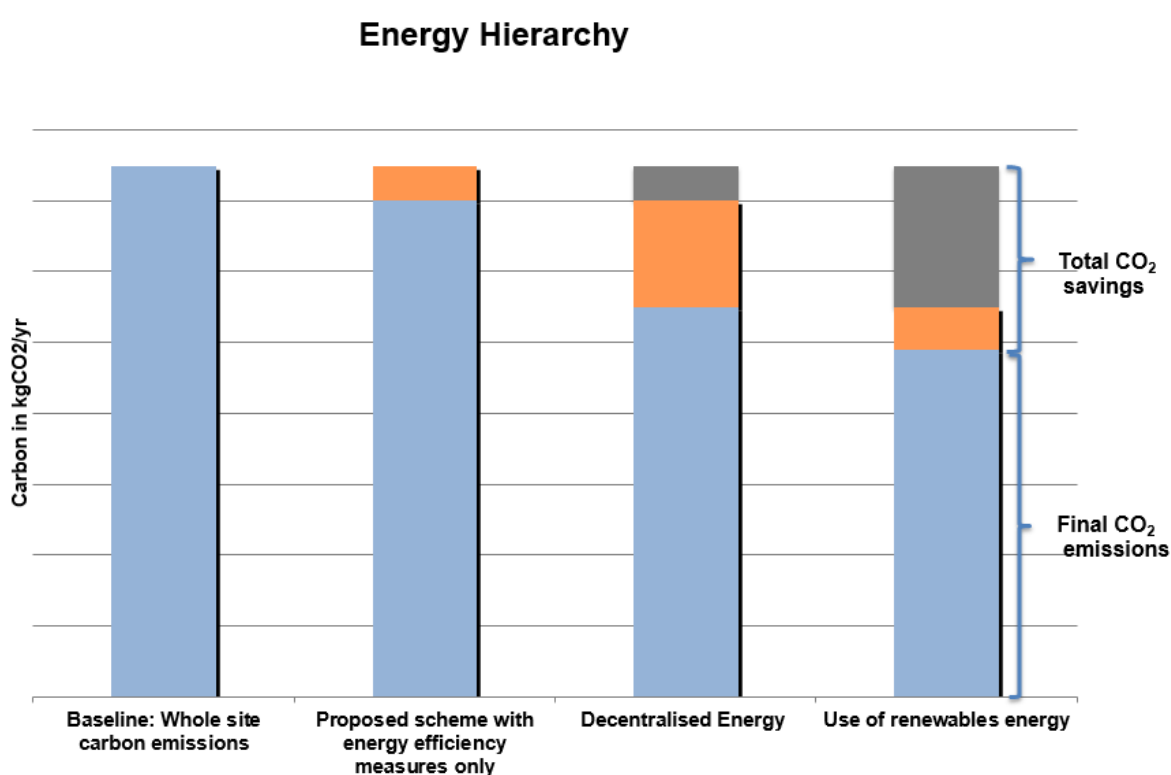
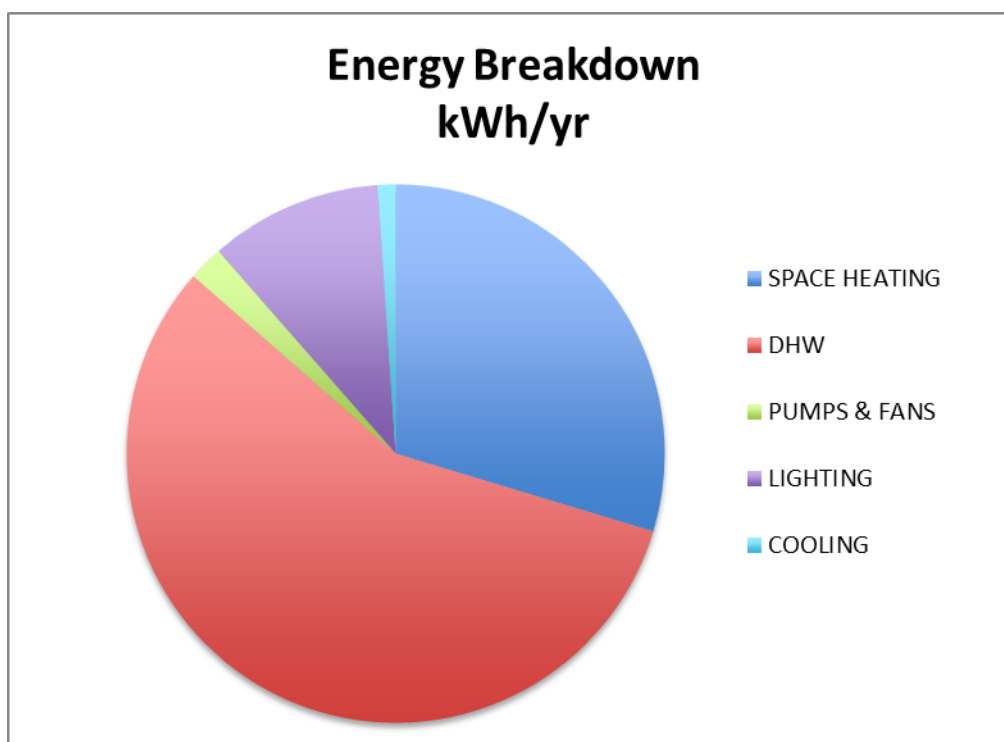


Figure 2 - Energy Hierarchy Diagram

The table below shows the energy and carbon demand for the baseline.

	Space Heating	Dhw	Pumps & Fans	Lighting	Cooling
Energy Breakdown kWh/yr	848,251	1,623,489	60,286	296,318	30,795
Carbon Breakdown kgCO ₂ /yr	183,572	354,281	31,254	153,848	16,13.00



The sample Output Documents and Energy Reports can be found in Appendix A.

4 'Be Lean' Stage – Reduction by Energy Efficiency Measures

Specific energy efficient measures have been identified, reviewed and appraised for the proposed scheme. The sample Output Documents and Energy Reports can be found in Appendix B.

The measures outlined in this section result in an annual carbon emission saving of 7.12% which equate to 55,795kg CO₂/yr saved over the baseline.

4.1 Proposed Measures (Residential Part of the Development)

The following measures are applicable to the residential part of the scheme and allow the proposed development to comply with Building Regulation Part L1A 2013.

The energy efficiency measures include:

Passive

The development has been orientated to suit the site conditions.

Enhanced Building Fabric U-Values

Enhancements of the building fabric will be used.

The table below demonstrates the limiting U-Value set by Approved Document Part L and the proposed U-Value for the development.

Elements	Building Regulations Part L 1A 2013 minimum U-Value (W/m ² K)	Proposed U-Value (W/m ² K) Indicative Build-Up	% Improvement
External Walls	0.30	0.17	43%
Party Walls	0.50	0.00	100%
Floor	0.25	0.10	60%
Roof	0.20	0.11	45%
Windows (Double Glazing)	2.00	1.40 (G-Value 0.45)	30%

Enhanced Air Tightness

The proposed development will be designed to high performance with good air tightness. It is proposed that the scheme not exceed an air permeability level of 5m³/hr/m² at 50Pa during testing.

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

Thermal Junctions

Heat lost through thermal bridges has a significant impact on the performance of a building's external envelope; this becomes ever more so as buildings become more airtight and more carefully insulated.

High-impact thermal bridges generally occur where two thermal elements meet (for example, the floor slab and perimeter wall), or where a thermal element is penetrated by a conductive material, such as steel or concrete. The heat loss through this junction is measured in W/m.K, and is known as a ' ψ ' (psi) value; the average of these values is taken to provide the Y-Value, a figure which is ultimately entered into SAP software to measure the overall fabric energy efficiency.

The Design Team has agreed to mitigate the cold bridges and eliminate the potential for surface condensation. This will be review during design and modelling of thermal junctions.

Ventilation

The ventilation within the development will mechanical ventilation with heat recovery for the dwellings facing Kenavon Drive and Watlington Street. All remaining dwellings will be fitted with Centralised Mechanical extract Ventilation. Appendix F is illustrative drawings showing the location of the units to be fitted with MVHR and dwellings to be fitted with MEV.

Mechanical Ventilation with Heat Recovery

Dwelling Type	Specific Fan Power (W/l/s)
Kitchen + 1 Wet Room	0.52
Kitchen + 2 Wet Rooms	0.56
Kitchen + 3 Wet Rooms	0.67
Kitchen + 4 Wet Rooms	0.78

Centralised Mechanical Extract Ventilation

Dwelling Type	Specific Fan Power (W/l/s)
Kitchen + 1 Wet Room	0.35
Kitchen + 2 Wet Rooms	0.30
Kitchen + 3 Wet Rooms	0.31
Kitchen + 4 Wet Rooms	0.33

Heating

Space heating is to be supplied from a central heating system. The energy centre will include gas fired boiler and Combined Heat and Power Unit.

The flues will be extended to roof level. Flue discharge will be in line with the Clean Air Act.

Cooling

Cooling will not be provided.

Domestic Hot Water

The domestic hot water will be provided by the main system.

Lighting

All lighting will be dedicated low energy fittings.

Lighting systems to a number of spaces may include LED technology where viable and subject to the performance of each product being able to deliver to the performance requirements of the space served.

4.2 Proposed Measures (Commercial Part of the Development)

The following measures are applicable to the commercial part of the scheme and allow the proposed development to comply with Building Regulation Part L2A 2013.

The energy efficiency measures include:

4.3 Passive

The development has been orientated to maximise the benefit from solar gain.

4.4 Enhanced Building Fabric U-Values

Enhancements of the building fabric will be used, the table below demonstrates the limiting U-Values set by the Approved Document Part L and the proposed U-Value for the proposed development.

Elements	Building Regulations Part L2A 2013 minimum U-Value (W/m ² K)	Proposed U-Value (W/m ² K) Indicative Build-up	% Improvement
External Walls	0.35	0.20	43%
Floor	0.25	0.13	48%
Roof	0.25	0.13	48%
Windows (Double Glazing)	2.20	1.6	27%

Enhanced Air Tightness

The proposed development will be designed to high performance with good air tightness. It is proposed that the scheme does not exceed an air permeability level of 7m³/hr/m² at 50Pa during testing.

This target will be achieved by ensuring that sensitive areas are accounted for in the design and construction phases to make certain that a tightly sealed building is constructed and all punctures through the seal are airtight.

The Design Team must ensure that all openings, both major and minor, such as services, be accounted for and assessed to reduce air leakage.

Ventilation

The ventilation for the WC's in each commercial unit has been assumed to have a specific fan power of 0.50W/l/s.

Heating/Cooling

Space heating and Cooling will be supplied by a split system to each commercial unit. The condenser will be located outside at lower level. The Air source Heat Pump will have a COP of at least 4 for space heating and 3.6 for cooling.

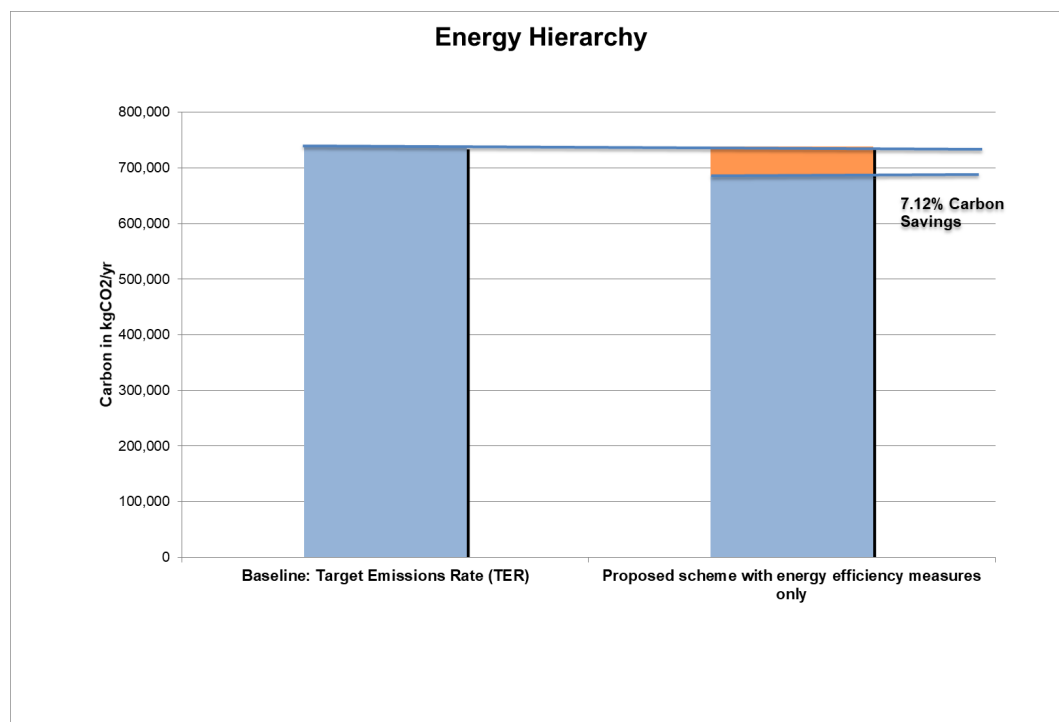
Domestic Hot Water

The domestic hot water will be provided by instantaneous electric point of use water heaters for each commercial unit. The domestic hot water for the cafés/restaurant will be provided by a gas-fired boiler with an efficiency of 95%.

Lighting

The lighting for the cafés/restaurant and retail areas has been modelled at 90 lamp lumens per circuit watt. The nursery has been modelled 90 luminaire lumens per circuit watt.

The following graph illustrates the carbon savings of the lean stage against the baseline.



5 'Be Clean' – Selection of Low Carbon Energy Supply Strategy

5.1 Connection to Existing Low Carbon Heating Infrastructure

The site is not located near an existing communal heating network. The plant room of the proposed development will be design to ensure that enough space is available when a district heating system will be available. Following discussion with the local authorities, it has been identified that there are no current provision in the area to include a Planned District Heating Networks.

5.2 Feasibility of CHP Scheme

It is possible to incorporate CHP (energy centre) into the scheme to meet the Reading Plan Hierarchy of providing 'clean' energy. The electricity generated will be harnessed directly by the development. Should the demand not be there at all times, excess electricity generated will be exported to the grid. The CHP will be sized to deliver 60% of the annual energy demand of the development.

Flue arrangements for the CHP and boiler plant will be carefully considered and calculated against all relevant British Standard Criteria to ensure flue gases are dissipated above dwellings and buildings, both on the development site and any adjacent and in close proximity to the site. An air quality assessment has been provided.

Combined Heat and Power (CHP)

Only Applicable to the Residential part of the Development

Combined Heat and Power Generation (CHP) is an important technology for efficient fuel use and can use biomass or gas as the fuel source. The sample Output Documents and Energy Reports can be found in Appendix C.

A gas-fired CHP is regarded as a low carbon technology, not a true renewable. Should the supply of fuel to the CHP be biomass then the system can be considered as a true renewable system.

CHP primarily offers carbon emission reductions by reducing the amount of electricity imported from the national grid – a 'carbon heavy' source of electricity.

The system produces electricity that can be used in the building or exported to the grid, and heat for space, water and even process heating. Systems must be heat led for high efficiency, which best suits applications to situations where there is a significant demand for heat for long periods of time (particularly through the summer period). This will also apply to residential developments, hospitals, hotels and leisure centres (swimming pools being ideal).

The split of heat to power and losses in both types of CHP systems are slightly different, but in principal, each unit of gas supplied would generate approx 35% electricity, 50% heat and 15% in losses.

CHP units operate most efficiently when supplying the base load of the building. Given the nature of the building (predominantly domestic) the base load will be on the lower side and with peaks and troughs throughout the occupied period; we are, therefore, proposing a base load of 60% of the annual energy demand.

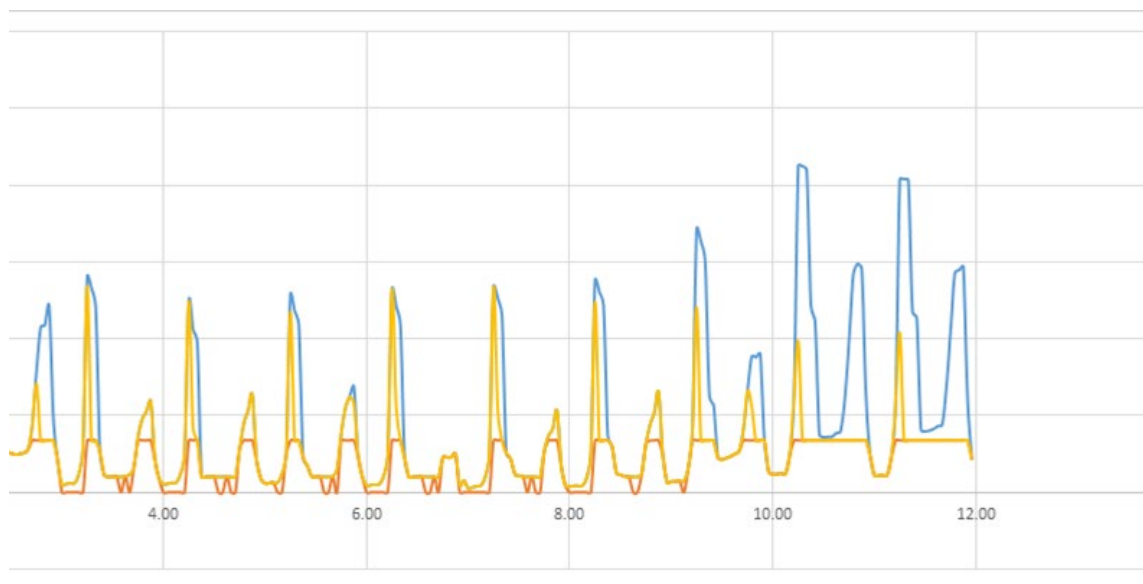
Regarding the commercial units, it has been identified that the head load profile the units will not be suitable to connect to a CHP system as the space heating and domestic hot water will be low.

CHP Size

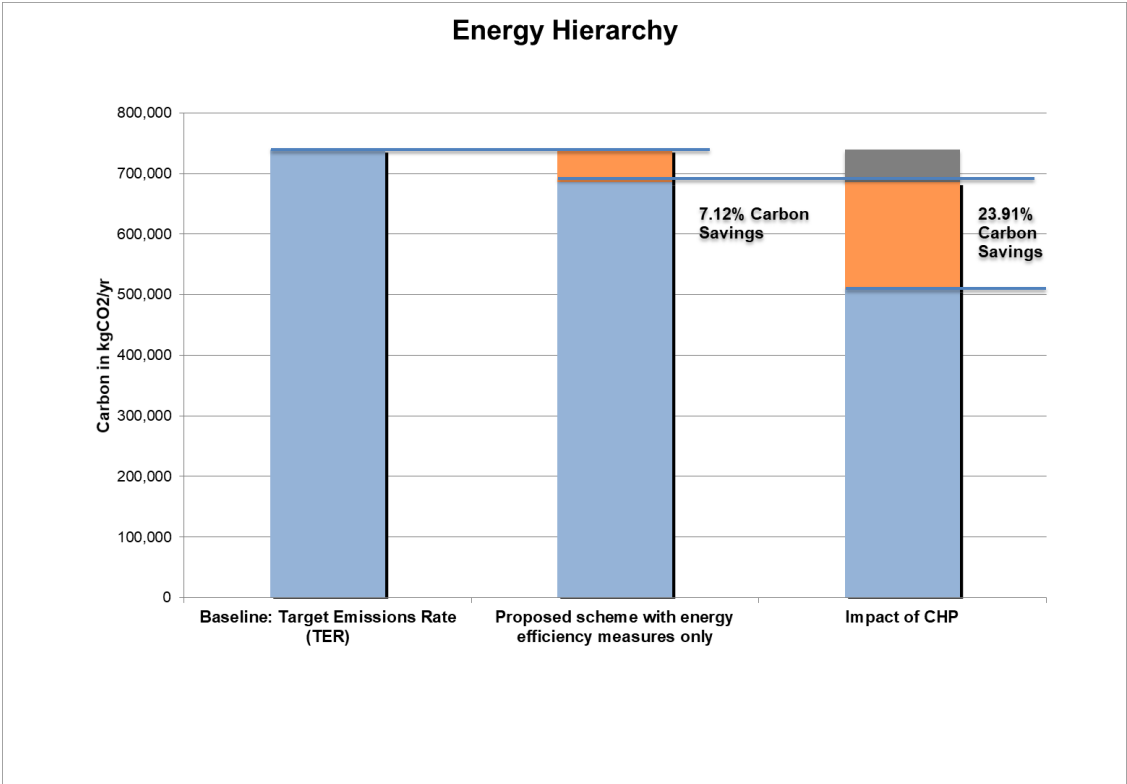
The following table demonstrate the calculation to size the combined heat and power unit. Details calculation will be undertaken at details design.

	Consumption kWh/Annum
Assumed average annual space heating energy consumption	2,500 kWh
Assumed average annual hot water heating energy consumption	1,580 kWh
Total space heating and hot water energy demand per dwelling	4,350 kWh
Adding 20% system losses in thermal storage and distribution	5,220 kWh
Proposed number of dwellings	787
Assumed 60% Contribution from CHP as per Energy Strategy	2,464,844
CHP size required @ 17h a day providing 6205 running hours (thermal)	378 kW

Building Load Analysis



The following graph illustrates the carbon savings of the clean stage against the lean stage.



6 'Be Green' – Renewable Technologies

6.1 Green Technologies

The following types of green/renewable energy technologies have been considered:

- Air Source Heat Pump.

Other renewable technology options were investigated and discounted.

These alternative technologies included:

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

The justification for discounting these technologies can be found in Appendix E.

6.2 Proposed Green Measures

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

6.2.1 Chosen Technology

Air Source Heat Pump

Only Applicable to the Commercial Part of the Development



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

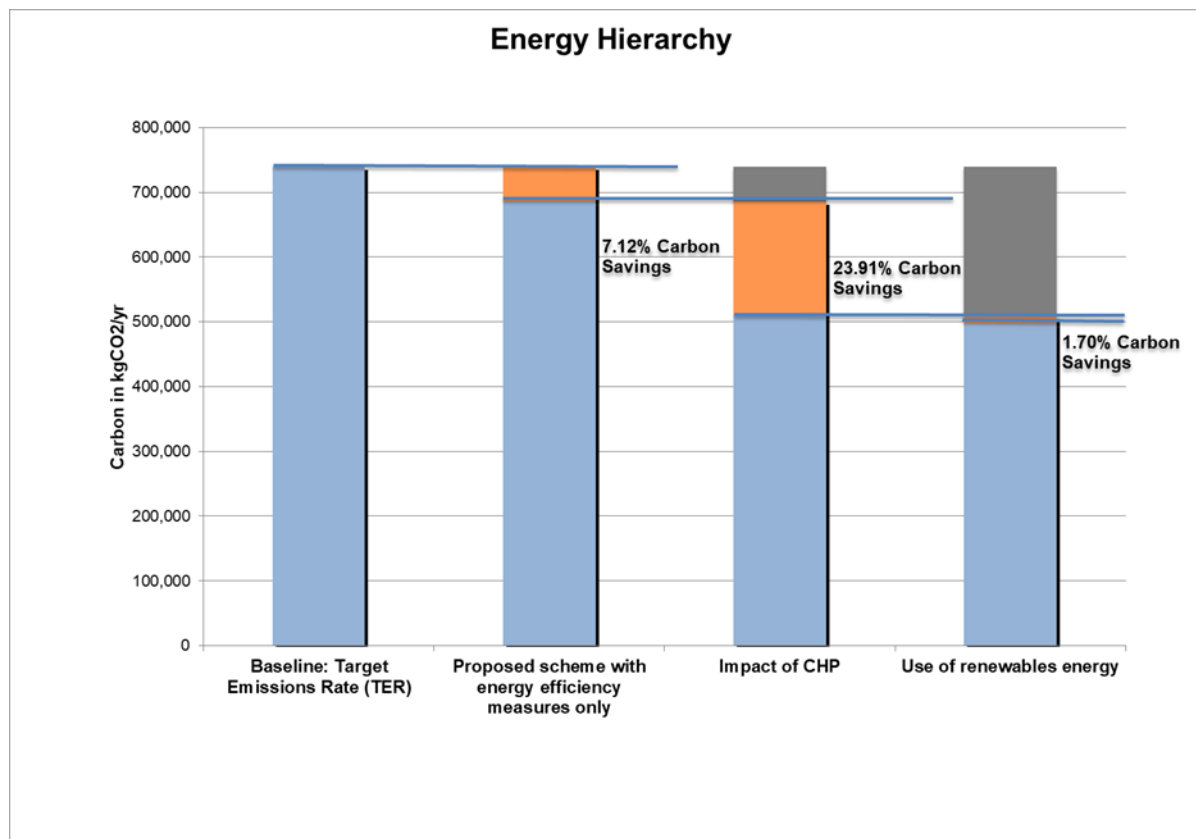
The overall efficiency of a heat pump is determined by the difference in temperature between the heat source itself (the ground, air or water) and the temperature of the area or environment to be heated. The smaller the temperature difference the higher the coefficient of performance (COP) will be.

Typical COPs will be in the range two - four depending upon operating conditions. Heat pumps can supply 100% of heat demand, but it will usually only pre-heat domestic hot water, so an additional method of heating the hot water (e.g. an immersion heater) may be needed.

Units range in size but the smaller ones only require equipment approximately the size of a small air conditioning unit on the outside of the property.

Air source heat pumps can be connected in series and thus provide a heating system, modules only work as and when demand requires thus providing excellent efficiencies. The commercial unit will have its own system to reduce the number of units needed in order to serve this development and associated space.

The following graph illustrates the carbon savings of the green stage against the clean stage.



7 Conclusion

This report has followed the Policy CS1 of the Core Strategy of Reading Borough Council Strategy and Philosophy and in doing so has identified measures to improve energy efficiency and mitigate CO₂ emissions of the proposed development.

The following table provides a summary of the improvements recognised by each step of the energy hierarchy approach:

	Carbon Dioxide Emissions (Tonnes/Annum)	Incremental CO ₂ Emissions Reduction (%)	Cumulative CO ₂ Emissions Reduction (%)
Step 1 – Baseline	738.97	-	-
Step 2 – ‘Be Lean’	686.37	7.12	
Step 3 – ‘Be Clean’	509.70	23.91	-
Step 4 – ‘Be Green’	497.01	1.72	32.74

The use of on-site CHP unit will allow the development to currently achieve 23.91% carbon reduction against the ‘Be Lean’ stage. The incorporation of the air source heat pumps systems (for the commercial unit only) could allow the development to achieve an overall carbon savings of 32.74% against Building Regulations Part L 2013.

This will exceed the required reduction in carbon emissions through the use of low and zero carbon technologies onsite which will be a minimum of 20% over 2013 building regulations, as per the Local Authority Strategy. The proposed development has enhanced the fabric and passive measures to high level and followed the Reading Plan energy hierarchy with the implementation of a combined heat and power unit. All renewable have been assessed and due to site constraint, the site is only suitable for air source heat pumps.

Appendix A - Step One - Baseline Output Document and Energy Report Figures

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 09:03:11 2016

Administrative information

Building Details

Address: Cafe/Restaurant, East Block, Kenavon Drive,
READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	95
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	95
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	86.5
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Cafe) - Eat & Drink_W_8
Floor	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Cafe) - Eat & Drink_G_9
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Main Multipoint BF

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.76	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
0 Ground (Cafe) - Eat & Drink	-	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - Food Prep	-	-	-	-	-	-	-	-	1	-	-	N/A
0 Ground (Cafe) - WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - Food Prep	YES
0 Ground (Cafe) - WC	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Cafe) - Eat & Drink	-	90	90	349

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
0 Ground (Cafe) - Food Prep		-	90	-	156
0 Ground (Cafe) - WC		-	90	-	27

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Cafe) - Eat & Drink	NO (-10.2%)	NO
0 Ground (Cafe) - Food Prep	N/A	N/A
0 Ground (Cafe) - WC	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	156.9	156.9
External area [m ²]	256.1	256.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	5
Average conductance [W/K]	127.39	104.3
Average U-value [W/m ² K]	0.5	0.41
Alpha value* [%]	17.23	17.31

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	83.69	76.62
Cooling	21.47	31.93
Auxiliary	22.79	14.1
Lighting	29.14	56.39
Hot water	140.19	123.41
Equipment*	126.49	126.49
TOTAL**	297.29	302.44

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	624.3	639.7
Primary energy* [kWh/m ²]	498.48	550.58
Total emissions [kg/m ²]	86.5	95

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	277.8	346.5	83.7	21.5	22.8	0.92	4.48	0.94	6
Notional	225.9	413.8	76.6	31.9	14.1	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Cafe) - Eat & Drink_W_8
Floor	0.2	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.15	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Cafe) - Eat & Drink_G_9
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]			U _{i-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 09:17:40 2016

Administrative information

Building Details

Address: Cafe, West Block, Kenavon Drive, READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	95
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	95
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	86.4
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Cafe) - Eat & Drink_W_6
Floor	0.25	0.13	0.13	0 Ground (Cafe) - Food Prep_S_3
Roof	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Cafe) - Eat & Drink_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Main Multipoint BF

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.76	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
0 Ground (Cafe) - Food Prep	-	-	-	-	-	-	-	-	1	-	-	N/A
0 Ground (Cafe) - Eat & Drink	-	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - WCs	-	-	0.5	-	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Cafe) - Food Prep	YES
0 Ground (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - WCs	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Cafe) - Food Prep	-	90	-	156

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
0 Ground (Cafe) - Eat & Drink		-	90	90	347
0 Ground (Cafe) - WCs		-	90	-	27

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Cafe) - Food Prep	N/A	N/A
0 Ground (Cafe) - Eat & Drink	NO (-7.7%)	NO
0 Ground (Cafe) - WCs	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	156.4	156.4
External area [m ²]	255.3	255.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	5
Average conductance [W/K]	127.13	103.95
Average U-value [W/m ² K]	0.5	0.41
Alpha value* [%]	17.23	17.31

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	82.37	75.62
Cooling	21.81	32.23
Auxiliary	22.86	14.14
Lighting	29.12	56.37
Hot water	140.14	123.36
Equipment*	126.52	126.52
TOTAL **	296.3	301.71

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	625.52	640.69
Primary energy* [kWh/m ²]	498.01	550.27
Total emissions [kg/m ²]	86.4	95

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	273.4	352.1	82.4	21.8	22.9	0.92	4.48	0.94	6
Notional	222.9	417.7	75.6	32.2	14.1	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Cafe) - Eat & Drink_W_6
Floor	0.2	0.13	0 Ground (Cafe) - Food Prep_S_3
Roof	0.15	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Cafe) - Eat & Drink_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]			U _{i-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 11:08:32 2016

Administrative information

Building Details

Address: Cafe/Restaurant, Middle Block, Kenavon Drive,
READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	89.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	89.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	78.5
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	1 First (Cafe) - Eat & Drink_W_6
Floor	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.6	1.6	1 First (Cafe) - Eat & Drink_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Gas-fired condensing water heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	0.015
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
1 First (Cafe) - Eat & Drink		-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - Eat & Drink		-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - Food Prep		-	-	-	-	-	-	-	-	1	-	N/A
0 Ground (Cafe) - WCs		-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
1 First (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - Food Prep	YES
0 Ground (Cafe) - WCs	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
1 First (Cafe) - Eat & Drink	-	90	90	810

General lighting and display lighting		Luminous efficacy [lm/W]		
Zone name		Luminaire	Lamp	Display lamp
	Standard value	60	60	22
0 Ground (Cafe) - Eat & Drink		-	90	90
0 Ground (Cafe) - Food Prep		-	90	-
0 Ground (Cafe) - WCs		-	90	-
				General lighting [W]
				649
				572
				69

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 First (Cafe) - Eat & Drink	NO (-55.3%)	NO
0 Ground (Cafe) - Eat & Drink	NO (-12.9%)	NO
0 Ground (Cafe) - Food Prep	N/A	N/A
0 Ground (Cafe) - WCs	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	657.8	657.8
External area [m ²]	641.5	641.5
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	3
Average conductance [W/K]	378.7	321.19
Average U-value [W/m ² K]	0.59	0.5
Alpha value* [%]	12.49	15.4

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	62.87	63.63
Cooling	18.08	31.87
Auxiliary	23.72	14.64
Lighting	27.84	50.42
Hot water	133.14	123.02
Equipment*	127.18	127.18
TOTAL**	265.66	283.58

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	500.56	600.6
Primary energy* [kWh/m ²]	452.96	517.82
Total emissions [kg/m ²]	78.5	89.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	208.7	291.9	62.9	18.1	23.7	0.92	4.48	0.94	6
Notional	187.6	413	63.6	31.9	14.6	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	1 First (Cafe) - Eat & Drink_W_6
Floor	0.2	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.6	1 First (Cafe) - Eat & Drink_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)] * There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 10:34:59 2016

Administrative information

Building Details

Address: Nursery, Middle Block, Kenavon Drive,
READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	16.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	16.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	16.2
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Nursery) - Teaching_W_9
Floor	0.25	0.13	0.13	0 Ground (Nursery) - Teaching_S_3
Roof	0.25	0.13	0.13	0 Ground (Nursery) - Teaching_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Nursery) - Teaching_G_10
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW instantaneous electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
0 Ground (Nursery) - Teaching	-	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Nursery) - WCs	-	-	0.5	-	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Nursery) - Teaching	YES
0 Ground (Nursery) - WCs	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Nursery) - Teaching	90	-	-	1287
0 Ground (Nursery) - WCs	-	90	-	48

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Nursery) - Teaching	NO (-39.7%)	NO
0 Ground (Nursery) - WCs	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	280.4	280.4
External area [m ²]	572.7	572.7
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	3
Average conductance [W/K]	165.21	256.35
Average U-value [W/m ² K]	0.29	0.45
Alpha value* [%]	19.19	15.99

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
100	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.92	19.33
Cooling	5.28	6.61
Auxiliary	0.54	0.65
Lighting	7.28	8.1
Hot water	12.72	14.72
Equipment*	14.09	14.09
TOTAL**	38.74	49.41

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	128.13	142.72
Primary energy* [kWh/m ²]	95.04	85.74
Total emissions [kg/m ²]	16.2	16.6

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	42.9	85.2	12.9	5.3	0.5	0.92	4.48	0.94	6
Notional	57	85.7	19.3	6.6	0.6	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Nursery) - Teaching_W_9
Floor	0.2	0.13	0 Ground (Nursery) - Teaching_S_3
Roof	0.15	0.13	0 Ground (Nursery) - Teaching_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Nursery) - Teaching_G_10
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 09:24:09 2016

Administrative information

Building Details

Address: Retail, West Block, Kenavon Drive, READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	40.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	40.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	29.1
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Retail) - Sales_W_10
Floor	0.25	0.13	0.13	0 Ground (Retail) - Sales_S_3
Roof	0.25	0.13	0.13	0 Ground (Retail) - Sales_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Retail) - Sales_G_11
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW instantaneous electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
0 Ground (Retail) - Sales	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Retail) - WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Retail) - Sales	YES
0 Ground (Retail) - WC	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Retail) - Sales	-	90	90	3979
0 Ground (Retail) - WC	-	90	-	36

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Retail) - Sales	NO (-6.8%)	NO
0 Ground (Retail) - WC	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	406.9	406.9
External area [m ²]	640.3	640.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	3
Average conductance [W/K]	189.59	261.69
Average U-value [W/m ² K]	0.3	0.41
Alpha value* [%]	14.67	13.12

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	10.73	13.64
Cooling	11.91	17.05
Auxiliary	0.17	0.2
Lighting	37.87	56.3
Hot water	1.68	1.94
Equipment*	20.25	20.25
TOTAL**	62.35	89.13

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	227.88	261.16
Primary energy* [kWh/m ²]	171.58	238.93
Total emissions [kg/m ²]	29.1	40.8

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	35.6	192.3	10.7	11.9	0.2	0.92	4.48	0.94	6
Notional	40.2	221	13.6	17	0.2	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Retail) - Sales_W_10
Floor	0.2	0.13	0 Ground (Retail) - Sales_S_3
Roof	0.15	0.13	0 Ground (Retail) - Sales_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Retail) - Sales_G_11
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)] * There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 1

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total		m ³ per hour
Number of chimneys	0	+	0	=	0	x 40 = 0 (6a)
Number of open flues	0	+	0	=	0	x 20 = 0 (6b)
Number of intermittent fans				3	x 10 =	30 (7a)
Number of passive vents				0	x 10 =	0 (7b)
Number of flueless gas fires				0	x 40 =	0 (7c)
						Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30	÷ (5) =	0.14 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>						
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)
<i>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</i>						
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0						0 (12)
If no draught lobby, enter 0.05, else enter 0						0 (13)
Percentage of windows and doors draught stripped						0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area						5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)						0.39 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>						
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) =		0.3 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

TER 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	0.38	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 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 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 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 0.56 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= 0.57 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			2.15	x 1	= 2.15		(26)
Windows Type 1			4.12	x 1/[1/(1.4) + 0.04]	= 5.46		(27)
Windows Type 2			2.23	x 1/[1/(1.4) + 0.04]	= 2.96		(27)
Windows Type 3			2.23	x 1/[1/(1.4) + 0.04]	= 2.96		(27)
Floor			43.96	x 0.13	= 5.7148		(28)
Walls	65.46	10.73	54.73	x 0.18	= 9.85		(29)
Total area of elements, m²			109.42				(31)
Party wall			65.46	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) = 29.09 (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 0.5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 29.59 (37)

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

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

(38)m=	40.8	40.6	40.4	39.46	39.28	38.46	38.46	38.31	38.78	39.28	39.64	40.01	(38)
--------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Heat transfer coefficient, W/K

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

(39)m=	70.39	70.19	69.99	69.05	68.87	68.05	68.05	67.9	68.37	68.87	69.23	69.6	
Average = Sum(39) _{1...12} /12=												69.05	(39)

Heat loss parameter (HLP), W/m²K

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

(40)m=	0.8	0.8	0.8	0.79	0.78	0.77	0.77	0.77	0.78	0.78	0.79	0.79	
Average = Sum(40) _{1...12} /12=												0.79	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.6 (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 95.86 (43)

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

	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=	105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44	
Total = Sum(44) _{1...12} =												1150.31	(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=	156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44	
Total = Sum(45) _{1...12} =												1508.23	(45)

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

(46)m=	23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

TER 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=	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------

(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=	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------

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

2056.85

(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=	89.27	79.14	84.2	76.98	76.53	69.95	68.66	73.3	72.52	79.75	82.44	87.63
--------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	-------

(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=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

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

(67)m=	24.34	21.62	17.58	13.31	9.95	8.4	9.07	11.8	15.83	20.1	23.46	25.01
--------	-------	-------	-------	-------	------	-----	------	------	-------	------	-------	-------

(67)

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

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	119.99	117.77	113.17	106.92	102.86	97.15	92.29	98.51	100.73	107.2	114.5	117.78
--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	-------	-------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	444.46	441.97	427.18	403.57	379.62	356.82	342.27	348.77	361.17	385	412.2	432.56
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(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Southwest0.9x	0.77	4.12	36.79	0.63	0.7	46.33	(79)
Southwest0.9x	0.77	2.23	36.79	0.63	0.7	25.08	(79)

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Southwest0.9x	0.77	x	2.23	x	36.79	0.63	x	0.7	=	25.08	(79)
Southwest0.9x	0.77	x	4.12	x	62.67	0.63	x	0.7	=	78.91	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.63	x	0.7	=	42.71	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.63	x	0.7	=	42.71	(79)
Southwest0.9x	0.77	x	4.12	x	85.75	0.63	x	0.7	=	107.97	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.63	x	0.7	=	58.44	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.63	x	0.7	=	58.44	(79)
Southwest0.9x	0.77	x	4.12	x	106.25	0.63	x	0.7	=	133.78	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.63	x	0.7	=	72.41	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.63	x	0.7	=	72.41	(79)
Southwest0.9x	0.77	x	4.12	x	119.01	0.63	x	0.7	=	149.85	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.63	x	0.7	=	81.11	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.63	x	0.7	=	81.11	(79)
Southwest0.9x	0.77	x	4.12	x	118.15	0.63	x	0.7	=	148.77	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.63	x	0.7	=	80.52	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.63	x	0.7	=	80.52	(79)
Southwest0.9x	0.77	x	4.12	x	113.91	0.63	x	0.7	=	143.43	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.63	x	0.7	=	77.63	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.63	x	0.7	=	77.63	(79)
Southwest0.9x	0.77	x	4.12	x	104.39	0.63	x	0.7	=	131.44	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.63	x	0.7	=	71.14	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.63	x	0.7	=	71.14	(79)
Southwest0.9x	0.77	x	4.12	x	92.85	0.63	x	0.7	=	116.91	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.63	x	0.7	=	63.28	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.63	x	0.7	=	63.28	(79)
Southwest0.9x	0.77	x	4.12	x	69.27	0.63	x	0.7	=	87.22	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.63	x	0.7	=	47.21	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.63	x	0.7	=	47.21	(79)
Southwest0.9x	0.77	x	4.12	x	44.07	0.63	x	0.7	=	55.49	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.63	x	0.7	=	30.03	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.63	x	0.7	=	30.03	(79)
Southwest0.9x	0.77	x	4.12	x	31.49	0.63	x	0.7	=	39.65	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.63	x	0.7	=	21.46	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.63	x	0.7	=	21.46	(79)

Solar gains in watts, calculated for each month

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

(83)m=	96.48	164.34	224.86	278.61	312.06	309.81	298.69	273.73	243.47	181.63	115.56	82.57	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	540.94	606.31	652.04	682.18	691.69	666.63	640.95	622.5	604.64	566.63	527.76	515.12	(84)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

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

(86)m=	1	0.99	0.98	0.94	0.84	0.64	0.47	0.5	0.74	0.95	0.99	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.4	20.57	20.78	20.93	20.99	21	21	20.98	20.8	20.5	20.25	(87)
--------	-------	------	-------	-------	-------	-------	----	----	-------	------	------	-------	------

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

(88)m=	20.25	20.25	20.26	20.27	20.27	20.28	20.28	20.27	20.27	20.26	20.26	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.42	0.68	0.93	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.28	19.46	19.71	20.01	20.2	20.27	20.28	20.28	20.25	20.04	19.61	19.25	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.79	20.02	20.28	20.46	20.53	20.53	20.53	20.51	20.31	19.93	19.61	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.63	19.79	20.02	20.28	20.46	20.53	20.53	20.53	20.51	20.31	19.93	19.61	(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=	1	0.99	0.97	0.93	0.81	0.6	0.42	0.45	0.7	0.93	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	538.44	599.94	635.08	631.78	557.93	398.42	267.28	280.07	424.32	528.88	521.69	513.35	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	1079.21	1045.22	946.03	785.98	603.28	403.28	267.63	280.65	438.27	668.54	888.03	1072.21	(97)
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Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	402.33	299.23	231.35	111.02	33.73	0	0	0	0	103.91	263.77	415.79	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1861.14	(98)
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Space heating requirement in kWh/m²/year

21.17	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

(211)m = {[(98)m × (204)]} × 100 ÷ (206)	402.33	299.23	231.35	111.02	33.73	0	0	0	0	103.91	263.77	415.79	(211)
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Total (kWh/year) = Sum(211) _{1...5,10...12} =	1990.52	(211)
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TER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

0 (215)

Water heating

Output from water heater (calculated above)

202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
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Efficiency of water heater

79.8 (216)

(217)m=	86.61	86.18	85.37	83.74	81.44	79.8	79.8	79.8	79.8	83.49	85.77	86.75
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(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	234.36	207.54	219.89	200.78	202.18	184.17	176.69	194.14	193.88	208.84	215.17	228.29
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Total = Sum(219a)_{1...12} =

2465.92 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

1990.52

Water heating fuel used

2465.92

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

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

75 (231)

Electricity for lighting

429.79 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	429.95 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	532.64 (264)
Space and water heating	(261) + (262) + (263) + (264) =		962.59 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	223.06 (268)
Total CO2, kg/year	sum of (265)...(271) =		1224.58 (272)

TER =

13.93 (273)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 1

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total		m ³ per hour
Number of chimneys	0	+	0	=	0	x 40 = 0 (6a)
Number of open flues	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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =						30 ÷ (5) = 0.14 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)						
Number of storeys in the dwelling (ns)						0 (9)
Additional infiltration					[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction						0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35						
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0						0 (12)
If no draught lobby, enter 0.05, else enter 0						0 (13)
Percentage of windows and doors draught stripped						0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area						5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)						0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used						
Number of sides sheltered						3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =		0.78 (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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

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

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:

(23a)

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

(23b)

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

(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	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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(24d)

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1	2.15		(26)
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		(27)
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Floor			43.96	0.13	5.7148		(28)
Walls	65.46	10.73	54.73	0.18	9.85		(29)
Total area of elements, m²			109.42				(31)
Party wall			65.46	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 29.09 (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 0.5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 29.59 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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(38)m=	40.8	40.6	40.4	39.46	39.28	38.46	38.46	38.31	38.78	39.28	39.64	40.01	(38)
--------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Heat transfer coefficient, W/K

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

(39)m=	70.39	70.19	69.99	69.05	68.87	68.05	68.05	67.9	68.37	68.87	69.23	69.6	
Average = Sum(39) _{1...12} /12=												69.05	(39)

Heat loss parameter (HLP), W/m²K

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

(40)m=	0.8	0.8	0.8	0.79	0.78	0.77	0.77	0.77	0.78	0.78	0.79	0.79	
Average = Sum(40) _{1...12} /12=												0.79	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.6

(42)

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

95.86

(43)

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

	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=	105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44	
Total = Sum(44) _{1...12} =												1150.31	(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=	156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44	
Total = Sum(45) _{1...12} =												1508.23	(45)

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

(46)m=	23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72	(46)
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Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

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

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

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

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

(61)

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

(62)m=	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
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(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

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

(63)

Output from water heater

(64)m=	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------

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

2056.85

(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=	89.27	79.14	84.2	76.98	76.53	69.95	68.66	73.3	72.52	79.75	82.44	87.63
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(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

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

(67)m=	24.34	21.62	17.58	13.31	9.95	8.4	9.07	11.8	15.83	20.1	23.46	25.01
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(67)

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

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
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(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
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(71)

Water heating gains (Table 5)

(72)m=	119.99	117.77	113.17	106.92	102.86	97.15	92.29	98.51	100.73	107.2	114.5	117.78
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(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	444.46	441.97	427.18	403.57	379.62	356.82	342.27	348.77	361.17	385	412.2	432.56
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	-------	--------

(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Southwest0.9x	0.77	4.12	36.79	0.63	0.7	46.33	(79)
Southwest0.9x	0.77	2.23	36.79	0.63	0.7	25.08	(79)

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Southwest0.9x	0.77	x	2.23	x	36.79	0.63	x	0.7	=	25.08	(79)
Southwest0.9x	0.77	x	4.12	x	62.67	0.63	x	0.7	=	78.91	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.63	x	0.7	=	42.71	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.63	x	0.7	=	42.71	(79)
Southwest0.9x	0.77	x	4.12	x	85.75	0.63	x	0.7	=	107.97	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.63	x	0.7	=	58.44	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.63	x	0.7	=	58.44	(79)
Southwest0.9x	0.77	x	4.12	x	106.25	0.63	x	0.7	=	133.78	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.63	x	0.7	=	72.41	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.63	x	0.7	=	72.41	(79)
Southwest0.9x	0.77	x	4.12	x	119.01	0.63	x	0.7	=	149.85	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.63	x	0.7	=	81.11	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.63	x	0.7	=	81.11	(79)
Southwest0.9x	0.77	x	4.12	x	118.15	0.63	x	0.7	=	148.77	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.63	x	0.7	=	80.52	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.63	x	0.7	=	80.52	(79)
Southwest0.9x	0.77	x	4.12	x	113.91	0.63	x	0.7	=	143.43	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.63	x	0.7	=	77.63	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.63	x	0.7	=	77.63	(79)
Southwest0.9x	0.77	x	4.12	x	104.39	0.63	x	0.7	=	131.44	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.63	x	0.7	=	71.14	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.63	x	0.7	=	71.14	(79)
Southwest0.9x	0.77	x	4.12	x	92.85	0.63	x	0.7	=	116.91	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.63	x	0.7	=	63.28	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.63	x	0.7	=	63.28	(79)
Southwest0.9x	0.77	x	4.12	x	69.27	0.63	x	0.7	=	87.22	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.63	x	0.7	=	47.21	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.63	x	0.7	=	47.21	(79)
Southwest0.9x	0.77	x	4.12	x	44.07	0.63	x	0.7	=	55.49	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.63	x	0.7	=	30.03	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.63	x	0.7	=	30.03	(79)
Southwest0.9x	0.77	x	4.12	x	31.49	0.63	x	0.7	=	39.65	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.63	x	0.7	=	21.46	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.63	x	0.7	=	21.46	(79)

Solar gains in watts, calculated for each month

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

(83)m=	96.48	164.34	224.86	278.61	312.06	309.81	298.69	273.73	243.47	181.63	115.56	82.57	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	540.94	606.31	652.04	682.18	691.69	666.63	640.95	622.5	604.64	566.63	527.76	515.12	(84)
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7. Mean internal temperature (heating season)

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

21 (85)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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(86)m=	1	0.99	0.98	0.94	0.84	0.64	0.47	0.5	0.74	0.95	0.99	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.4	20.57	20.78	20.93	20.99	21	21	20.98	20.8	20.5	20.25	(87)
--------	-------	------	-------	-------	-------	-------	----	----	-------	------	------	-------	------

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

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

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

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.42	0.68	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=	19.28	19.46	19.71	20.01	20.2	20.27	20.28	20.28	20.25	20.04	19.61	19.25	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
---------------------------	------	------

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

(92)m=	19.63	19.79	20.02	20.28	20.46	20.53	20.53	20.53	20.51	20.31	19.93	19.61	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.63	19.79	20.02	20.28	20.46	20.53	20.53	20.53	20.51	20.31	19.93	19.61	(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=	1	0.99	0.97	0.93	0.81	0.6	0.42	0.45	0.7	0.93	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	538.44	599.94	635.08	631.78	557.93	398.42	267.28	280.07	424.32	528.88	521.69	513.35	(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 × ((93)m – (96)m)]

(97)m=	1079.21	1045.22	946.03	785.98	603.28	403.28	267.63	280.65	438.27	668.54	888.03	1072.21	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	402.33	299.23	231.35	111.02	33.73	0	0	0	0	103.91	263.77	415.79	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1861.14	(98)
---	---------	------

Space heating requirement in kWh/m²/year

21.17	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

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

Space heating requirement (calculated above)

(211)m = {[(98)m × (204)]} × 100 ÷ (206)	402.33	299.23	231.35	111.02	33.73	0	0	0	0	103.91	263.77	415.79	(211)
--	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	-------

Total (kWh/year) = Sum(211) _{1...5,10...12} =	1990.52	(211)
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Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03		
Efficiency of water heater													79.8	(216)
(217)m=	86.61	86.18	85.37	83.74	81.44	79.8	79.8	79.8	79.8	83.49	85.77	86.75		(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	234.36	207.54	219.89	200.78	202.18	184.17	176.69	194.14	193.88	208.84	215.17	228.29		
Total = Sum(219a) _{1...12} =													2465.92	(219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 75 (231)

Electricity for lighting

429.79 (232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	429.95	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	532.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				962.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	223.06	(268)
Total CO2, kg/year	sum of (265)...(271) =				1224.58	(272)

TER = 13.93 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 2

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total		m ³ per hour
Number of chimneys	0	+	0	=	0	x 40 = 0 (6a)
Number of open flues	0	+	0	=	0	x 20 = 0 (6b)
Number of intermittent fans				3	x 10 =	30 (7a)
Number of passive vents				0	x 10 =	0 (7b)
Number of flueless gas fires				0	x 40 =	0 (7c)
						Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30	÷ (5) =	0.14 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>						
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)
<i>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</i>						
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0						0 (12)
If no draught lobby, enter 0.05, else enter 0						0 (13)
Percentage of windows and doors draught stripped						0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area						5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)						0.39 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>						
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) =		0.3 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

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

(23a)

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

(23b)

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

(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	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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(24d)

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1	2.15		(26)
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		(27)
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Floor			43.96	0.13	5.7148		(28)
Walls	28.71	10.73	17.98	0.18	3.24		(29)
Total area of elements, m²			72.67				(31)
Party wall			102.21	0	0		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 22.48 (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 0.35 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 22.83 (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
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(38)m=

40.8	40.6	40.4	39.46	39.28	38.46	38.46	38.31	38.78	39.28	39.64	40.01
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 (38)

Heat transfer coefficient, W/K

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

(39)m=

63.63	63.42	63.22	62.28	62.11	61.29	61.29	61.14	61.6	62.11	62.46	62.83
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 (39)

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

62.28

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.72	0.72	0.72	0.71	0.71	0.7	0.7	0.7	0.7	0.71	0.71	0.71
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 (40)

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

0.71

Number of days in month (Table 1a)

(41)m=

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

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.6

(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

95.86

(43)

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

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44

 (44)

Total = Sum(44)_{1...12} = 1150.31

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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
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 (45)

Total = Sum(45)_{1...12} = 1508.23

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

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
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 (46)

Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

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

(57)m=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
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 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
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(59)

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

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

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

(62)m=	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
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(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

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

(63)

Output from water heater

(64)m=	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------

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

2056.85

(64)

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

(65)m=	89.27	79.14	84.2	76.98	76.53	69.95	68.66	73.3	72.52	79.75	82.44	87.63
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(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

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

(67)m=	24.34	21.62	17.58	13.31	9.95	8.4	9.07	11.8	15.83	20.1	23.46	25.01
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(67)

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

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

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

(70)

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

(71)m=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
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(71)

Water heating gains (Table 5)

(72)m=	119.99	117.77	113.17	106.92	102.86	97.15	92.29	98.51	100.73	107.2	114.5	117.78
--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	-------	-------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	444.46	441.97	427.18	403.57	379.62	356.82	342.27	348.77	361.17	385	412.2	432.56
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(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Northwest 0.9x	0.77	4.12	11.28	0.63	0.7	14.21	(81)
Northwest 0.9x	0.77	2.23	11.28	0.63	0.7	7.69	(81)

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Northwest 0.9x	0.77	x	2.23	x	11.28	x	0.63	x	0.7	=	7.69	(81)
Northwest 0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.63	x	0.7	=	15.65	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.63	x	0.7	=	15.65	(81)
Northwest 0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.63	x	0.7	=	28.2	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.63	x	0.7	=	28.2	(81)
Northwest 0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.63	x	0.7	=	46.31	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.63	x	0.7	=	46.31	(81)
Northwest 0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.63	x	0.7	=	62.25	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.63	x	0.7	=	62.25	(81)
Northwest 0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.63	x	0.7	=	66.37	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.63	x	0.7	=	66.37	(81)
Northwest 0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.63	x	0.7	=	62.09	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.63	x	0.7	=	62.09	(81)
Northwest 0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.63	x	0.7	=	49.5	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.63	x	0.7	=	49.5	(81)
Northwest 0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.63	x	0.7	=	34.36	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.63	x	0.7	=	34.36	(81)
Northwest 0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.63	x	0.7	=	19.13	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.63	x	0.7	=	19.13	(81)
Northwest 0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.63	x	0.7	=	9.68	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.63	x	0.7	=	9.68	(81)
Northwest 0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.63	x	0.7	=	6.28	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.63	x	0.7	=	6.28	(81)

Solar gains in watts, calculated for each month

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

(83)m= 29.59 60.22 108.5 178.19 239.52 255.36 238.88 190.44 132.21 73.6 37.23 24.16 (83)

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

(84)m= 474.05 502.19 535.69 581.76 619.15 612.18 581.15 539.21 493.38 458.6 449.42 456.72 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

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

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(86)m=	1	1	0.99	0.96	0.85	0.63	0.46	0.52	0.81	0.98	1	1	(86)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(87)m=	20.32	20.4	20.55	20.78	20.94	20.99	21	21	20.97	20.77	20.51	20.3	(87)
--------	-------	------	-------	-------	-------	-------	----	----	-------	-------	-------	------	------

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

(88)m=	20.32	20.32	20.32	20.33	20.34	20.34	20.34	20.34	20.34	20.34	20.33	20.33	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.95	0.81	0.57	0.39	0.45	0.75	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	19.39	19.51	19.74	20.06	20.28	20.34	20.34	20.34	20.32	20.06	19.69	19.38	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.36 \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	19.72	19.83	20.03	20.32	20.51	20.57	20.58	20.58	20.55	20.31	19.98	19.71	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.72	19.83	20.03	20.32	20.51	20.57	20.58	20.58	20.55	20.31	19.98	19.71	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.95	0.82	0.59	0.42	0.47	0.77	0.97	0.99	1	(94)

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

(95)m=	472.92	500.04	529.4	553.32	508.94	363.11	243.52	254.93	379.62	443.26	446.91	455.88	(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=	981.25	946.66	855.36	711.06	547.33	366.03	243.71	255.37	397.22	603.23	804.52	974.51	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	378.2	300.13	242.51	113.58	28.56	0	0	0	0	119.02	257.48	385.86	(98)
--------	-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 1825.33 \quad (98)$$

Space heating requirement in kWh/m²/year

$$20.76 \quad (99)$$

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

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

Space heating requirement (calculated above)

(211)m = {[(98)m x (204)]} x 100 ÷ (206)	378.2	300.13	242.51	113.58	28.56	0	0	0	0	119.02	257.48	385.86	(211)
--	-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	-------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 1952.22 \quad (211)$$

TER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

= {(98)m x (201)} x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03		
Efficiency of water heater													79.8	(216)
(217)m=	86.45	86.18	85.5	83.79	81.22	79.8	79.8	79.8	79.8	83.82	85.7	86.56		(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	234.77	207.52	219.56	200.65	202.73	184.17	176.69	194.14	193.88	208	215.33	228.77		
Total = Sum(219a) _{1...12} =													2466.21	(219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 75 (231)

Electricity for lighting

429.79 (232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	421.68	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	532.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =				954.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	223.06	(268)
Total CO2, kg/year	sum of (265)...(271) =					1216.37 (272)

TER = 13.83 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 2

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour			
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)			
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)			
Number of intermittent fans							3	x 10 =	30 (7a)			
Number of passive vents							0	x 10 =	0 (7b)			
Number of flueless gas fires							0	x 40 =	0 (7c)			
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =							30	÷ (5) =	0.14 (8)			
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>												
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)			
<i>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</i>												
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0									0 (12)			
If no draught lobby, enter 0.05, else enter 0									0 (13)			
Percentage of windows and doors draught stripped									0 (14)			
Window infiltration							0.25 - [0.2 x (14) ÷ 100] =		0 (15)			
Infiltration rate							(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)			
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area									5 (17)			
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)									0.39 (18)			
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>												
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) =		0.3 (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

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Wind Factor (22a)m = (22)m ÷ 4

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

(23a)

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

(23b)

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

(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	0.56	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=	0.57	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			2.15	1	2.15		(26)
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		(27)
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Floor			43.96	0.13	5.7148		(28)
Walls	28.71	10.73	17.98	0.18	3.24		(29)
Total area of elements, m²			72.67				(31)
Party wall			102.21	0	0		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 22.48 (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 0.35 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 22.83 (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
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TER WorkSheet: New dwelling design stage

(38)m=

40.8	40.6	40.4	39.46	39.28	38.46	38.46	38.31	38.78	39.28	39.64	40.01
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 (38)

Heat transfer coefficient, W/K

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

(39)m=

63.63	63.42	63.22	62.28	62.11	61.29	61.29	61.14	61.6	62.11	62.46	62.83
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 (39)

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

62.28

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.72	0.72	0.72	0.71	0.71	0.7	0.7	0.7	0.7	0.71	0.71	0.71
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 (40)

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

0.71

Number of days in month (Table 1a)

(41)m=

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

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.6

(42)

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

95.86

(43)

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

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44

 (44)

Total = Sum(44)_{1...12} = 1150.31

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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
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 (45)

Total = Sum(45)_{1...12} = 1508.23

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

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
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 (46)

Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

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

(57)m=

23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

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

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

(61)

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

(62)m=	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------

(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=	202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------

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

2056.85

(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=	89.27	79.14	84.2	76.98	76.53	69.95	68.66	73.3	72.52	79.75	82.44	87.63
--------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	-------

(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=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

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

(67)m=	24.34	21.62	17.58	13.31	9.95	8.4	9.07	11.8	15.83	20.1	23.46	25.01
--------	-------	-------	-------	-------	------	-----	------	------	-------	------	-------	-------

(67)

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

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

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

(70)

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

(71)m=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	119.99	117.77	113.17	106.92	102.86	97.15	92.29	98.51	100.73	107.2	114.5	117.78
--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	-------	-------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	444.46	441.97	427.18	403.57	379.62	356.82	342.27	348.77	361.17	385	412.2	432.56
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	-------	--------

(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Northwest 0.9x	0.77	4.12	11.28	0.63	0.7	14.21	(81)
Northwest 0.9x	0.77	2.23	11.28	0.63	0.7	7.69	(81)

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Northwest 0.9x	0.77	x	2.23	x	11.28	x	0.63	x	0.7	=	7.69	(81)
Northwest 0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.63	x	0.7	=	15.65	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.63	x	0.7	=	15.65	(81)
Northwest 0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.63	x	0.7	=	28.2	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.63	x	0.7	=	28.2	(81)
Northwest 0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.63	x	0.7	=	46.31	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.63	x	0.7	=	46.31	(81)
Northwest 0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.63	x	0.7	=	62.25	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.63	x	0.7	=	62.25	(81)
Northwest 0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.63	x	0.7	=	66.37	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.63	x	0.7	=	66.37	(81)
Northwest 0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.63	x	0.7	=	62.09	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.63	x	0.7	=	62.09	(81)
Northwest 0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.63	x	0.7	=	49.5	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.63	x	0.7	=	49.5	(81)
Northwest 0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.63	x	0.7	=	34.36	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.63	x	0.7	=	34.36	(81)
Northwest 0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.63	x	0.7	=	19.13	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.63	x	0.7	=	19.13	(81)
Northwest 0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.63	x	0.7	=	9.68	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.63	x	0.7	=	9.68	(81)
Northwest 0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.63	x	0.7	=	6.28	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.63	x	0.7	=	6.28	(81)

Solar gains in watts, calculated for each month

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

(83)m= 29.59 60.22 108.5 178.19 239.52 255.36 238.88 190.44 132.21 73.6 37.23 24.16 (83)

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

(84)m= 474.05 502.19 535.69 581.76 619.15 612.18 581.15 539.21 493.38 458.6 449.42 456.72 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

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

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(86)m=	1	1	0.99	0.96	0.85	0.63	0.46	0.52	0.81	0.98	1	1	(86)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(87)m=	20.32	20.4	20.55	20.78	20.94	20.99	21	21	20.97	20.77	20.51	20.3	(87)
--------	-------	------	-------	-------	-------	-------	----	----	-------	-------	-------	------	------

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

(88)m=	20.32	20.32	20.32	20.33	20.34	20.34	20.34	20.34	20.34	20.34	20.33	20.33	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.95	0.81	0.57	0.39	0.45	0.75	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	19.39	19.51	19.74	20.06	20.28	20.34	20.34	20.34	20.32	20.06	19.69	19.38	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
---------------------------	------	------

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

(92)m=	19.72	19.83	20.03	20.32	20.51	20.57	20.58	20.58	20.55	20.31	19.98	19.71	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.72	19.83	20.03	20.32	20.51	20.57	20.58	20.58	20.55	20.31	19.98	19.71	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.95	0.82	0.59	0.42	0.47	0.77	0.97	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	472.92	500.04	529.4	553.32	508.94	363.11	243.52	254.93	379.62	443.26	446.91	455.88	(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 × ((93)m – (96)m)]

(97)m=	981.25	946.66	855.36	711.06	547.33	366.03	243.71	255.37	397.22	603.23	804.52	974.51	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(98)m=	378.2	300.13	242.51	113.58	28.56	0	0	0	0	119.02	257.48	385.86	(98)
--------	-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1825.33	(98)
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Space heating requirement in kWh/m²/year

20.76	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

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

Space heating requirement (calculated above)

(211)m = {[(98)m × (204)]} × 100 ÷ (206)	378.2	300.13	242.51	113.58	28.56	0	0	0	0	119.02	257.48	385.86	(211)
--	-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	-------

404.49	320.99	259.37	121.47	30.54	0	0	0	0	127.29	275.37	412.68		
Total (kWh/year) =Sum(211) _{1, 5, 10, 12} =												1952.22	(211)

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Space heating fuel (secondary), kWh/month

= {(98)m x (201)} x 100 ÷ (208)

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

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

0 (215)

Water heating

Output from water heater (calculated above)

202.97	178.85	187.72	168.13	164.65	146.97	141	154.92	154.71	174.35	184.55	198.03
--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------

Efficiency of water heater

79.8 (216)

(217)m=	86.45	86.18	85.5	83.79	81.22	79.8	79.8	79.8	79.8	83.82	85.7	86.56
---------	-------	-------	------	-------	-------	------	------	------	------	-------	------	-------

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	234.77	207.52	219.56	200.65	202.73	184.17	176.69	194.14	193.88	208	215.33	228.77
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------

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

2466.21 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

1952.22

Water heating fuel used

2466.21

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

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

75 (231)

Electricity for lighting

429.79 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	421.68 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	532.7 (264)
Space and water heating	(261) + (262) + (263) + (264) =		954.38 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	223.06 (268)
Total CO2, kg/year	sum of (265)...(271) =		1216.37 (272)

TER =

13.83 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 3

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a) x	2.4 (2a) =	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				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) = 0.18 (8)

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

Number of storeys in the dwelling (ns)	0 (9)
--	-------

Additional infiltration	[(9)-1]x0.1 = 0 (10)
-------------------------	----------------------

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
--	--------

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
---	--------

If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
--	--------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
---------------------	------------------------------------

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
-------------------	---

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5 (17)
---	--------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.43 (18)
--	-----------

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

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

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

Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.33 (21)
--	--------------------------------

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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TER WorkSheet: New dwelling design stage

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

0.42	0.41	0.4	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39
------	------	-----	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Windows Type 4			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Walls	40.7	11.45	29.25	x 0.18 =	5.27		(29)
Total area of elements, m²			40.7				(31)
Party wall			32.57	x 0 =	0		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 20.45 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 0.2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 20.65 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	33.08	32.89	32.7	31.81	31.64	30.87	30.87	30.72	31.17	31.64	31.98	32.33

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

(39)m=	53.73	53.54	53.35	52.45	52.29	51.51	51.51	51.37	51.81	52.29	52.63	52.98
Average = Sum(39) _{1...12} /12=												52.45 (39)

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Heat loss parameter (HLP), W/m²K

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

(40)m=	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.73	0.74	0.74	0.75		
Average = Sum(40) _{1...12} /12=													0.74	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.27

(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

88.09

(43)

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

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

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

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
Total = Sum(44) _{1...12} =													1057.12	(44)

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

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
Total = Sum(45) _{1...12} =													1386.06	(45)

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

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

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

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76	
Output from water heater (annual) _{1...12}												1934.67	(64)

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

(65)m=	85.06	75.46	80.4	73.67	73.35	67.2	66.12	70.38	69.57	76.31	78.69	83.55	(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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

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

(67)m=	18.53	16.46	13.38	10.13	7.57	6.39	6.91	8.98	12.05	15.3	17.86	19.04	(67)
--------	-------	-------	-------	-------	------	------	------	------	-------	------	-------	-------	------

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

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	114.32	112.29	108.06	102.32	98.59	93.34	88.87	94.59	96.63	102.57	109.29	112.3	(72)
--------	--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------	-------	------

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

(73)m=	392.42	390.38	377.86	357.76	337.45	317.84	305.09	310.81	321.13	341.44	364.73	382.1	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.63	x	0.7	=	26.76	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.63	x	0.7	=	45.59	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.63	x	0.7	=	62.37	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.63	x	0.7	=	77.28	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.63	x	0.7	=	86.56	(77)

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Southeast	0.9x	0.77	x	2.38	x	118.15	x	0.63	x	0.7	=	85.94	(77)
Southeast	0.9x	0.77	x	2.38	x	113.91	x	0.63	x	0.7	=	82.85	(77)
Southeast	0.9x	0.77	x	2.38	x	104.39	x	0.63	x	0.7	=	75.93	(77)
Southeast	0.9x	0.77	x	2.38	x	92.85	x	0.63	x	0.7	=	67.54	(77)
Southeast	0.9x	0.77	x	2.38	x	69.27	x	0.63	x	0.7	=	50.38	(77)
Southeast	0.9x	0.77	x	2.38	x	44.07	x	0.63	x	0.7	=	32.06	(77)
Southeast	0.9x	0.77	x	2.38	x	31.49	x	0.63	x	0.7	=	22.9	(77)
Southwest	0.9x	0.77	x	2.38	x	36.79		0.63	x	0.7	=	26.76	(79)
Southwest	0.9x	0.77	x	2.42	x	36.79		0.63	x	0.7	=	27.21	(79)
Southwest	0.9x	0.77	x	4.27	x	36.79		0.63	x	0.7	=	48.01	(79)
Southwest	0.9x	0.77	x	2.38	x	62.67		0.63	x	0.7	=	45.59	(79)
Southwest	0.9x	0.77	x	2.42	x	62.67		0.63	x	0.7	=	46.35	(79)
Southwest	0.9x	0.77	x	4.27	x	62.67		0.63	x	0.7	=	81.79	(79)
Southwest	0.9x	0.77	x	2.38	x	85.75		0.63	x	0.7	=	62.37	(79)
Southwest	0.9x	0.77	x	2.42	x	85.75		0.63	x	0.7	=	63.42	(79)
Southwest	0.9x	0.77	x	4.27	x	85.75		0.63	x	0.7	=	111.9	(79)
Southwest	0.9x	0.77	x	2.38	x	106.25		0.63	x	0.7	=	77.28	(79)
Southwest	0.9x	0.77	x	2.42	x	106.25		0.63	x	0.7	=	78.58	(79)
Southwest	0.9x	0.77	x	4.27	x	106.25		0.63	x	0.7	=	138.65	(79)
Southwest	0.9x	0.77	x	2.38	x	119.01		0.63	x	0.7	=	86.56	(79)
Southwest	0.9x	0.77	x	2.42	x	119.01		0.63	x	0.7	=	88.02	(79)
Southwest	0.9x	0.77	x	4.27	x	119.01		0.63	x	0.7	=	155.31	(79)
Southwest	0.9x	0.77	x	2.38	x	118.15		0.63	x	0.7	=	85.94	(79)
Southwest	0.9x	0.77	x	2.42	x	118.15		0.63	x	0.7	=	87.38	(79)
Southwest	0.9x	0.77	x	4.27	x	118.15		0.63	x	0.7	=	154.18	(79)
Southwest	0.9x	0.77	x	2.38	x	113.91		0.63	x	0.7	=	82.85	(79)
Southwest	0.9x	0.77	x	2.42	x	113.91		0.63	x	0.7	=	84.25	(79)
Southwest	0.9x	0.77	x	4.27	x	113.91		0.63	x	0.7	=	148.65	(79)
Southwest	0.9x	0.77	x	2.38	x	104.39		0.63	x	0.7	=	75.93	(79)
Southwest	0.9x	0.77	x	2.42	x	104.39		0.63	x	0.7	=	77.21	(79)
Southwest	0.9x	0.77	x	4.27	x	104.39		0.63	x	0.7	=	136.23	(79)
Southwest	0.9x	0.77	x	2.38	x	92.85		0.63	x	0.7	=	67.54	(79)
Southwest	0.9x	0.77	x	2.42	x	92.85		0.63	x	0.7	=	68.67	(79)
Southwest	0.9x	0.77	x	4.27	x	92.85		0.63	x	0.7	=	121.17	(79)
Southwest	0.9x	0.77	x	2.38	x	69.27		0.63	x	0.7	=	50.38	(79)
Southwest	0.9x	0.77	x	2.42	x	69.27		0.63	x	0.7	=	51.23	(79)
Southwest	0.9x	0.77	x	4.27	x	69.27		0.63	x	0.7	=	90.39	(79)
Southwest	0.9x	0.77	x	2.38	x	44.07		0.63	x	0.7	=	32.06	(79)
Southwest	0.9x	0.77	x	2.42	x	44.07		0.63	x	0.7	=	32.59	(79)
Southwest	0.9x	0.77	x	4.27	x	44.07		0.63	x	0.7	=	57.51	(79)
Southwest	0.9x	0.77	x	2.38	x	31.49		0.63	x	0.7	=	22.9	(79)

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Southwest 0.9x

0.77

 x

2.42

 x

31.49

0.63

 x

0.7

 =

23.29

 (79)

Southwest 0.9x

0.77

 x

4.27

 x

31.49

0.63

 x

0.7

 =

41.09

 (79)

Solar gains in watts, calculated for each month

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

(83)m=

128.75	219.31	300.07	371.8	416.45	413.44	398.6	365.29	324.91	242.39	154.21	110.18
--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	--------

 (83)

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

(84)m=

521.17	609.69	677.94	729.56	753.9	731.28	703.69	676.1	646.05	583.82	518.95	492.29
--------	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.97	0.93	0.81	0.64	0.45	0.32	0.35	0.55	0.85	0.97	0.99

 (86)

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

(87)m=

20.46	20.62	20.79	20.94	20.99	21	21	21	21	20.93	20.68	20.43
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 (87)

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

(88)m=

20.29	20.29	20.3	20.31	20.31	20.32	20.32	20.32	20.31	20.31	20.3	20.3
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

 (88)

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

(89)m=

0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.5	0.81	0.97	0.99
------	------	------	------	------	-----	------	-----	-----	------	------	------

 (89)

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

(90)m=

19.57	19.8	20.05	20.24	20.3	20.32	20.32	20.32	20.31	20.24	19.9	19.54
-------	------	-------	-------	------	-------	-------	-------	-------	-------	------	-------

 (90)

fLA = Living area ÷ (4) =

0.56

 (91)

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

(92)m=

20.07	20.26	20.46	20.63	20.68	20.7	20.7	20.7	20.69	20.62	20.33	20.03
-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------

 (92)

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

(93)m=

20.07	20.26	20.46	20.63	20.68	20.7	20.7	20.7	20.69	20.62	20.33	20.03
-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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	0.62	0.43	0.3	0.33	0.53	0.83	0.97	0.99
------	------	------	------	------	------	-----	------	------	------	------	------

 (94)

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

(95)m=

514.71	589.23	620.01	578.2	463.97	313.72	211.05	220.76	340.11	482.69	501.7	487.85
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------

 (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=

847.03	822.1	744.82	615.19	469.73	314.07	211.08	220.8	341.61	523.98	696.35	838.77
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (97)

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

(98)m=

247.25	156.49	92.86	26.64	4.29	0	0	0	0	30.72	140.14	261.09
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------

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

959.47

 (98)

Space heating requirement in kWh/m²/year

13.52

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
247.25	156.49	92.86	26.64	4.29	0	0	0	0	30.72	140.14	261.09	

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

264.43	167.37	99.32	28.49	4.58	0	0	0	0	32.86	149.89	279.24		
Total (kWh/year) =Sum(211) _{1,5,10,...12} =												1026.18	(211)

Space heating fuel (secondary), kWh/month

= {[[(98)m × (201)] } × 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76	
-------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--

Efficiency of water heater 79.8 (216)

(217)m=	85.51	84.63	83.19	81.18	80.05	79.8	79.8	79.8	79.8	81.32	84.25	85.72	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	222.54	198.24	211.9	194.82	193.73	173.83	167.11	183.14	182.75	201.68	205.62	216.71	
Total = Sum(219a) _{1..12} =												2352.07	(219)

Annual totals

Space heating fuel used, main system 1

kWh/year

1026.18

Water heating fuel used

2352.07

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 75 (231)

Electricity for lighting

327.19 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.216	=	221.65 (261)
Space heating (secondary)	(215) ×	0.519	=	0 (263)
Water heating	(219) ×	0.216	=	508.05 (264)
Space and water heating	(261) + (262) + (263) + (264) =			729.7 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	=	38.93 (267)
Electricity for lighting	(232) ×	0.519	=	169.81 (268)

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Total CO2, kg/year

sum of (265)...(271) =

938.44

(272)

TER =

13.22

(273)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 3

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a)	2.4 (2a)	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.18 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.43 (18)

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

Number of sides sheltered 3 (19)

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

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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TER WorkSheet: New dwelling design stage

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

0.42	0.41	0.4	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39
------	------	-----	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Windows Type 4			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Walls	40.7	11.45	29.25	x 0.18 =	5.27		(29)
Total area of elements, m²			40.7				(31)
Party wall			32.57	x 0 =	0		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 20.45 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 0.2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 20.65 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	33.08	32.89	32.7	31.81	31.64	30.87	30.87	30.72	31.17	31.64	31.98	32.33

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

(39)m=	53.73	53.54	53.35	52.45	52.29	51.51	51.51	51.37	51.81	52.29	52.63	52.98
Average = Sum(39) _{1...12} /12=												52.45 (39)

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Heat loss parameter (HLP), W/m²K

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

(40)m=	0.76	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.73	0.74	0.74	0.75		
Average = Sum(40) _{1...12} /12=													0.74	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.27

(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

88.09

(43)

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

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

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

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
Total = Sum(44) _{1...12} =													1057.12	(44)

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

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
Total = Sum(45) _{1...12} =													1386.06	(45)

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

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

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

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76	
Output from water heater (annual) _{1...12}												1934.67	(64)

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

(65)m=	85.06	75.46	80.4	73.67	73.35	67.2	66.12	70.38	69.57	76.31	78.69	83.55	(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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

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

(67)m=	18.53	16.46	13.38	10.13	7.57	6.39	6.91	8.98	12.05	15.3	17.86	19.04	(67)
--------	-------	-------	-------	-------	------	------	------	------	-------	------	-------	-------	------

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

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	114.32	112.29	108.06	102.32	98.59	93.34	88.87	94.59	96.63	102.57	109.29	112.3	(72)
--------	--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------	-------	------

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

(73)m=	392.42	390.38	377.86	357.76	337.45	317.84	305.09	310.81	321.13	341.44	364.73	382.1	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.63	x	0.7	=	26.76	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.63	x	0.7	=	45.59	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.63	x	0.7	=	62.37	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.63	x	0.7	=	77.28	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.63	x	0.7	=	86.56	(77)

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Southeast	0.9x	0.77	x	2.38	x	118.15	x	0.63	x	0.7	=	85.94	(77)
Southeast	0.9x	0.77	x	2.38	x	113.91	x	0.63	x	0.7	=	82.85	(77)
Southeast	0.9x	0.77	x	2.38	x	104.39	x	0.63	x	0.7	=	75.93	(77)
Southeast	0.9x	0.77	x	2.38	x	92.85	x	0.63	x	0.7	=	67.54	(77)
Southeast	0.9x	0.77	x	2.38	x	69.27	x	0.63	x	0.7	=	50.38	(77)
Southeast	0.9x	0.77	x	2.38	x	44.07	x	0.63	x	0.7	=	32.06	(77)
Southeast	0.9x	0.77	x	2.38	x	31.49	x	0.63	x	0.7	=	22.9	(77)
Southwest	0.9x	0.77	x	2.38	x	36.79		0.63	x	0.7	=	26.76	(79)
Southwest	0.9x	0.77	x	2.42	x	36.79		0.63	x	0.7	=	27.21	(79)
Southwest	0.9x	0.77	x	4.27	x	36.79		0.63	x	0.7	=	48.01	(79)
Southwest	0.9x	0.77	x	2.38	x	62.67		0.63	x	0.7	=	45.59	(79)
Southwest	0.9x	0.77	x	2.42	x	62.67		0.63	x	0.7	=	46.35	(79)
Southwest	0.9x	0.77	x	4.27	x	62.67		0.63	x	0.7	=	81.79	(79)
Southwest	0.9x	0.77	x	2.38	x	85.75		0.63	x	0.7	=	62.37	(79)
Southwest	0.9x	0.77	x	2.42	x	85.75		0.63	x	0.7	=	63.42	(79)
Southwest	0.9x	0.77	x	4.27	x	85.75		0.63	x	0.7	=	111.9	(79)
Southwest	0.9x	0.77	x	2.38	x	106.25		0.63	x	0.7	=	77.28	(79)
Southwest	0.9x	0.77	x	2.42	x	106.25		0.63	x	0.7	=	78.58	(79)
Southwest	0.9x	0.77	x	4.27	x	106.25		0.63	x	0.7	=	138.65	(79)
Southwest	0.9x	0.77	x	2.38	x	119.01		0.63	x	0.7	=	86.56	(79)
Southwest	0.9x	0.77	x	2.42	x	119.01		0.63	x	0.7	=	88.02	(79)
Southwest	0.9x	0.77	x	4.27	x	119.01		0.63	x	0.7	=	155.31	(79)
Southwest	0.9x	0.77	x	2.38	x	118.15		0.63	x	0.7	=	85.94	(79)
Southwest	0.9x	0.77	x	2.42	x	118.15		0.63	x	0.7	=	87.38	(79)
Southwest	0.9x	0.77	x	4.27	x	118.15		0.63	x	0.7	=	154.18	(79)
Southwest	0.9x	0.77	x	2.38	x	113.91		0.63	x	0.7	=	82.85	(79)
Southwest	0.9x	0.77	x	2.42	x	113.91		0.63	x	0.7	=	84.25	(79)
Southwest	0.9x	0.77	x	4.27	x	113.91		0.63	x	0.7	=	148.65	(79)
Southwest	0.9x	0.77	x	2.38	x	104.39		0.63	x	0.7	=	75.93	(79)
Southwest	0.9x	0.77	x	2.42	x	104.39		0.63	x	0.7	=	77.21	(79)
Southwest	0.9x	0.77	x	4.27	x	104.39		0.63	x	0.7	=	136.23	(79)
Southwest	0.9x	0.77	x	2.38	x	92.85		0.63	x	0.7	=	67.54	(79)
Southwest	0.9x	0.77	x	2.42	x	92.85		0.63	x	0.7	=	68.67	(79)
Southwest	0.9x	0.77	x	4.27	x	92.85		0.63	x	0.7	=	121.17	(79)
Southwest	0.9x	0.77	x	2.38	x	69.27		0.63	x	0.7	=	50.38	(79)
Southwest	0.9x	0.77	x	2.42	x	69.27		0.63	x	0.7	=	51.23	(79)
Southwest	0.9x	0.77	x	4.27	x	69.27		0.63	x	0.7	=	90.39	(79)
Southwest	0.9x	0.77	x	2.38	x	44.07		0.63	x	0.7	=	32.06	(79)
Southwest	0.9x	0.77	x	2.42	x	44.07		0.63	x	0.7	=	32.59	(79)
Southwest	0.9x	0.77	x	4.27	x	44.07		0.63	x	0.7	=	57.51	(79)
Southwest	0.9x	0.77	x	2.38	x	31.49		0.63	x	0.7	=	22.9	(79)

TER WorkSheet: New dwelling design stage

Southwest 0.9x

0.77

 x

2.42

 x

31.49

0.63

 x

0.7

 =

23.29

 (79)

Southwest 0.9x

0.77

 x

4.27

 x

31.49

0.63

 x

0.7

 =

41.09

 (79)

Solar gains in watts, calculated for each month

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

(83)m=

128.75	219.31	300.07	371.8	416.45	413.44	398.6	365.29	324.91	242.39	154.21	110.18
--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------	--------

 (83)

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

(84)m=

521.17	609.69	677.94	729.56	753.9	731.28	703.69	676.1	646.05	583.82	518.95	492.29
--------	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.97	0.93	0.81	0.64	0.45	0.32	0.35	0.55	0.85	0.97	0.99

 (86)

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

(87)m=

20.46	20.62	20.79	20.94	20.99	21	21	21	21	20.93	20.68	20.43
-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------

 (87)

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

(88)m=

20.29	20.29	20.3	20.31	20.31	20.32	20.32	20.32	20.31	20.31	20.3	20.3
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

 (88)

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

(89)m=

0.99	0.97	0.91	0.78	0.59	0.4	0.27	0.3	0.5	0.81	0.97	0.99
------	------	------	------	------	-----	------	-----	-----	------	------	------

 (89)

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

(90)m=

19.57	19.8	20.05	20.24	20.3	20.32	20.32	20.32	20.31	20.24	19.9	19.54
-------	------	-------	-------	------	-------	-------	-------	-------	-------	------	-------

 (90)

fLA = Living area ÷ (4) =

0.56

 (91)

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

(92)m=

20.07	20.26	20.46	20.63	20.68	20.7	20.7	20.7	20.69	20.62	20.33	20.03
-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------

 (92)

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

(93)m=

20.07	20.26	20.46	20.63	20.68	20.7	20.7	20.7	20.69	20.62	20.33	20.03
-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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	0.62	0.43	0.3	0.33	0.53	0.83	0.97	0.99
------	------	------	------	------	------	-----	------	------	------	------	------

 (94)

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

(95)m=

514.71	589.23	620.01	578.2	463.97	313.72	211.05	220.76	340.11	482.69	501.7	487.85
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------

 (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=

847.03	822.1	744.82	615.19	469.73	314.07	211.08	220.8	341.61	523.98	696.35	838.77
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (97)

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

(98)m=

247.25	156.49	92.86	26.64	4.29	0	0	0	0	30.72	140.14	261.09
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------

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

959.47

 (98)

Space heating requirement in kWh/m²/year

13.52

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
247.25	156.49	92.86	26.64	4.29	0	0	0	0	30.72	140.14	261.09	

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

264.43	167.37	99.32	28.49	4.58	0	0	0	0	32.86	149.89	279.24		
Total (kWh/year) =Sum(211) _{1..5,10...12} =												1026.18	(211)

Space heating fuel (secondary), kWh/month

= {[[(98)m × (201)] } × 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76
-------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------

Efficiency of water heater 79.8 (216)

(217)m=	85.51	84.63	83.19	81.18	80.05	79.8	79.8	79.8	79.8	81.32	84.25	85.72	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	222.54	198.24	211.9	194.82	193.73	173.83	167.11	183.14	182.75	201.68	205.62	216.71	
Total = Sum(219a) _{1..12} =												2352.07	(219)

Annual totals

Space heating fuel used, main system 1

1026.18

Water heating fuel used

2352.07

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 75 (231)

Electricity for lighting

327.19 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.216	=	221.65 (261)
Space heating (secondary)	(215) ×	0.519	=	0 (263)
Water heating	(219) ×	0.216	=	508.05 (264)
Space and water heating	(261) + (262) + (263) + (264) =			729.7 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	=	38.93 (267)
Electricity for lighting	(232) ×	0.519	=	169.81 (268)

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Total CO2, kg/year sum of (265)...(271) = 938.44 (272)

TER = 13.22 (273)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 4

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a)	2.4 (2a)	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.18 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.43 (18)

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

Number of sides sheltered 3 (19)

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

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39
------	------	-----	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	22.56	9.07	13.49	x 0.18 =	2.43		(29)
Total area of elements, m²			22.56				(31)
Party wall			36	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 14.45 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 0.33 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 14.78 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	33.08	32.89	32.7	31.81	31.64	30.87	30.87	30.72	31.17	31.64	31.98	32.33

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

(39)m=	47.86	47.67	47.48	46.59	46.42	45.64	45.64	45.5	45.94	46.42	46.76	47.11
Average = Sum(39) _{1...12} /12=												46.59 (39)

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Heat loss parameter (HLP), W/m²K

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

(40)m=	0.67	0.67	0.67	0.66	0.65	0.64	0.64	0.64	0.65	0.65	0.66	0.66		
	Average = Sum(40) _{1...12} /12=												0.66	(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

88.09

(43)

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

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

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

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
	Total = Sum(44) _{1...12} =												1057.12	(44)

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

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
	Total = Sum(45) _{1...12} =												1386.06	(45)

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

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

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

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76	
Output from water heater (annual) _{1...12}												1934.67	(64)

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

(65)m=	85.06	75.46	80.4	73.67	73.35	67.2	66.12	70.38	69.57	76.31	78.69	83.55	(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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

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

(67)m=	19.47	17.29	14.06	10.65	7.96	6.72	7.26	9.44	12.67	16.08	18.77	20.01	(67)
--------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	114.32	112.29	108.06	102.32	98.59	93.34	88.87	94.59	96.63	102.57	109.29	112.3	(72)
--------	--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------	-------	------

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

(73)m=	393.36	391.22	378.55	358.28	337.84	318.17	305.44	311.27	321.75	342.22	365.64	383.07	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.63	x	0.7	=	26.76	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.63	x	0.7	=	27.21	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.63	x	0.7	=	48.01	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.63	x	0.7	=	45.59	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.63	x	0.7	=	46.35	(77)

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Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.63	x	0.7	=	81.79	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.63	x	0.7	=	62.37	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.63	x	0.7	=	63.42	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.63	x	0.7	=	111.9	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.63	x	0.7	=	77.28	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.63	x	0.7	=	78.58	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.63	x	0.7	=	138.65	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.63	x	0.7	=	86.56	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.63	x	0.7	=	88.02	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.63	x	0.7	=	155.31	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.63	x	0.7	=	85.94	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.63	x	0.7	=	87.38	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.63	x	0.7	=	154.18	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.63	x	0.7	=	82.85	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.63	x	0.7	=	84.25	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.63	x	0.7	=	148.65	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.63	x	0.7	=	75.93	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.63	x	0.7	=	77.21	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.63	x	0.7	=	136.23	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.63	x	0.7	=	67.54	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.63	x	0.7	=	68.67	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.63	x	0.7	=	121.17	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.63	x	0.7	=	50.38	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.63	x	0.7	=	51.23	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.63	x	0.7	=	90.39	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.63	x	0.7	=	32.06	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.63	x	0.7	=	32.59	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.63	x	0.7	=	57.51	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.63	x	0.7	=	22.9	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.63	x	0.7	=	23.29	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.63	x	0.7	=	41.09	(77)

Solar gains in watts, calculated for each month

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

(83)m= 101.99 173.73 237.7 294.52 329.89 327.5 315.75 289.36 257.38 192 122.16 87.28 (83)

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

(84)m= 495.35 564.94 616.24 652.8 667.72 645.67 621.19 600.63 579.12 534.22 487.8 470.35 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.97	0.93	0.81	0.64	0.45	0.32	0.35	0.55	0.84	0.97	0.99

(86)

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

(87)m= 20.55 20.69 20.83 20.95 20.99 21 21 21 21 20.95 20.75 20.53 (87)

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

(88)m=	20.36	20.37	20.37	20.38	20.38	20.39	20.39	20.39	20.39	20.38	20.38	20.37	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.97	0.91	0.78	0.6	0.41	0.28	0.3	0.5	0.81	0.97	0.99	(89)
--------	------	------	------	------	-----	------	------	-----	-----	------	------	------	------

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

(90)m=	19.77	19.96	20.17	20.33	20.38	20.39	20.39	20.39	20.39	20.33	20.06	19.74	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.56 \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	20.21	20.36	20.54	20.68	20.72	20.73	20.73	20.73	20.73	20.68	20.44	20.18	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	20.21	20.36	20.54	20.68	20.72	20.73	20.73	20.73	20.73	20.68	20.44	20.18	(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	0.62	0.43	0.3	0.33	0.52	0.82	0.97	0.99	(94)
--------	------	------	------	-----	------	------	-----	------	------	------	------	------	------

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

(95)m=	489.32	547.11	566.59	521.41	415.04	279.63	188.51	197.05	303.71	439.33	471.22	466.14	(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=	761.3	737.18	666.49	548.65	418.69	279.79	188.52	197.06	304.47	467.72	623.77	752.89	(97)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	202.35	127.73	74.33	19.62	2.72	0	0	0	0	21.12	109.84	213.34	(98)
--------	--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 771.04 \quad (98)$$

Space heating requirement in kWh/m²/year

$$10.87 \quad (99)$$

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

Space heating:

Fraction of space heat from secondary/supplementary system

$$0 \quad (201)$$

Fraction of space heat from main system(s)

$$(202) = 1 - (201) = 1 \quad (202)$$

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] = 1 \quad (204)$$

Efficiency of main space heating system 1

$$93.5 \quad (206)$$

Efficiency of secondary/supplementary heating system, %

$$0 \quad (208)$$

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

kWh/year

Space heating requirement (calculated above)

202.35	127.73	74.33	19.62	2.72	0	0	0	0	21.12	109.84	213.34
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206) \quad (211)$$

216.42	136.61	79.49	20.98	2.91	0	0	0	0	22.59	117.47	228.17
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 824.64 \quad (211)$$

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

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

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

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Water heating

Output from water heater (calculated above)

190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76
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Efficiency of water heater

79.8 (216)

(217)m= 84.98 84.1 82.7 80.85 79.96 79.8 79.8 79.8 79.8 80.89 83.64 85.18 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

223.94	199.49	213.17	195.61	193.95	173.83	167.11	183.14	182.75	202.74	207.14	218.08
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2360.96 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

824.64

Water heating fuel used

2360.96

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

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

75 (231)

Electricity for lighting

343.84

(232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	178.12	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	509.97	(264)
Space and water heating	(261) + (262) + (263) + (264) =					688.09 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	178.45	(268)
Total CO2, kg/year	sum of (265)...(271) =					905.47 (272)

TER =

12.76 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 4

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a)	2.4 (2a)	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.18 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.43 (18)

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

Number of sides sheltered 3 (19)

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

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.33 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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TER WorkSheet: New dwelling design stage

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

0.42	0.41	0.4	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39
------	------	-----	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	22.56	9.07	13.49	x 0.18 =	2.43		(29)
Total area of elements, m²			22.56				(31)
Party wall			36	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 14.45 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 0.33 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 14.78 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	33.08	32.89	32.7	31.81	31.64	30.87	30.87	30.72	31.17	31.64	31.98	32.33

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

(39)m= 47.86 47.67 47.48 46.59 46.42 45.64 45.64 45.5 45.94 46.42 46.76 47.11
Average = Sum(39)_{1...12} /12= 46.59 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	0.67	0.67	0.67	0.66	0.65	0.64	0.64	0.64	0.65	0.65	0.66	0.66		
	Average = Sum(40) _{1...12} /12=												0.66	(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

88.09

(43)

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

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

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

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
	Total = Sum(44) _{1...12} =												1057.12	(44)

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

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
	Total = Sum(45) _{1...12} =												1386.06	(45)

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

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

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

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76	
Output from water heater (annual) _{1...12}												1934.67	(64)

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

(65)m=	85.06	75.46	80.4	73.67	73.35	67.2	66.12	70.38	69.57	76.31	78.69	83.55	(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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

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

(67)m=	19.47	17.29	14.06	10.65	7.96	6.72	7.26	9.44	12.67	16.08	18.77	20.01	(67)
--------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	114.32	112.29	108.06	102.32	98.59	93.34	88.87	94.59	96.63	102.57	109.29	112.3	(72)
--------	--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------	-------	------

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

(73)m=	393.36	391.22	378.55	358.28	337.84	318.17	305.44	311.27	321.75	342.22	365.64	383.07	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.63	x	0.7	=	26.76	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.63	x	0.7	=	27.21	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.63	x	0.7	=	48.01	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.63	x	0.7	=	45.59	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.63	x	0.7	=	46.35	(77)

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Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.63	x	0.7	=	81.79	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.63	x	0.7	=	62.37	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.63	x	0.7	=	63.42	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.63	x	0.7	=	111.9	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.63	x	0.7	=	77.28	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.63	x	0.7	=	78.58	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.63	x	0.7	=	138.65	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.63	x	0.7	=	86.56	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.63	x	0.7	=	88.02	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.63	x	0.7	=	155.31	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.63	x	0.7	=	85.94	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.63	x	0.7	=	87.38	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.63	x	0.7	=	154.18	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.63	x	0.7	=	82.85	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.63	x	0.7	=	84.25	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.63	x	0.7	=	148.65	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.63	x	0.7	=	75.93	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.63	x	0.7	=	77.21	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.63	x	0.7	=	136.23	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.63	x	0.7	=	67.54	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.63	x	0.7	=	68.67	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.63	x	0.7	=	121.17	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.63	x	0.7	=	50.38	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.63	x	0.7	=	51.23	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.63	x	0.7	=	90.39	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.63	x	0.7	=	32.06	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.63	x	0.7	=	32.59	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.63	x	0.7	=	57.51	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.63	x	0.7	=	22.9	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.63	x	0.7	=	23.29	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.63	x	0.7	=	41.09	(77)

Solar gains in watts, calculated for each month

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

(83)m= 101.99 173.73 237.7 294.52 329.89 327.5 315.75 289.36 257.38 192 122.16 87.28 (83)

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

(84)m= 495.35 564.94 616.24 652.8 667.72 645.67 621.19 600.63 579.12 534.22 487.8 470.35 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.97	0.93	0.81	0.64	0.45	0.32	0.35	0.55	0.84	0.97	0.99

(86)

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

(87)m= 20.55 20.69 20.83 20.95 20.99 21 21 21 21 20.95 20.75 20.53 (87)

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

(88)m=	20.36	20.37	20.37	20.38	20.38	20.39	20.39	20.39	20.39	20.38	20.38	20.37	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.97	0.91	0.78	0.6	0.41	0.28	0.3	0.5	0.81	0.97	0.99	(89)
--------	------	------	------	------	-----	------	------	-----	-----	------	------	------	------

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

(90)m=	19.77	19.96	20.17	20.33	20.38	20.39	20.39	20.39	20.39	20.33	20.06	19.74	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.56 \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	20.21	20.36	20.54	20.68	20.72	20.73	20.73	20.73	20.73	20.68	20.44	20.18	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	20.21	20.36	20.54	20.68	20.72	20.73	20.73	20.73	20.73	20.68	20.44	20.18	(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	0.62	0.43	0.3	0.33	0.52	0.82	0.97	0.99	(94)
--------	------	------	------	-----	------	------	-----	------	------	------	------	------	------

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

(95)m=	489.32	547.11	566.59	521.41	415.04	279.63	188.51	197.05	303.71	439.33	471.22	466.14	(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=	761.3	737.18	666.49	548.65	418.69	279.79	188.52	197.06	304.47	467.72	623.77	752.89	(97)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	202.35	127.73	74.33	19.62	2.72	0	0	0	0	21.12	109.84	213.34	(98)
--------	--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 771.04 \quad (98)$$

Space heating requirement in kWh/m²/year

$$10.87 \quad (99)$$

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

Space heating:

Fraction of space heat from secondary/supplementary system

$$0 \quad (201)$$

Fraction of space heat from main system(s)

$$(202) = 1 - (201) = 1 \quad (202)$$

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] = 1 \quad (204)$$

Efficiency of main space heating system 1

$$93.5 \quad (206)$$

Efficiency of secondary/supplementary heating system, %

$$0 \quad (208)$$

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

kWh/year

Space heating requirement (calculated above)

202.35	127.73	74.33	19.62	2.72	0	0	0	0	21.12	109.84	213.34
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206) \quad (211)$$

216.42	136.61	79.49	20.98	2.91	0	0	0	0	22.59	117.47	228.17
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 824.64 \quad (211)$$

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

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

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

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Water heating

Output from water heater (calculated above)

190.3	167.77	176.29	158.16	155.09	138.71	133.35	146.15	145.83	164	173.25	185.76
-------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------

Efficiency of water heater

79.8 (216)

(217)m= 84.98 84.1 82.7 80.85 79.96 79.8 79.8 79.8 79.8 80.89 83.64 85.18 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

223.94	199.49	213.17	195.61	193.95	173.83	167.11	183.14	182.75	202.74	207.14	218.08
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2360.96 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

824.64

Water heating fuel used

2360.96

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

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

75 (231)

Electricity for lighting

343.84

(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	178.12 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	509.97 (264)
Space and water heating	(261) + (262) + (263) + (264) =		688.09 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	178.45 (268)
Total CO2, kg/year		sum of (265)...(271) =	905.47 (272)

TER =

12.76 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 5

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	63.7 (1a)	2.4 (2a)	152.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	152.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

Additional infiltration

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

$$0.25 - [0.2 \times (14) \div 100] =$$

Infiltration rate

$$(8) + (10) + (11) + (12) + (13) + (15) =$$

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

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

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

Number of sides sheltered

Shelter factor

$$(20) = 1 - [0.075 \times (19)] =$$

Infiltration rate incorporating shelter factor

$$(21) = (18) \times (20) =$$

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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TER 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	0.3	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

(24d)m= 0.57 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
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	39.36	9.07	30.29	x 0.18 =	5.45		(29)
Roof	63.7	0	63.7	x 0.13 =	8.28		(30)
Total area of elements, m²			103.06				(31)
Party wall			15.82	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 25.76 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 573.3 (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 0.47 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 26.23 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.8	28.66	28.52	27.88	27.76	27.21	27.21	27.11	27.42	27.76	28.01	28.26

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

(39)m=	55.03	54.89	54.76	54.12	54	53.44	53.44	53.34	53.66	54	54.24	54.49
Average = Sum(39) _{1...12} /12=												54.12 (39)

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Heat loss parameter (HLP), W/m²K

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

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.08

(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

83.7

(43)

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

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

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

(44)m=	92.07	88.72	85.37	82.02	78.68	75.33	75.33	78.68	82.02	85.37	88.72	92.07		
	Total = Sum(44) _{1...12} =												1004.36	(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=	136.53	119.41	123.22	107.43	103.08	88.95	82.43	94.58	95.71	111.55	121.76	132.22		
	Total = Sum(45) _{1...12} =												1316.88	(45)

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

(46)m=	20.48	17.91	18.48	16.11	15.46	13.34	12.36	14.19	14.36	16.73	18.26	19.83		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

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

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	183.13	161.5	169.82	152.52	149.67	134.04	129.02	141.18	140.81	158.14	166.85	178.82	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	183.13	161.5	169.82	152.52	149.67	134.04	129.02	141.18	140.81	158.14	166.85	178.82	
Output from water heater (annual) _{1...12}												1865.5	(64)

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

(65)m=	82.67	73.37	78.25	71.79	71.55	65.65	64.68	68.73	67.9	74.36	76.56	81.24	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	(66)

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

(67)m=	17.36	15.42	12.54	9.49	7.1	5.99	6.47	8.41	11.29	14.34	16.74	17.84	(67)
--------	-------	-------	-------	------	-----	------	------	------	-------	-------	-------	-------	------

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

(68)m=	182.17	184.06	179.3	169.16	156.36	144.32	136.29	134.4	139.16	149.3	162.1	174.13	(68)
--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	-------	-------	--------	------

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

(69)m=	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	111.12	109.19	105.17	99.71	96.17	91.18	86.94	92.37	94.3	99.95	106.33	109.19	(72)
--------	--------	--------	--------	-------	-------	-------	-------	-------	------	-------	--------	--------	------

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

(73)m=	367.91	365.93	354.27	335.63	316.88	298.76	286.96	292.44	302.02	320.86	342.43	358.43	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.63	x	0.7	=	26.76	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.63	x	0.7	=	27.21	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.63	x	0.7	=	48.01	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.63	x	0.7	=	45.59	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.63	x	0.7	=	46.35	(77)

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Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.63	x	0.7	=	81.79	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.63	x	0.7	=	62.37	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.63	x	0.7	=	63.42	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.63	x	0.7	=	111.9	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.63	x	0.7	=	77.28	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.63	x	0.7	=	78.58	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.63	x	0.7	=	138.65	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.63	x	0.7	=	86.56	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.63	x	0.7	=	88.02	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.63	x	0.7	=	155.31	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.63	x	0.7	=	85.94	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.63	x	0.7	=	87.38	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.63	x	0.7	=	154.18	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.63	x	0.7	=	82.85	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.63	x	0.7	=	84.25	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.63	x	0.7	=	148.65	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.63	x	0.7	=	75.93	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.63	x	0.7	=	77.21	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.63	x	0.7	=	136.23	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.63	x	0.7	=	67.54	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.63	x	0.7	=	68.67	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.63	x	0.7	=	121.17	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.63	x	0.7	=	50.38	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.63	x	0.7	=	51.23	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.63	x	0.7	=	90.39	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.63	x	0.7	=	32.06	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.63	x	0.7	=	32.59	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.63	x	0.7	=	57.51	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.63	x	0.7	=	22.9	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.63	x	0.7	=	23.29	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.63	x	0.7	=	41.09	(77)

Solar gains in watts, calculated for each month

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

(83)m= 101.99 173.73 237.7 294.52 329.89 327.5 315.75 289.36 257.38 192 122.16 87.28 (83)

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

(84)m= 469.9 539.65 591.97 630.15 646.77 626.26 602.71 581.81 559.4 512.86 464.59 445.71 (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	0.74	0.54	0.39	0.42	0.65	0.9	0.98	0.99

(86)

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

(87)m= 20.3 20.45 20.64 20.85 20.96 21 21 21 20.99 20.85 20.54 20.26 (87)

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

(88)m=	20.2	20.2	20.2	20.21	20.21	20.22	20.22	20.22	20.22	20.21	20.21	20.21	(88)
--------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.94	0.85	0.69	0.48	0.32	0.35	0.58	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=	19.27	19.49	19.77	20.04	20.18	20.22	20.22	20.22	20.21	20.05	19.62	19.23	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.33 \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	19.61	19.81	20.06	20.31	20.43	20.47	20.48	20.48	20.46	20.31	19.92	19.57	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.61	19.81	20.06	20.31	20.43	20.47	20.48	20.48	20.46	20.31	19.92	19.57	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.86	0.7	0.5	0.34	0.37	0.6	0.88	0.97	0.99	(94)
--------	------	------	------	------	-----	-----	------	------	-----	------	------	------	------

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

(95)m=	464.75	526.07	557.15	539.8	453.3	312.14	207.05	217.27	335.93	448.94	452.5	442.02	(95)
--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------	-------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	842.28	818.2	742.23	617.24	471.64	313.89	207.18	217.49	341.46	524.33	695.51	837.45	(97)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	280.88	196.31	137.69	55.75	13.64	0	0	0	0	56.09	174.97	294.19	(98)
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 1209.54 \quad (98)$$

Space heating requirement in kWh/m²/year

$$18.99 \quad (99)$$

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

Space heating:

Fraction of space heat from secondary/supplementary system

$$0 \quad (201)$$

Fraction of space heat from main system(s)

$$(202) = 1 - (201) = 1 \quad (202)$$

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] = 1 \quad (204)$$

Efficiency of main space heating system 1

$$93.5 \quad (206)$$

Efficiency of secondary/supplementary heating system, %

$$0 \quad (208)$$

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

kWh/year

Space heating requirement (calculated above)

280.88	196.31	137.69	55.75	13.64	0	0	0	0	56.09	174.97	294.19
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206) \quad (211)$$

300.41	209.96	147.27	59.63	14.59	0	0	0	0	59.99	187.13	314.65
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 1293.62 \quad (211)$$

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

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

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

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Water heating

Output from water heater (calculated above)

183.13	161.5	169.82	152.52	149.67	134.04	129.02	141.18	140.81	158.14	166.85	178.82
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

79.8 (216)

(217)m= 85.95 85.34 84.26 82.41 80.6 79.8 79.8 79.8 79.8 82.35 84.94 86.13 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

213.06	189.25	201.54	185.08	185.71	167.97	161.68	176.92	176.45	192.04	196.43	207.61
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2253.73 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

1293.62

Water heating fuel used

2253.73

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

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

75

(231)

Electricity for lighting

306.58

(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	279.42 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	486.81 (264)
Space and water heating	(261) + (262) + (263) + (264) =		766.23 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	159.11 (268)
Total CO2, kg/year		sum of (265)...(271) =	964.27 (272)

TER =

15.14 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 5

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	63.7 (1a)	2.4 (2a)	152.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	152.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

Additional infiltration

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

$$0.25 - [0.2 \times (14) \div 100] =$$

Infiltration rate

$$(8) + (10) + (11) + (12) + (13) + (15) =$$

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

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

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

Number of sides sheltered

Shelter factor

$$(20) = 1 - [0.075 \times (19)] =$$

Infiltration rate incorporating shelter factor

$$(21) = (18) \times (20) =$$

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.37	0.36	0.32	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) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

(24d)m= 0.57 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
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	39.36	9.07	30.29	x 0.18 =	5.45		(29)
Roof	63.7	0	63.7	x 0.13 =	8.28		(30)
Total area of elements, m²			103.06				(31)
Party wall			15.82	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 25.76 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 573.3 (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 0.47 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 26.23 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.8	28.66	28.52	27.88	27.76	27.21	27.21	27.11	27.42	27.76	28.01	28.26

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

(39)m=	55.03	54.89	54.76	54.12	54	53.44	53.44	53.34	53.66	54	54.24	54.49
Average = Sum(39) _{1...12} /12=												54.12 (39)

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Heat loss parameter (HLP), W/m²K

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

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.08

(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

83.7

(43)

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

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

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

(44)m=	92.07	88.72	85.37	82.02	78.68	75.33	75.33	78.68	82.02	85.37	88.72	92.07		
	Total = Sum(44) _{1...12} =												1004.36	(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=	136.53	119.41	123.22	107.43	103.08	88.95	82.43	94.58	95.71	111.55	121.76	132.22		
	Total = Sum(45) _{1...12} =												1316.88	(45)

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

(46)m=	20.48	17.91	18.48	16.11	15.46	13.34	12.36	14.19	14.36	16.73	18.26	19.83		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

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

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(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=	183.13	161.5	169.82	152.52	149.67	134.04	129.02	141.18	140.81	158.14	166.85	178.82	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	183.13	161.5	169.82	152.52	149.67	134.04	129.02	141.18	140.81	158.14	166.85	178.82	
Output from water heater (annual) _{1...12}												1865.5	(64)

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

(65)m=	82.67	73.37	78.25	71.79	71.55	65.65	64.68	68.73	67.9	74.36	76.56	81.24	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	(66)

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

(67)m=	17.36	15.42	12.54	9.49	7.1	5.99	6.47	8.41	11.29	14.34	16.74	17.84	(67)
--------	-------	-------	-------	------	-----	------	------	------	-------	-------	-------	-------	------

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

(68)m=	182.17	184.06	179.3	169.16	156.36	144.32	136.29	134.4	139.16	149.3	162.1	174.13	(68)
--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	-------	-------	--------	------

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

(69)m=	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	111.12	109.19	105.17	99.71	96.17	91.18	86.94	92.37	94.3	99.95	106.33	109.19	(72)
--------	--------	--------	--------	-------	-------	-------	-------	-------	------	-------	--------	--------	------

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

(73)m=	367.91	365.93	354.27	335.63	316.88	298.76	286.96	292.44	302.02	320.86	342.43	358.43	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.63	x	0.7	=	26.76	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.63	x	0.7	=	27.21	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.63	x	0.7	=	48.01	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.63	x	0.7	=	45.59	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.63	x	0.7	=	46.35	(77)

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Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.63	x	0.7	=	81.79	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.63	x	0.7	=	62.37	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.63	x	0.7	=	63.42	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.63	x	0.7	=	111.9	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.63	x	0.7	=	77.28	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.63	x	0.7	=	78.58	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.63	x	0.7	=	138.65	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.63	x	0.7	=	86.56	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.63	x	0.7	=	88.02	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.63	x	0.7	=	155.31	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.63	x	0.7	=	85.94	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.63	x	0.7	=	87.38	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.63	x	0.7	=	154.18	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.63	x	0.7	=	82.85	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.63	x	0.7	=	84.25	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.63	x	0.7	=	148.65	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.63	x	0.7	=	75.93	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.63	x	0.7	=	77.21	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.63	x	0.7	=	136.23	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.63	x	0.7	=	67.54	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.63	x	0.7	=	68.67	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.63	x	0.7	=	121.17	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.63	x	0.7	=	50.38	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.63	x	0.7	=	51.23	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.63	x	0.7	=	90.39	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.63	x	0.7	=	32.06	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.63	x	0.7	=	32.59	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.63	x	0.7	=	57.51	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.63	x	0.7	=	22.9	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.63	x	0.7	=	23.29	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.63	x	0.7	=	41.09	(77)

Solar gains in watts, calculated for each month

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

(83)m= 101.99 173.73 237.7 294.52 329.89 327.5 315.75 289.36 257.38 192 122.16 87.28 (83)

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

(84)m= 469.9 539.65 591.97 630.15 646.77 626.26 602.71 581.81 559.4 512.86 464.59 445.71 (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	0.74	0.54	0.39	0.42	0.65	0.9	0.98	0.99

(86)

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

(87)m= 20.3 20.45 20.64 20.85 20.96 21 21 21 20.99 20.85 20.54 20.26 (87)

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

(88)m=	20.2	20.2	20.2	20.21	20.21	20.22	20.22	20.22	20.22	20.21	20.21	20.21	(88)
--------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.94	0.85	0.69	0.48	0.32	0.35	0.58	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=	19.27	19.49	19.77	20.04	20.18	20.22	20.22	20.22	20.21	20.05	19.62	19.23	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.33 \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	19.61	19.81	20.06	20.31	20.43	20.47	20.48	20.48	20.46	20.31	19.92	19.57	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.61	19.81	20.06	20.31	20.43	20.47	20.48	20.48	20.46	20.31	19.92	19.57	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.86	0.7	0.5	0.34	0.37	0.6	0.88	0.97	0.99	(94)
--------	------	------	------	------	-----	-----	------	------	-----	------	------	------	------

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

(95)m=	464.75	526.07	557.15	539.8	453.3	312.14	207.05	217.27	335.93	448.94	452.5	442.02	(95)
--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------	-------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	842.28	818.2	742.23	617.24	471.64	313.89	207.18	217.49	341.46	524.33	695.51	837.45	(97)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	280.88	196.31	137.69	55.75	13.64	0	0	0	0	56.09	174.97	294.19	(98)
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 1209.54 \quad (98)$$

Space heating requirement in kWh/m²/year

$$18.99 \quad (99)$$

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

Space heating:

Fraction of space heat from secondary/supplementary system

$$0 \quad (201)$$

Fraction of space heat from main system(s)

$$(202) = 1 - (201) = 1 \quad (202)$$

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] = 1 \quad (204)$$

Efficiency of main space heating system 1

$$93.5 \quad (206)$$

Efficiency of secondary/supplementary heating system, %

$$0 \quad (208)$$

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

kWh/year

Space heating requirement (calculated above)

280.88	196.31	137.69	55.75	13.64	0	0	0	0	56.09	174.97	294.19
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206) \quad (211)$$

300.41	209.96	147.27	59.63	14.59	0	0	0	0	59.99	187.13	314.65
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 1293.62 \quad (211)$$

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

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

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

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Water heating

Output from water heater (calculated above)

183.13	161.5	169.82	152.52	149.67	134.04	129.02	141.18	140.81	158.14	166.85	178.82
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

79.8 (216)

(217)m= 85.95 85.34 84.26 82.41 80.6 79.8 79.8 79.8 79.8 82.35 84.94 86.13 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

213.06	189.25	201.54	185.08	185.71	167.97	161.68	176.92	176.45	192.04	196.43	207.61
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2253.73 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

1293.62

Water heating fuel used

2253.73

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

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

75 (231)

Electricity for lighting

306.58 (232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	279.42	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	486.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =					766.23 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	159.11	(268)
Total CO2, kg/year	sum of (265)...(271) =					964.27 (272)

TER =

15.14 (273)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 6

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	82.45 (1a) x	2.4 (2a) =	197.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	197.88 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	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)

Additional infiltration

[(9)-1]x0.1 =

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

0.25 - [0.2 x (14) ÷ 100] =

Infiltration rate

(8) + (10) + (11) + (12) + (13) + (15) =

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

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

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

Number of sides sheltered

Shelter factor

(20) = 1 - [0.075 x (19)] =

Infiltration rate incorporating shelter factor

(21) = (18) x (20) =

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

(24d)m= 0.58 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
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			6.16	$\times 1/[1/(1.4) + 0.04] =$	8.17		(27)
Windows Type 4			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 5			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Walls	41.57	15.8	25.77	x 0.18 =	4.64		(29)
Roof	82.45	0	82.45	x 0.13 =	10.72		(30)
Total area of elements, m²			124.02				(31)
Party wall			34.2	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 36.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 742.05 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 1 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.3 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	37.79	37.59	37.4	36.48	36.31	35.5	35.5	35.36	35.81	36.31	36.65	37.02

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

(39)m= 75.1 74.9 74.7 73.78 73.61 72.81 72.81 72.66 73.12 73.61 73.96 74.32 (39)

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Heat loss parameter (HLP), W/m²K

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

(40)m=	0.91	0.91	0.91	0.89	0.89	0.88	0.88	0.88	0.89	0.89	0.9	0.9		
Average = Sum(40) _{1...12} /12=													0.89	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

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

if TFA ≤ 13.9, N = 1

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

93.76

(43)

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

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

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

(44)m=	103.13	99.38	95.63	91.88	88.13	84.38	84.38	88.13	91.88	95.63	99.38	103.13		
Total = Sum(44) _{1...12} =													1125.1	(44)

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

(45)m=	152.94	133.77	138.03	120.34	115.47	99.64	92.33	105.95	107.22	124.95	136.4	148.12		
Total = Sum(45) _{1...12} =													1475.18	(45)

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

(46)m=	22.94	20.06	20.71	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22		(46)
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Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

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

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

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

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

(62)m=	199.54	175.85	184.63	165.43	162.07	144.73	138.93	152.55	152.31	171.55	181.49	194.71	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	199.54	175.85	184.63	165.43	162.07	144.73	138.93	152.55	152.31	171.55	181.49	194.71	
Output from water heater (annual) _{1...12}												2023.8	(64)

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

(65)m=	88.13	78.15	83.17	76.09	75.67	69.2	67.98	72.51	71.72	78.82	81.43	86.53	(65)
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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=	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	(66)

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

(67)m=	20.26	17.99	14.63	11.08	8.28	6.99	7.55	9.82	13.18	16.73	19.53	20.82	(67)
--------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	224.48	226.81	220.94	208.45	192.67	177.85	167.94	165.61	171.48	183.98	199.75	214.58	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	(71)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water heating gains (Table 5)

(72)m=	118.45	116.29	111.79	105.68	101.71	96.12	91.37	97.45	99.62	105.95	113.09	116.3	(72)
--------	--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	-------	------

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

(73)m=	426.81	424.71	410.98	388.82	366.27	344.57	330.48	336.5	347.89	370.27	395.99	415.31	(73)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest _{0.9x}	0.77	x	6.16	x	36.79		0.63	x	0.7	=	69.27	(79)
Southwest _{0.9x}	0.77	x	6.16	x	62.67		0.63	x	0.7	=	117.99	(79)
Southwest _{0.9x}	0.77	x	6.16	x	85.75		0.63	x	0.7	=	161.44	(79)
Southwest _{0.9x}	0.77	x	6.16	x	106.25		0.63	x	0.7	=	200.03	(79)
Southwest _{0.9x}	0.77	x	6.16	x	119.01		0.63	x	0.7	=	224.05	(79)

TER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	6.16	x	118.15	0.63	x	0.7	=	222.43	(79)
Southwest	0.9x	0.77	x	6.16	x	113.91	0.63	x	0.7	=	214.44	(79)
Southwest	0.9x	0.77	x	6.16	x	104.39	0.63	x	0.7	=	196.52	(79)
Southwest	0.9x	0.77	x	6.16	x	92.85	0.63	x	0.7	=	174.8	(79)
Southwest	0.9x	0.77	x	6.16	x	69.27	0.63	x	0.7	=	130.4	(79)
Southwest	0.9x	0.77	x	6.16	x	44.07	0.63	x	0.7	=	82.97	(79)
Southwest	0.9x	0.77	x	6.16	x	31.49	0.63	x	0.7	=	59.28	(79)
West	0.9x	0.77	x	2.38	x	19.64	0.63	x	0.7	=	14.29	(80)
West	0.9x	0.77	x	2.42	x	19.64	0.63	x	0.7	=	14.53	(80)
West	0.9x	0.77	x	2.38	x	38.42	0.63	x	0.7	=	27.95	(80)
West	0.9x	0.77	x	2.42	x	38.42	0.63	x	0.7	=	28.42	(80)
West	0.9x	0.77	x	2.38	x	63.27	0.63	x	0.7	=	46.02	(80)
West	0.9x	0.77	x	2.42	x	63.27	0.63	x	0.7	=	46.8	(80)
West	0.9x	0.77	x	2.38	x	92.28	0.63	x	0.7	=	67.12	(80)
West	0.9x	0.77	x	2.42	x	92.28	0.63	x	0.7	=	68.25	(80)
West	0.9x	0.77	x	2.38	x	113.09	0.63	x	0.7	=	82.26	(80)
West	0.9x	0.77	x	2.42	x	113.09	0.63	x	0.7	=	83.64	(80)
West	0.9x	0.77	x	2.38	x	115.77	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	2.42	x	115.77	0.63	x	0.7	=	85.62	(80)
West	0.9x	0.77	x	2.38	x	110.22	0.63	x	0.7	=	80.17	(80)
West	0.9x	0.77	x	2.42	x	110.22	0.63	x	0.7	=	81.52	(80)
West	0.9x	0.77	x	2.38	x	94.68	0.63	x	0.7	=	68.86	(80)
West	0.9x	0.77	x	2.42	x	94.68	0.63	x	0.7	=	70.02	(80)
West	0.9x	0.77	x	2.38	x	73.59	0.63	x	0.7	=	53.53	(80)
West	0.9x	0.77	x	2.42	x	73.59	0.63	x	0.7	=	54.43	(80)
West	0.9x	0.77	x	2.38	x	45.59	0.63	x	0.7	=	33.16	(80)
West	0.9x	0.77	x	2.42	x	45.59	0.63	x	0.7	=	33.72	(80)
West	0.9x	0.77	x	2.38	x	24.49	0.63	x	0.7	=	17.81	(80)
West	0.9x	0.77	x	2.42	x	24.49	0.63	x	0.7	=	18.11	(80)
West	0.9x	0.77	x	2.38	x	16.15	0.63	x	0.7	=	11.75	(80)
West	0.9x	0.77	x	2.42	x	16.15	0.63	x	0.7	=	11.95	(80)
Northwest	0.9x	0.77	x	2.42	x	11.28	0.63	x	0.7	=	8.34	(81)
Northwest	0.9x	0.77	x	2.42	x	11.28	0.63	x	0.7	=	8.34	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	0.63	x	0.7	=	16.99	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	0.63	x	0.7	=	16.99	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	0.63	x	0.7	=	30.6	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	0.63	x	0.7	=	30.6	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	0.63	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	0.63	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	0.63	x	0.7	=	67.56	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	0.63	x	0.7	=	67.56	(81)

TER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.63	x	0.7	=	72.02	(81)
Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.63	x	0.7	=	72.02	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.63	x	0.7	=	67.38	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.63	x	0.7	=	67.38	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.63	x	0.7	=	53.71	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.63	x	0.7	=	53.71	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.63	x	0.7	=	37.29	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.63	x	0.7	=	37.29	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.63	x	0.7	=	20.76	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.63	x	0.7	=	20.76	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.63	x	0.7	=	10.5	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.63	x	0.7	=	10.5	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.63	x	0.7	=	6.81	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.63	x	0.7	=	6.81	(81)

Solar gains in watts, calculated for each month

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

(83)m=	114.77	208.32	315.46	435.91	525.06	536.3	510.88	442.83	357.33	238.79	139.89	96.6	(83)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------	------

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

(84)m=	541.58	633.03	726.44	824.73	891.34	880.87	841.36	779.33	705.22	609.07	535.88	511.91	(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	0.73	0.52	0.38	0.43	0.69	0.94	0.99	1	(86)

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

(87)m=	20.15	20.31	20.55	20.81	20.96	21	21	21	20.98	20.77	20.41	20.12	(87)
--------	-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

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

(88)m=	20.16	20.16	20.16	20.17	20.17	20.18	20.18	20.18	20.18	20.17	20.17	20.17	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.96	0.86	0.67	0.46	0.31	0.35	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=	19.02	19.26	19.6	19.96	20.13	20.18	20.18	20.18	20.16	19.92	19.41	18.98	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.36 (91)

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

(92)m=	19.43	19.64	19.94	20.27	20.43	20.48	20.48	20.48	20.46	20.23	19.77	19.4	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	19.43	19.64	19.94	20.27	20.43	20.48	20.48	20.48	20.46	20.23	19.77	19.4	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.87	0.69	0.48	0.34	0.38	0.64	0.92	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

TER WorkSheet: New dwelling design stage

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

(95)m=	538.44	623.75	695.57	715.79	616.62	425.37	282.24	296.01	452.42	558.46	528.41	509.73	(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=	1136.33	1103.98	1004.28	839.08	642.87	427.81	282.44	296.44	464.9	708.56	937.02	1129.48	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	444.83	322.71	229.68	88.77	19.53	0	0	0	0	111.67	294.2	461.1	
--------	--------	--------	--------	-------	-------	---	---	---	---	--------	-------	-------	--

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1972.5 (98)

Space heating requirement in kWh/m²/year

23.92 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.5 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	444.83	322.71	229.68	88.77	19.53	0	0	0	0	111.67	294.2	461.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	475.76	345.15	245.65	94.94	20.89	0	0	0	0	119.44	314.66	493.15	
Total (kWh/year) = Sum(211) _{1...5,10...12} =	2109.63 (211)												(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

199.54	175.85	184.63	165.43	162.07	144.73	138.93	152.55	152.31	171.55	181.49	194.71
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Efficiency of water heater

79.8 (216)

(217)m=	86.89	86.41	85.4	83.24	80.83	79.8	79.8	79.8	79.8	83.7	86.1	87.04	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.64	203.5	216.2	198.75	200.51	181.37	174.1	191.16	190.87	204.95	210.8	223.72	
Total = Sum(219a) _{1...12} =	2425.57 (219)												(219)

Annual totals

Space heating fuel used, main system 1

2109.63 kWh/year

Water heating fuel used

2425.57 kWh/year

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

TER WorkSheet: New dwelling design stage

boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75	(231)
Electricity for lighting		357.71	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	455.68 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	523.92 (264)
Space and water heating	(261) + (262) + (263) + (264) =		979.6 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	185.65 (268)
Total CO2, kg/year	sum of (265)...(271) =		1204.18 (272)

TER = 14.6 (273)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 6

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	82.45 (1a)	2.4 (2a)	197.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	197.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.15 (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)
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Additional infiltration	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
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if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
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Percentage of windows and doors draught stripped	0 (14)
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Window infiltration	0 (15)
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Infiltration rate	0 (16)
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Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.4 (18)
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Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
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Shelter factor	0.78 (20)
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Infiltration rate incorporating shelter factor	0.31 (21)
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Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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TER 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	0.33	0.3	0.3	0.29	0.31	0.33	0.35	0.37
-----	------	------	------	------	-----	-----	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

(24d)m= 0.58 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
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			6.16	$\times 1/[1/(1.4) + 0.04] =$	8.17		(27)
Windows Type 4			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 5			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Walls	41.57	15.8	25.77	x 0.18 =	4.64		(29)
Roof	82.45	0	82.45	x 0.13 =	10.72		(30)
Total area of elements, m²			124.02				(31)
Party wall			34.2	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 36.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 742.05 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 1 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 37.3 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	37.79	37.59	37.4	36.48	36.31	35.5	35.5	35.36	35.81	36.31	36.65	37.02

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

(39)m= 75.1 74.9 74.7 73.78 73.61 72.81 72.81 72.66 73.12 73.61 73.96 74.32 (39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	0.91	0.91	0.91	0.89	0.89	0.88	0.88	0.88	0.89	0.89	0.9	0.9		
Average = Sum(40) _{1...12} /12=													0.89	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

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

if TFA ≤ 13.9, N = 1

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

93.76

(43)

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

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

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

(44)m=	103.13	99.38	95.63	91.88	88.13	84.38	84.38	88.13	91.88	95.63	99.38	103.13		
Total = Sum(44) _{1...12} =													1125.1	(44)

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

(45)m=	152.94	133.77	138.03	120.34	115.47	99.64	92.33	105.95	107.22	124.95	136.4	148.12		
Total = Sum(45) _{1...12} =													1475.18	(45)

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

(46)m=	22.94	20.06	20.71	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

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

150

(47)

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

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

Water storage loss:

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

1.39

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

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

0.75

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0.75

(55)

Water storage loss calculated for each month

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

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

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

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

(62)m=	199.54	175.85	184.63	165.43	162.07	144.73	138.93	152.55	152.31	171.55	181.49	194.71	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	199.54	175.85	184.63	165.43	162.07	144.73	138.93	152.55	152.31	171.55	181.49	194.71	
Output from water heater (annual) _{1...12}												2023.8	(64)

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

(65)m=	88.13	78.15	83.17	76.09	75.67	69.2	67.98	72.51	71.72	78.82	81.43	86.53	(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=	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	(66)

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

(67)m=	20.26	17.99	14.63	11.08	8.28	6.99	7.55	9.82	13.18	16.73	19.53	20.82	(67)
--------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	224.48	226.81	220.94	208.45	192.67	177.85	167.94	165.61	171.48	183.98	199.75	214.58	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	(71)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water heating gains (Table 5)

(72)m=	118.45	116.29	111.79	105.68	101.71	96.12	91.37	97.45	99.62	105.95	113.09	116.3	(72)
--------	--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	-------	------

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

(73)m=	426.81	424.71	410.98	388.82	366.27	344.57	330.48	336.5	347.89	370.27	395.99	415.31	(73)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest _{0.9x}	0.77	x	6.16	x	36.79		0.63	x	0.7	=	69.27	(79)
Southwest _{0.9x}	0.77	x	6.16	x	62.67		0.63	x	0.7	=	117.99	(79)
Southwest _{0.9x}	0.77	x	6.16	x	85.75		0.63	x	0.7	=	161.44	(79)
Southwest _{0.9x}	0.77	x	6.16	x	106.25		0.63	x	0.7	=	200.03	(79)
Southwest _{0.9x}	0.77	x	6.16	x	119.01		0.63	x	0.7	=	224.05	(79)

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Southwest	0.9x	0.77	x	6.16	x	118.15	0.63	x	0.7	=	222.43	(79)
Southwest	0.9x	0.77	x	6.16	x	113.91	0.63	x	0.7	=	214.44	(79)
Southwest	0.9x	0.77	x	6.16	x	104.39	0.63	x	0.7	=	196.52	(79)
Southwest	0.9x	0.77	x	6.16	x	92.85	0.63	x	0.7	=	174.8	(79)
Southwest	0.9x	0.77	x	6.16	x	69.27	0.63	x	0.7	=	130.4	(79)
Southwest	0.9x	0.77	x	6.16	x	44.07	0.63	x	0.7	=	82.97	(79)
Southwest	0.9x	0.77	x	6.16	x	31.49	0.63	x	0.7	=	59.28	(79)
West	0.9x	0.77	x	2.38	x	19.64	0.63	x	0.7	=	14.29	(80)
West	0.9x	0.77	x	2.42	x	19.64	0.63	x	0.7	=	14.53	(80)
West	0.9x	0.77	x	2.38	x	38.42	0.63	x	0.7	=	27.95	(80)
West	0.9x	0.77	x	2.42	x	38.42	0.63	x	0.7	=	28.42	(80)
West	0.9x	0.77	x	2.38	x	63.27	0.63	x	0.7	=	46.02	(80)
West	0.9x	0.77	x	2.42	x	63.27	0.63	x	0.7	=	46.8	(80)
West	0.9x	0.77	x	2.38	x	92.28	0.63	x	0.7	=	67.12	(80)
West	0.9x	0.77	x	2.42	x	92.28	0.63	x	0.7	=	68.25	(80)
West	0.9x	0.77	x	2.38	x	113.09	0.63	x	0.7	=	82.26	(80)
West	0.9x	0.77	x	2.42	x	113.09	0.63	x	0.7	=	83.64	(80)
West	0.9x	0.77	x	2.38	x	115.77	0.63	x	0.7	=	84.21	(80)
West	0.9x	0.77	x	2.42	x	115.77	0.63	x	0.7	=	85.62	(80)
West	0.9x	0.77	x	2.38	x	110.22	0.63	x	0.7	=	80.17	(80)
West	0.9x	0.77	x	2.42	x	110.22	0.63	x	0.7	=	81.52	(80)
West	0.9x	0.77	x	2.38	x	94.68	0.63	x	0.7	=	68.86	(80)
West	0.9x	0.77	x	2.42	x	94.68	0.63	x	0.7	=	70.02	(80)
West	0.9x	0.77	x	2.38	x	73.59	0.63	x	0.7	=	53.53	(80)
West	0.9x	0.77	x	2.42	x	73.59	0.63	x	0.7	=	54.43	(80)
West	0.9x	0.77	x	2.38	x	45.59	0.63	x	0.7	=	33.16	(80)
West	0.9x	0.77	x	2.42	x	45.59	0.63	x	0.7	=	33.72	(80)
West	0.9x	0.77	x	2.38	x	24.49	0.63	x	0.7	=	17.81	(80)
West	0.9x	0.77	x	2.42	x	24.49	0.63	x	0.7	=	18.11	(80)
West	0.9x	0.77	x	2.38	x	16.15	0.63	x	0.7	=	11.75	(80)
West	0.9x	0.77	x	2.42	x	16.15	0.63	x	0.7	=	11.95	(80)
Northwest	0.9x	0.77	x	2.42	x	11.28	0.63	x	0.7	=	8.34	(81)
Northwest	0.9x	0.77	x	2.42	x	11.28	0.63	x	0.7	=	8.34	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	0.63	x	0.7	=	16.99	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	0.63	x	0.7	=	16.99	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	0.63	x	0.7	=	30.6	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	0.63	x	0.7	=	30.6	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	0.63	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	0.63	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	0.63	x	0.7	=	67.56	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	0.63	x	0.7	=	67.56	(81)

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Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.63	x	0.7	=	72.02	(81)
Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.63	x	0.7	=	72.02	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.63	x	0.7	=	67.38	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.63	x	0.7	=	67.38	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.63	x	0.7	=	53.71	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.63	x	0.7	=	53.71	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.63	x	0.7	=	37.29	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.63	x	0.7	=	37.29	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.63	x	0.7	=	20.76	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.63	x	0.7	=	20.76	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.63	x	0.7	=	10.5	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.63	x	0.7	=	10.5	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.63	x	0.7	=	6.81	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.63	x	0.7	=	6.81	(81)

Solar gains in watts, calculated for each month

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

(83)m=	114.77	208.32	315.46	435.91	525.06	536.3	510.88	442.83	357.33	238.79	139.89	96.6	(83)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------	------

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

(84)m=	541.58	633.03	726.44	824.73	891.34	880.87	841.36	779.33	705.22	609.07	535.88	511.91	(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	0.73	0.52	0.38	0.43	0.69	0.94	0.99	1	(86)

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

(87)m=	20.15	20.31	20.55	20.81	20.96	21	21	21	20.98	20.77	20.41	20.12	(87)
--------	-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

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

(88)m=	20.16	20.16	20.16	20.17	20.17	20.18	20.18	20.18	20.18	20.17	20.17	20.17	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.96	0.86	0.67	0.46	0.31	0.35	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=	19.02	19.26	19.6	19.96	20.13	20.18	20.18	20.18	20.16	19.92	19.41	18.98	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.36 (91)

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

(92)m=	19.43	19.64	19.94	20.27	20.43	20.48	20.48	20.48	20.46	20.23	19.77	19.4	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	19.43	19.64	19.94	20.27	20.43	20.48	20.48	20.48	20.46	20.23	19.77	19.4	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.87	0.69	0.48	0.34	0.38	0.64	0.92	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

TER WorkSheet: New dwelling design stage

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

(95)m=	538.44	623.75	695.57	715.79	616.62	425.37	282.24	296.01	452.42	558.46	528.41	509.73	(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=	1136.33	1103.98	1004.28	839.08	642.87	427.81	282.44	296.44	464.9	708.56	937.02	1129.48	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	-------	--------	--------	---------	------

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

(98)m=	444.83	322.71	229.68	88.77	19.53	0	0	0	0	111.67	294.2	461.1	
--------	--------	--------	--------	-------	-------	---	---	---	---	--------	-------	-------	--

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1972.5 (98)

Space heating requirement in kWh/m²/year

23.92 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0 (201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1 (202)

Fraction of total heating from main system 1

(204) = (202) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

93.5 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	444.83	322.71	229.68	88.77	19.53	0	0	0	0	111.67	294.2	461.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	475.76	345.15	245.65	94.94	20.89	0	0	0	0	119.44	314.66	493.15	
Total (kWh/year) = Sum(211) _{1...5,10...12} =	2109.63 (211)												(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

199.54	175.85	184.63	165.43	162.07	144.73	138.93	152.55	152.31	171.55	181.49	194.71
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

79.8 (216)

(217)m=	86.89	86.41	85.4	83.24	80.83	79.8	79.8	79.8	79.8	83.7	86.1	87.04	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.64	203.5	216.2	198.75	200.51	181.37	174.1	191.16	190.87	204.95	210.8	223.72	
Total = Sum(219a) _{1...12} =	2425.57 (219)												(219)

Annual totals

Space heating fuel used, main system 1

2109.63 kWh/year

Water heating fuel used

2425.57 kWh/year

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

TER WorkSheet: New dwelling design stage

boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75	(231)
Electricity for lighting		357.71	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 455.68 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 523.92 (264)
Space and water heating	(261) + (262) + (263) + (264) =		979.6 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 185.65 (268)
Total CO2, kg/year		sum of (265)...(271) =	1204.18 (272)

TER = 14.6 (273)

DRAFT

Appendix B - Step Two – 'Be Lean' Output Document and Energy Report Figures

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 09:03:11 2016

Administrative information

Building Details

Address: Cafe/Restaurant, East Block, Kenavon Drive,
READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	95
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	95
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	86.5
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Cafe) - Eat & Drink_W_8
Floor	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Cafe) - Eat & Drink_G_9
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Main Multipoint BF

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.76	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
0 Ground (Cafe) - Eat & Drink	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - Food Prep	-	-	-	-	-	-	-	-	1	-	N/A
0 Ground (Cafe) - WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - Food Prep	YES
0 Ground (Cafe) - WC	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Cafe) - Eat & Drink	-	90	90	349

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
0 Ground (Cafe) - Food Prep		-	90	-	156
0 Ground (Cafe) - WC		-	90	-	27

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Cafe) - Eat & Drink	NO (-10.2%)	NO
0 Ground (Cafe) - Food Prep	N/A	N/A
0 Ground (Cafe) - WC	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	156.9	156.9
External area [m ²]	256.1	256.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	5
Average conductance [W/K]	127.39	104.3
Average U-value [W/m ² K]	0.5	0.41
Alpha value* [%]	17.23	17.31

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	83.69	76.62
Cooling	21.47	31.93
Auxiliary	22.79	14.1
Lighting	29.14	56.39
Hot water	140.19	123.41
Equipment*	126.49	126.49
TOTAL**	297.29	302.44

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	624.3	639.7
Primary energy* [kWh/m ²]	498.48	550.58
Total emissions [kg/m ²]	86.5	95

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	277.8	346.5	83.7	21.5	22.8	0.92	4.48	0.94	6
Notional	225.9	413.8	76.6	31.9	14.1	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Cafe) - Eat & Drink_W_8
Floor	0.2	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.15	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Cafe) - Eat & Drink_G_9
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 09:17:40 2016

Administrative information

Building Details

Address: Cafe, West Block, Kenavon Drive, READING,

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	95
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	95
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	86.4
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Cafe) - Eat & Drink_W_6
Floor	0.25	0.13	0.13	0 Ground (Cafe) - Food Prep_S_3
Roof	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Cafe) - Eat & Drink_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Main Multipoint BF

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.76	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
0 Ground (Cafe) - Food Prep		-	-	-	-	-	-	-	-	1	-	N/A
0 Ground (Cafe) - Eat & Drink		-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - WCs		-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Cafe) - Food Prep	YES
0 Ground (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - WCs	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
	Standard value	60	60	22
0 Ground (Cafe) - Food Prep	-	90	-	156

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
0 Ground (Cafe) - Eat & Drink		-	90	90	347
0 Ground (Cafe) - WCs		-	90	-	27

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Cafe) - Food Prep	N/A	N/A
0 Ground (Cafe) - Eat & Drink	NO (-7.7%)	NO
0 Ground (Cafe) - WCs	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	156.4	156.4
External area [m ²]	255.3	255.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	5
Average conductance [W/K]	127.13	103.95
Average U-value [W/m ² K]	0.5	0.41
Alpha value* [%]	17.23	17.31

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	82.37	75.62
Cooling	21.81	32.23
Auxiliary	22.86	14.14
Lighting	29.12	56.37
Hot water	140.14	123.36
Equipment*	126.52	126.52
TOTAL**	296.3	301.71

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	625.52	640.69
Primary energy* [kWh/m ²]	498.01	550.27
Total emissions [kg/m ²]	86.4	95

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	273.4	352.1	82.4	21.8	22.9	0.92	4.48	0.94	6
Notional	222.9	417.7	75.6	32.2	14.1	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Cafe) - Eat & Drink_W_6
Floor	0.2	0.13	0 Ground (Cafe) - Food Prep_S_3
Roof	0.15	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Cafe) - Eat & Drink_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)] * There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 11:08:32 2016

Administrative information

Building Details

Address: Cafe/Restaurant, Middle Block, Kenavon Drive,
READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	89.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	89.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	78.5
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	1 First (Cafe) - Eat & Drink_W_6
Floor	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.6	1.6	1 First (Cafe) - Eat & Drink_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- Gas-fired condensing water heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	0.015
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
1 First (Cafe) - Eat & Drink		-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - Eat & Drink		-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - Food Prep		-	-	-	-	-	-	-	-	1	-	N/A
0 Ground (Cafe) - WCs		-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
1 First (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - Food Prep	YES
0 Ground (Cafe) - WCs	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
1 First (Cafe) - Eat & Drink	-	90	90	810

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
0 Ground (Cafe) - Eat & Drink		-	90	90	649
0 Ground (Cafe) - Food Prep		-	90	-	572
0 Ground (Cafe) - WCs		-	90	-	69

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 First (Cafe) - Eat & Drink	NO (-55.3%)	NO
0 Ground (Cafe) - Eat & Drink	NO (-12.9%)	NO
0 Ground (Cafe) - Food Prep	N/A	N/A
0 Ground (Cafe) - WCs	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	657.8	657.8
External area [m ²]	641.5	641.5
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	3
Average conductance [W/K]	378.7	321.19
Average U-value [W/m ² K]	0.59	0.5
Alpha value* [%]	12.49	15.4

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	62.87	63.63
Cooling	18.08	31.87
Auxiliary	23.72	14.64
Lighting	27.84	50.42
Hot water	133.14	123.02
Equipment*	127.18	127.18
TOTAL**	265.66	283.58

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	500.56	600.6
Primary energy* [kWh/m ²]	452.96	517.82
Total emissions [kg/m ²]	78.5	89.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	208.7	291.9	62.9	18.1	23.7	0.92	4.48	0.94	6
Notional	187.6	413	63.6	31.9	14.6	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	1 First (Cafe) - Eat & Drink_W_6
Floor	0.2	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.6	1 First (Cafe) - Eat & Drink_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 10:34:59 2016

Administrative information

Building Details

Address: Nursery, Middle Block, Kenavon Drive,
READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	16.6
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	16.6
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	16.2
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Nursery) - Teaching_W_9
Floor	0.25	0.13	0.13	0 Ground (Nursery) - Teaching_S_3
Roof	0.25	0.13	0.13	0 Ground (Nursery) - Teaching_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Nursery) - Teaching_G_10
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW instantaneous electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
0 Ground (Nursery) - Teaching	-	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Nursery) - WCs	-	-	0.5	-	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Nursery) - Teaching	YES
0 Ground (Nursery) - WCs	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Nursery) - Teaching	90	-	-	1287
0 Ground (Nursery) - WCs	-	90	-	48

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Nursery) - Teaching	NO (-39.7%)	NO
0 Ground (Nursery) - WCs	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	280.4	280.4
External area [m ²]	572.7	572.7
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	3
Average conductance [W/K]	165.21	256.35
Average U-value [W/m ² K]	0.29	0.45
Alpha value* [%]	19.19	15.99

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
100	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.92	19.33
Cooling	5.28	6.61
Auxiliary	0.54	0.65
Lighting	7.28	8.1
Hot water	12.72	14.72
Equipment*	14.09	14.09
TOTAL**	38.74	49.41

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	128.13	142.72
Primary energy* [kWh/m ²]	95.04	85.74
Total emissions [kg/m ²]	16.2	16.6

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	42.9	85.2	12.9	5.3	0.5	0.92	4.48	0.94	6
Notional	57	85.7	19.3	6.6	0.6	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Nursery) - Teaching_W_9
Floor	0.2	0.13	0 Ground (Nursery) - Teaching_S_3
Roof	0.15	0.13	0 Ground (Nursery) - Teaching_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Nursery) - Teaching_G_10
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 09:24:09 2016

Administrative information

Building Details

Address: Retail, West Block, Kenavon Drive, READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	40.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	40.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	29.1
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Retail) - Sales_W_10
Floor	0.25	0.13	0.13	0 Ground (Retail) - Sales_S_3
Roof	0.25	0.13	0.13	0 Ground (Retail) - Sales_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Retail) - Sales_G_11
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating by boiler and cooling by split units

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- DHW instantaneous electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
0 Ground (Retail) - Sales	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Retail) - WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Retail) - Sales	YES
0 Ground (Retail) - WC	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Retail) - Sales	-	90	90	3979
0 Ground (Retail) - WC	-	90	-	36

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Retail) - Sales	NO (-6.8%)	NO
0 Ground (Retail) - WC	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	406.9	406.9
External area [m ²]	640.3	640.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	3
Average conductance [W/K]	189.59	261.69
Average U-value [W/m ² K]	0.3	0.41
Alpha value* [%]	14.67	13.12

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	10.73	13.64
Cooling	11.91	17.05
Auxiliary	0.17	0.2
Lighting	37.87	56.3
Hot water	1.68	1.94
Equipment*	20.25	20.25
TOTAL**	62.35	89.13

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	227.88	261.16
Primary energy* [kWh/m ²]	171.58	238.93
Total emissions [kg/m ²]	29.1	40.8

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	35.6	192.3	10.7	11.9	0.2	0.92	4.48	0.94	6
Notional	40.2	221	13.6	17	0.2	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Retail) - Sales_W_10
Floor	0.2	0.13	0 Ground (Retail) - Sales_S_3
Roof	0.15	0.13	0 Ground (Retail) - Sales_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Retail) - Sales_G_11
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 1

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour		
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)		
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)		
Number of intermittent fans							0	x 10 =	0 (7a)		
Number of passive vents							0	x 10 =	0 (7b)		
Number of flueless gas fires							0	x 40 =	0 (7c)		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)											
Number of storeys in the dwelling (ns)									0 (9)		
Additional infiltration								[(9)-1]x0.1 =	0 (10)		
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction									0 (11)		
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35											
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0									0 (12)		
If no draught lobby, enter 0.05, else enter 0									0 (13)		
Percentage of windows and doors draught stripped									0 (14)		
Window infiltration							0.25 - [0.2 x (14) ÷ 100] =		0 (15)		
Infiltration rate							(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)		
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area									3 (17)		
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)									0.15 (18)		
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used											
Number of sides sheltered									3 (19)		
Shelter factor							(20) = 1 - [0.075 x (19)] =		0.78 (20)		
Infiltration rate incorporating shelter factor							(21) = (18) x (20) =		0.12 (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

	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

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=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(24c)

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1.5	3.225		(26)
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		(27)
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Floor			43.96	0.1	4.396		(28)
Walls	65.46	10.73	54.73	0.17	9.3		(29)
Total area of elements, m²			109.42				(31)
Party wall			65.46	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) =

28.3 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

Indicative Value: Medium

250 (35)

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

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

5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

33.3 (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=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (38)

Heat transfer coefficient, W/K

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

(39)m=

68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (39)

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

68.84

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
------	------	------	------	------	------	------	------	------	------	------	------

 (40)

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

0.78

Number of days in month (Table 1a)

(41)m=

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

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.6

(42)

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

95.86

(43)

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

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44

 (44)

Total = Sum(44)_{1...12} = 1150.31

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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

 (45)

Total = Sum(45)_{1...12} = 1508.23

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

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

(50)

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

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

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

(54)

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

1.03

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

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

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

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=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
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(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

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

(63)

Output from water heater

(64)m=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2159.07

(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=	96.22	85.42	91.15	83.71	83.48	76.67	75.61	80.24	79.24	86.7	89.16	94.57
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(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=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

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

(67)m=	24.26	21.55	17.53	13.27	9.92	8.37	9.05	11.76	15.79	20.04	23.39	24.94
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	129.32	127.11	122.51	116.26	112.2	106.48	101.63	107.85	110.06	116.53	123.84	127.12
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	450.73	448.24	433.47	409.86	385.93	363.13	348.57	355.07	367.46	391.28	418.46	438.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Southwest0.9x	0.77	4.12	36.79	0.45	0.71	33.56	(79)
Southwest0.9x	0.77	2.23	36.79	0.45	0.71	18.17	(79)

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Southwest0.9x	0.77	x	2.23	x	36.79	0.45	x	0.71	=	18.17	(79)
Southwest0.9x	0.77	x	4.12	x	62.67	0.45	x	0.71	=	57.17	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.45	x	0.71	=	30.95	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.45	x	0.71	=	30.95	(79)
Southwest0.9x	0.77	x	4.12	x	85.75	0.45	x	0.71	=	78.23	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.45	x	0.71	=	42.34	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.45	x	0.71	=	42.34	(79)
Southwest0.9x	0.77	x	4.12	x	106.25	0.45	x	0.71	=	96.93	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.45	x	0.71	=	52.46	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.45	x	0.71	=	52.46	(79)
Southwest0.9x	0.77	x	4.12	x	119.01	0.45	x	0.71	=	108.56	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.45	x	0.71	=	58.76	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.45	x	0.71	=	58.76	(79)
Southwest0.9x	0.77	x	4.12	x	118.15	0.45	x	0.71	=	107.78	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.45	x	0.71	=	58.34	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.45	x	0.71	=	58.34	(79)
Southwest0.9x	0.77	x	4.12	x	113.91	0.45	x	0.71	=	103.91	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.45	x	0.71	=	56.24	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.45	x	0.71	=	56.24	(79)
Southwest0.9x	0.77	x	4.12	x	104.39	0.45	x	0.71	=	95.23	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.45	x	0.71	=	51.54	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.45	x	0.71	=	51.54	(79)
Southwest0.9x	0.77	x	4.12	x	92.85	0.45	x	0.71	=	84.7	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.45	x	0.71	=	45.85	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.45	x	0.71	=	45.85	(79)
Southwest0.9x	0.77	x	4.12	x	69.27	0.45	x	0.71	=	63.19	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.45	x	0.71	=	34.2	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.45	x	0.71	=	34.2	(79)
Southwest0.9x	0.77	x	4.12	x	44.07	0.45	x	0.71	=	40.2	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.45	x	0.71	=	21.76	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.45	x	0.71	=	21.76	(79)
Southwest0.9x	0.77	x	4.12	x	31.49	0.45	x	0.71	=	28.72	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.45	x	0.71	=	15.55	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.45	x	0.71	=	15.55	(79)

Solar gains in watts, calculated for each month

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

(83)m= 69.9 119.06 162.91 201.85 226.09 224.45 216.4 198.31 176.39 131.59 83.72 59.82 (83)

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

(84)m= 520.63 567.3 596.37 611.71 612.02 587.59 564.97 553.38 543.85 522.87 502.18 498.64 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(86)m=	1	1	0.99	0.97	0.89	0.72	0.53	0.57	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=	20.28	20.38	20.53	20.72	20.89	20.98	21	21	20.96	20.76	20.48	20.25	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.95	0.86	0.65	0.45	0.48	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=	19.3	19.44	19.66	19.93	20.16	20.25	20.27	20.27	20.24	19.99	19.58	19.25	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
---------------------------	------	------

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

(92)m=	19.64	19.77	19.97	20.21	20.42	20.51	20.53	20.53	20.49	20.26	19.9	19.6	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------

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

(93)m=	19.64	19.77	19.97	20.21	20.42	20.51	20.53	20.53	20.49	20.26	19.9	19.6	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.86	0.67	0.48	0.51	0.77	0.95	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	518.63	562.99	586	582.72	529.38	396.58	269.46	282.66	416.16	497.97	497.7	497.2	(95)
--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1056.36	1023.88	927.45	778.9	600.25	407.04	270.33	284.05	440.07	665.11	881.25	1060.33	(97)
--------	---------	---------	--------	-------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	400.07	309.71	254.04	141.25	52.73	0	0	0	0	124.36	276.15	418.97	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1977.28	(98)
---	---------	------

Space heating requirement in kWh/m²/year

22.49	(99)
-------	------

9b. Energy requirements – Community heating scheme

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

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

0	(301)
---	-------

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

1	(302)
---	-------

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

Fraction of heat from Community boilers

1	(303a)
---	--------

Fraction of total space heat from Community boilers

(302) × (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

Annual space heating requirement

kWh/year
1977.28

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =		2076.15	(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			2159.07	
If DHW from community scheme:				
Water heat from Community boilers	(64) x (303a) x (305) x (306) =		2267.03	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =		43.43	(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			105.91	(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) =		105.91	(331)
Energy for lighting (calculated in Appendix L)			428.52	(332)
12b. CO2 Emissions – Community heating scheme				
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		98.6	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0	=	951.45 (367)
Electrical energy for heat distribution	[(313) x	0.52	=	22.54 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		=	973.99 (373)
CO2 associated with space heating (secondary)	(309) x	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			973.99 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	54.96 (378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	222.4 (379)
Total CO2, kg/year	sum of (376)...(382) =			1251.35 (383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.23 (384)
EI rating (section 14)				87.38 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 1

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour		
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)		
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)		
Number of intermittent fans							0	x 10 =	0 (7a)		
Number of passive vents							0	x 10 =	0 (7b)		
Number of flueless gas fires							0	x 40 =	0 (7c)		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)											
Number of storeys in the dwelling (ns)											0 (9)
Additional infiltration										[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction											0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35											
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0											0 (12)
If no draught lobby, enter 0.05, else enter 0											0 (13)
Percentage of windows and doors draught stripped											0 (14)
Window infiltration										0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate										(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area											3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)											0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used											
Number of sides sheltered											3 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor										(21) = (18) x (20) =	0.12 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m=	0.27	0.27	0.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26
---------	------	------	------	------	------	------	------	------	------	------	------	------

(24a)

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

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

(24b)

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

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

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

(24c)

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

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

(25)m=	0.27	0.27	0.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26
--------	------	------	------	------	------	------	------	------	------	------	------	------

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1.5	3.225		(26)
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		(27)
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Floor			43.96	0.1	4.396		(28)
Walls	65.46	10.73	54.73	0.17	9.3		(29)
Total area of elements, m²			109.42				(31)
Party wall			65.46	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 28.3 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 33.3 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m x (5)

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

19.19	18.98	18.78	17.74	17.54	16.5	16.5	16.3	16.92	17.54	17.95	18.36
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 (38)

Heat transfer coefficient, W/K

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

(39)m=

52.49	52.28	52.08	51.04	50.84	49.81	49.81	49.6	50.22	50.84	51.25	51.66
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

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

50.99

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.6	0.59	0.59	0.58	0.58	0.57	0.57	0.56	0.57	0.58	0.58	0.59
-----	------	------	------	------	------	------	------	------	------	------	------

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

0.58

 (40)

Number of days in month (Table 1a)

(41)m=

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

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

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

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44

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

1150.31

 (44)

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

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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

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

1508.23

 (45)

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

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

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

0

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

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

Water storage loss:

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

0

Temperature factor from Table 2b

0

Energy lost from water storage, kWh/year

(48) x (49) =

110

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

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

0.02

If community heating see section 4.3

Volume factor from Table 2a

1.03

Temperature factor from Table 2b

0.6

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

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

1.03

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

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

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
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 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(61)

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

(62)m=

211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=

211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2159.07

(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=

96.22	85.42	91.15	83.71	83.48	76.67	75.61	80.24	79.24	86.7	89.16	94.57
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

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

(67)m=

24.26	21.55	17.53	13.27	9.92	8.37	9.05	11.76	15.79	20.04	23.39	24.94
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

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

(68)m=

235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

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

(69)m=

35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=

129.32	127.11	122.51	116.26	112.2	106.48	101.63	107.85	110.06	116.53	123.84	127.12
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

450.73	448.24	433.47	409.86	385.93	363.13	348.57	355.07	367.46	391.28	418.46	438.82
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(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.12</td></tr></table>	4.12	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.45</td></tr></table>	0.45	x	<table><tr><td>0.71</td></tr></table>	0.71	=	<table><tr><td>33.56</td></tr></table>	33.56	(79)
0.77																		
4.12																		
36.79																		
0.45																		
0.71																		
33.56																		
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.23</td></tr></table>	2.23	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.45</td></tr></table>	0.45	x	<table><tr><td>0.71</td></tr></table>	0.71	=	<table><tr><td>18.17</td></tr></table>	18.17	(79)
0.77																		
2.23																		
36.79																		
0.45																		
0.71																		
18.17																		

DER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	2.23	x	36.79	0.45	x	0.71	=	18.17	(79)
Southwest0.9x	0.77	x	4.12	x	62.67	0.45	x	0.71	=	57.17	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.45	x	0.71	=	30.95	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.45	x	0.71	=	30.95	(79)
Southwest0.9x	0.77	x	4.12	x	85.75	0.45	x	0.71	=	78.23	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.45	x	0.71	=	42.34	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.45	x	0.71	=	42.34	(79)
Southwest0.9x	0.77	x	4.12	x	106.25	0.45	x	0.71	=	96.93	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.45	x	0.71	=	52.46	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.45	x	0.71	=	52.46	(79)
Southwest0.9x	0.77	x	4.12	x	119.01	0.45	x	0.71	=	108.56	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.45	x	0.71	=	58.76	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.45	x	0.71	=	58.76	(79)
Southwest0.9x	0.77	x	4.12	x	118.15	0.45	x	0.71	=	107.78	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.45	x	0.71	=	58.34	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.45	x	0.71	=	58.34	(79)
Southwest0.9x	0.77	x	4.12	x	113.91	0.45	x	0.71	=	103.91	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.45	x	0.71	=	56.24	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.45	x	0.71	=	56.24	(79)
Southwest0.9x	0.77	x	4.12	x	104.39	0.45	x	0.71	=	95.23	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.45	x	0.71	=	51.54	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.45	x	0.71	=	51.54	(79)
Southwest0.9x	0.77	x	4.12	x	92.85	0.45	x	0.71	=	84.7	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.45	x	0.71	=	45.85	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.45	x	0.71	=	45.85	(79)
Southwest0.9x	0.77	x	4.12	x	69.27	0.45	x	0.71	=	63.19	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.45	x	0.71	=	34.2	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.45	x	0.71	=	34.2	(79)
Southwest0.9x	0.77	x	4.12	x	44.07	0.45	x	0.71	=	40.2	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.45	x	0.71	=	21.76	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.45	x	0.71	=	21.76	(79)
Southwest0.9x	0.77	x	4.12	x	31.49	0.45	x	0.71	=	28.72	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.45	x	0.71	=	15.55	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.45	x	0.71	=	15.55	(79)

Solar gains in watts, calculated for each month

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

(83)m= 69.9 119.06 162.91 201.85 226.09 224.45 216.4 198.31 176.39 131.59 83.72 59.82 (83)

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

(84)m= 520.63 567.3 596.37 611.71 612.02 587.59 564.97 553.38 543.85 522.87 502.18 498.64 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(86)m=	1	0.99	0.97	0.9	0.75	0.54	0.39	0.41	0.63	0.9	0.99	1	(86)
--------	---	------	------	-----	------	------	------	------	------	-----	------	---	------

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

(87)m=	20.57	20.67	20.79	20.92	20.99	21	21	21	21	20.93	20.74	20.56	(87)
--------	-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.43	20.43	20.44	20.45	20.45	20.46	20.46	20.46	20.46	20.45	20.45	20.44	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.88	0.72	0.5	0.34	0.36	0.59	0.88	0.98	1	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.86	20	20.17	20.36	20.44	20.46	20.46	20.46	20.45	20.38	20.11	19.84	(90)
--------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.11	20.23	20.39	20.56	20.63	20.65	20.65	20.65	20.65	20.58	20.34	20.1	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.11	20.23	20.39	20.56	20.63	20.65	20.65	20.65	20.65	20.58	20.34	20.1	(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	0.99	0.96	0.89	0.73	0.51	0.36	0.38	0.6	0.89	0.98	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	517.32	559.08	573.93	542.59	445.71	301.08	201.8	210.94	327.45	463.14	492.85	496.29	(95)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m × [(93)m – (96)m]

(97)m=	830.09	801.73	723.49	595.21	454.1	301.4	201.81	210.96	328.79	507.15	678.38	821.37	(97)
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	232.7	163.06	111.28	37.89	6.25	0	0	0	0	32.74	133.58	241.86	(98)
--------	-------	--------	--------	-------	------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	959.35	(99)
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Space heating requirement in kWh/m²/year

10.91	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
---	-------

Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)
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Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)
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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)
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Space heating

Annual space heating requirement

kWh/year	
959.35	

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Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	1007.31	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2159.07	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2267.03	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	32.74	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		200.38	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	200.38	(331)
Energy for lighting (calculated in Appendix L)		428.52	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		98.6 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	717.3 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	16.99 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		734.29 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		734.29 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	104 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	222.4 (379)
Total CO2, kg/year	sum of (376)...(382) =		1060.69 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		12.06 (384)
EI rating (section 14)			89.31 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 2

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour		
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)		
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)		
Number of intermittent fans							0	x 10 =	0 (7a)		
Number of passive vents							0	x 10 =	0 (7b)		
Number of flueless gas fires							0	x 40 =	0 (7c)		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)											
Number of storeys in the dwelling (ns)									0 (9)		
Additional infiltration								[(9)-1]x0.1 =	0 (10)		
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction									0 (11)		
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35											
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0									0 (12)		
If no draught lobby, enter 0.05, else enter 0									0 (13)		
Percentage of windows and doors draught stripped									0 (14)		
Window infiltration							0.25 - [0.2 x (14) ÷ 100] =		0 (15)		
Infiltration rate							(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)		
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area									3 (17)		
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)									0.15 (18)		
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used											
Number of sides sheltered									3 (19)		
Shelter factor							(20) = 1 - [0.075 x (19)] =		0.78 (20)		
Infiltration rate incorporating shelter factor							(21) = (18) x (20) =		0.12 (21)		

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

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=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1.5	3.225		
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		
Floor			43.96	0.1	4.396		
Walls	28.71	10.73	17.98	0.17	3.06		
Total area of elements, m²			72.67				
Party wall			102.21	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 22.05 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 25.55 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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DER WorkSheet: New dwelling design stage

(38)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
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 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

61.09	61.09	61.09	61.09	61.09	61.09	61.09	61.09	61.09	61.09	61.09	61.09
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Average = Sum(39)_{1...12} /12=

61.09 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} /12=

0.69 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.6

(42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.86

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44

Total = Sum(44)_{1...12} = 1150.31 (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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} = 1508.23 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2159.07

(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=	96.22	85.42	91.15	83.71	83.48	76.67	75.61	80.24	79.24	86.7	89.16	94.57
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(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=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.26	21.55	17.53	13.27	9.92	8.37	9.05	11.76	15.79	20.04	23.39	24.94
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	129.32	127.11	122.51	116.26	112.2	106.48	101.63	107.85	110.06	116.53	123.84	127.12
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	450.73	448.24	433.47	409.86	385.93	363.13	348.57	355.07	367.46	391.28	418.46	438.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Northwest 0.9x	0.77	4.12	11.28	0.45	0.71	10.29	(81)
Northwest 0.9x	0.77	2.23	11.28	0.45	0.71	5.57	(81)

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Northwest 0.9x	0.77	x	2.23	x	11.28	x	0.45	x	0.71	=	5.57	(81)
Northwest 0.9x	0.77	x	4.12	x	22.97	x	0.45	x	0.71	=	20.95	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.45	x	0.71	=	11.34	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.45	x	0.71	=	11.34	(81)
Northwest 0.9x	0.77	x	4.12	x	41.38	x	0.45	x	0.71	=	37.75	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.45	x	0.71	=	20.43	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.45	x	0.71	=	20.43	(81)
Northwest 0.9x	0.77	x	4.12	x	67.96	x	0.45	x	0.71	=	61.99	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.45	x	0.71	=	33.55	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.45	x	0.71	=	33.55	(81)
Northwest 0.9x	0.77	x	4.12	x	91.35	x	0.45	x	0.71	=	83.33	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.45	x	0.71	=	45.1	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.45	x	0.71	=	45.1	(81)
Northwest 0.9x	0.77	x	4.12	x	97.38	x	0.45	x	0.71	=	88.84	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.45	x	0.71	=	48.08	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.45	x	0.71	=	48.08	(81)
Northwest 0.9x	0.77	x	4.12	x	91.1	x	0.45	x	0.71	=	83.1	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.45	x	0.71	=	44.98	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.45	x	0.71	=	44.98	(81)
Northwest 0.9x	0.77	x	4.12	x	72.63	x	0.45	x	0.71	=	66.25	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.45	x	0.71	=	35.86	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.45	x	0.71	=	35.86	(81)
Northwest 0.9x	0.77	x	4.12	x	50.42	x	0.45	x	0.71	=	45.99	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.45	x	0.71	=	24.9	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.45	x	0.71	=	24.9	(81)
Northwest 0.9x	0.77	x	4.12	x	28.07	x	0.45	x	0.71	=	25.6	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.45	x	0.71	=	13.86	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.45	x	0.71	=	13.86	(81)
Northwest 0.9x	0.77	x	4.12	x	14.2	x	0.45	x	0.71	=	12.95	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.45	x	0.71	=	7.01	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.45	x	0.71	=	7.01	(81)
Northwest 0.9x	0.77	x	4.12	x	9.21	x	0.45	x	0.71	=	8.41	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.45	x	0.71	=	4.55	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.45	x	0.71	=	4.55	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 21.43 43.63 78.61 129.1 173.53 185 173.07 137.97 95.79 53.32 26.97 17.5 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 472.16 491.87 512.08 538.96 559.46 548.14 521.64 493.04 463.24 444.6 445.43 456.32 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(86)m=	1	1	0.99	0.97	0.89	0.7	0.51	0.57	0.84	0.98	1	1	(86)
--------	---	---	------	------	------	-----	------	------	------	------	---	---	------

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.36	20.43	20.56	20.75	20.92	20.99	21	21	20.96	20.77	20.53	20.34	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.35	20.35	20.35	20.35	20.35	20.35	20.35	20.35	20.35	20.35	20.35	20.35	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.86	0.63	0.44	0.49	0.78	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.48	19.57	19.77	20.04	20.26	20.34	20.34	20.34	20.31	20.07	19.72	19.44	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.79	19.88	20.05	20.29	20.5	20.57	20.58	20.58	20.54	20.32	20.01	19.76	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.79	19.88	20.05	20.29	20.5	20.57	20.58	20.58	20.54	20.32	20.01	19.76	(93)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.96	0.87	0.66	0.47	0.52	0.8	0.97	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	471.01	489.9	507.07	519.72	484.48	359.17	242.62	254.38	371.2	431.32	442.98	455.46	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m × [(93)m – (96)m]

(97)m=	946.42	914.92	827.84	696.02	537.39	364.71	243	255.18	393.68	593.54	788.6	950.52	(97)
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	-------	--------	------

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	353.71	285.61	238.65	126.93	39.36	0	0	0	0	120.69	248.85	368.32	
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1782.12	(98)
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Space heating requirement in kWh/m²/year

20.27	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
---	-------

Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)
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Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)
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Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
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Distribution loss factor (Table 12c) for community heating system

1.05	(306)
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Space heating

Annual space heating requirement

kWh/year	
1782.12	

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Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	1871.23	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2159.07	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2267.03	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	41.38	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		105.91	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	105.91	(331)
Energy for lighting (calculated in Appendix L)		428.52	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		98.6 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	906.55 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	21.48 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		928.03 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		928.03 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	54.96 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	222.4 (379)
Total CO2, kg/year	$\text{sum of } (376)...(382) =$		1205.4 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		13.71 (384)
El rating (section 14)			87.85 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 2

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour		
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)		
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)		
Number of intermittent fans							0	x 10 =	0 (7a)		
Number of passive vents							0	x 10 =	0 (7b)		
Number of flueless gas fires							0	x 40 =	0 (7c)		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)											
Number of storeys in the dwelling (ns)											0 (9)
Additional infiltration										[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction											0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35											
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0											0 (12)
If no draught lobby, enter 0.05, else enter 0											0 (13)
Percentage of windows and doors draught stripped											0 (14)
Window infiltration										0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate										(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area											3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)											0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used											
Number of sides sheltered											3 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor										(21) = (18) x (20) =	0.12 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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

	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.27	0.27	0.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26
---------	------	------	------	------	------	------	------	------	------	------	------	------

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.27	0.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26
--------	------	------	------	------	------	------	------	------	------	------	------	------

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1.5	3.225		(26)
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		(27)
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Floor			43.96	0.1	4.396		(28)
Walls	28.71	10.73	17.98	0.17	3.06		(29)
Total area of elements, m²			72.67				(31)
Party wall			102.21	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

22.05 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

Indicative Value: Medium

250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

3.5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

25.55 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DER WorkSheet: New dwelling design stage

(38)m=

19.19	18.98	18.78	17.74	17.54	16.5	16.5	16.3	16.92	17.54	17.95	18.36
-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

44.74	44.54	44.33	43.3	43.09	42.06	42.06	41.85	42.47	43.09	43.5	43.92
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------

Average = Sum(39)_{1...12} /12=

43.25 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.51	0.51	0.5	0.49	0.49	0.48	0.48	0.48	0.48	0.49	0.49	0.5
------	------	-----	------	------	------	------	------	------	------	------	-----

Average = Sum(40)_{1...12} /12=

0.49 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.6 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Total = Sum(44)_{1...12} =

1150.31 (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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1508.23 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

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=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2159.07

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=	96.22	85.42	91.15	83.71	83.48	76.67	75.61	80.24	79.24	86.7	89.16	94.57
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(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=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.26	21.55	17.53	13.27	9.92	8.37	9.05	11.76	15.79	20.04	23.39	24.94
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	129.32	127.11	122.51	116.26	112.2	106.48	101.63	107.85	110.06	116.53	123.84	127.12
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	450.73	448.24	433.47	409.86	385.93	363.13	348.57	355.07	367.46	391.28	418.46	438.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Northwest 0.9x	0.77	4.12	11.28	0.45	0.71	10.29	(81)
Northwest 0.9x	0.77	2.23	11.28	0.45	0.71	5.57	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.23	x	11.28	x	0.45	x	0.71	=	5.57	(81)
Northwest 0.9x	0.77	x	4.12	x	22.97	x	0.45	x	0.71	=	20.95	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.45	x	0.71	=	11.34	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.45	x	0.71	=	11.34	(81)
Northwest 0.9x	0.77	x	4.12	x	41.38	x	0.45	x	0.71	=	37.75	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.45	x	0.71	=	20.43	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.45	x	0.71	=	20.43	(81)
Northwest 0.9x	0.77	x	4.12	x	67.96	x	0.45	x	0.71	=	61.99	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.45	x	0.71	=	33.55	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.45	x	0.71	=	33.55	(81)
Northwest 0.9x	0.77	x	4.12	x	91.35	x	0.45	x	0.71	=	83.33	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.45	x	0.71	=	45.1	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.45	x	0.71	=	45.1	(81)
Northwest 0.9x	0.77	x	4.12	x	97.38	x	0.45	x	0.71	=	88.84	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.45	x	0.71	=	48.08	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.45	x	0.71	=	48.08	(81)
Northwest 0.9x	0.77	x	4.12	x	91.1	x	0.45	x	0.71	=	83.1	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.45	x	0.71	=	44.98	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.45	x	0.71	=	44.98	(81)
Northwest 0.9x	0.77	x	4.12	x	72.63	x	0.45	x	0.71	=	66.25	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.45	x	0.71	=	35.86	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.45	x	0.71	=	35.86	(81)
Northwest 0.9x	0.77	x	4.12	x	50.42	x	0.45	x	0.71	=	45.99	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.45	x	0.71	=	24.9	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.45	x	0.71	=	24.9	(81)
Northwest 0.9x	0.77	x	4.12	x	28.07	x	0.45	x	0.71	=	25.6	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.45	x	0.71	=	13.86	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.45	x	0.71	=	13.86	(81)
Northwest 0.9x	0.77	x	4.12	x	14.2	x	0.45	x	0.71	=	12.95	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.45	x	0.71	=	7.01	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.45	x	0.71	=	7.01	(81)
Northwest 0.9x	0.77	x	4.12	x	9.21	x	0.45	x	0.71	=	8.41	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.45	x	0.71	=	4.55	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.45	x	0.71	=	4.55	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 21.43 43.63 78.61 129.1 173.53 185 173.07 137.97 95.79 53.32 26.97 17.5 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 472.16 491.87 512.08 538.96 559.46 548.14 521.64 493.04 463.24 444.6 445.43 456.32 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DER WorkSheet: New dwelling design stage

(86)m=	1	0.99	0.98	0.9	0.71	0.49	0.35	0.39	0.63	0.92	0.99	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.67	20.72	20.83	20.95	21	21	21	21	21	20.95	20.8	20.66	(87)
--------	-------	-------	-------	-------	----	----	----	----	----	-------	------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.51	20.51	20.52	20.53	20.53	20.54	20.54	20.54	20.54	20.53	20.53	20.52	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.46	0.32	0.35	0.59	0.89	0.98	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.06	20.15	20.3	20.47	20.53	20.54	20.54	20.54	20.54	20.48	20.27	20.06	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.28	20.35	20.49	20.64	20.69	20.7	20.7	20.71	20.7	20.64	20.46	20.27	(92)
--------	-------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.28	20.35	20.49	20.64	20.69	20.7	20.7	20.71	20.7	20.64	20.46	20.27	(93)
--------	-------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.88	0.69	0.47	0.33	0.37	0.6	0.9	0.98	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	469.7	487.1	497.66	476.12	384.9	256.67	172.6	180.18	279.78	400.09	438.46	454.48	(95)
--------	-------	-------	--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m × [(93)m – (96)m]

(97)m=	714.79	688.16	620.02	508.48	387.51	256.71	172.6	180.18	280.32	432.83	581.08	705.74	(97)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	182.34	135.11	91.04	23.3	1.94	0	0	0	0	24.36	102.68	186.94	
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	747.71	(98)
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Space heating requirement in kWh/m²/year

8.5	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
---	-------

Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)
---	--------

Fraction of total space heat from Community boilers

(302) × (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

Annual space heating requirement

kWh/year	
747.71	

DER WorkSheet: New dwelling design stage

Space heat from Community boilers	$(98) \times (304a) \times (305) \times (306) =$	785.09	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2159.07	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2267.03	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	30.52	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		200.38	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	200.38	(331)
Energy for lighting (calculated in Appendix L)		428.52	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	98.6	(367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	668.62 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	15.84 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		684.46 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		684.46 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	104 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	222.4 (379)
Total CO2, kg/year	sum of (376)...(382) =		1010.86 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		11.5 (384)
El rating (section 14)			89.81 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 3

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a)	2.4 (2a)	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.18 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
--	-------

Additional infiltration	0 (10)
-------------------------	--------

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
--	--------

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
---	--------

If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
--	--------

Window infiltration	0 (15)
---------------------	--------

Infiltration rate	0 (16)
-------------------	--------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (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	3 (19)
---------------------------	--------

Shelter factor	0.78 (20)
----------------	-----------

Infiltration rate incorporating shelter factor	0.25 (21)
--	-----------

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.32	0.32	0.31	0.28	0.27	0.24	0.24	0.23	0.25	0.27	0.28	0.3
------	------	------	------	------	------	------	------	------	------	------	-----

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.55 0.55 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.54 0.54 0.54 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.55 0.55 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.54 0.54 0.54 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Windows Type 4			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Walls	40.7	11.45	29.25	x 0.17 =	4.97		(29)
Total area of elements, m²			40.7				(31)
Party wall			32.57	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 20.15 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 22.15 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	31.02	30.91	30.79	30.27	30.17	29.72	29.72	29.64	29.9	30.17	30.37	30.58

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	53.17	53.06	52.95	52.43	52.33	51.87	51.87	51.79	52.05	52.33	52.53	52.73
Average = Sum(39) _{1...12} /12=												52.43 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.75	0.75	0.75	0.74	0.74	0.73	0.73	0.73	0.73	0.74	0.74	0.74		
Average = Sum(40) _{1...12} /12=													0.74	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.27

(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

88.09

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
Total = Sum(44) _{1...12} =													1057.12	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
Total = Sum(45) _{1...12} =													1386.06	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	
Output from water heater (annual) _{1...12}												2036.9	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92	81.73	87.35	80.39	80.3	73.92	73.07	77.32	76.29	83.26	85.41	90.5	(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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.48	16.41	13.35	10.1	7.55	6.38	6.89	8.96	12.02	15.26	17.81	18.99	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	123.66	121.63	117.4	111.65	107.92	102.67	98.21	103.93	105.96	111.91	118.62	121.63	(72)
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.7	396.67	384.16	364.07	343.77	324.16	311.41	317.12	327.44	347.73	371.02	388.39	(73)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)

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Southeast	0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast	0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast	0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast	0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast	0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast	0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast	0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southwest	0.9x	0.77	x	2.38	x	36.79		0.45	x	0.71	=	19.39	(79)
Southwest	0.9x	0.77	x	2.42	x	36.79		0.45	x	0.71	=	19.71	(79)
Southwest	0.9x	0.77	x	4.27	x	36.79		0.45	x	0.71	=	34.79	(79)
Southwest	0.9x	0.77	x	2.38	x	62.67		0.45	x	0.71	=	33.03	(79)
Southwest	0.9x	0.77	x	2.42	x	62.67		0.45	x	0.71	=	33.58	(79)
Southwest	0.9x	0.77	x	4.27	x	62.67		0.45	x	0.71	=	59.25	(79)
Southwest	0.9x	0.77	x	2.38	x	85.75		0.45	x	0.71	=	45.19	(79)
Southwest	0.9x	0.77	x	2.42	x	85.75		0.45	x	0.71	=	45.95	(79)
Southwest	0.9x	0.77	x	4.27	x	85.75		0.45	x	0.71	=	81.07	(79)
Southwest	0.9x	0.77	x	2.38	x	106.25		0.45	x	0.71	=	55.99	(79)
Southwest	0.9x	0.77	x	2.42	x	106.25		0.45	x	0.71	=	56.93	(79)
Southwest	0.9x	0.77	x	4.27	x	106.25		0.45	x	0.71	=	100.45	(79)
Southwest	0.9x	0.77	x	2.38	x	119.01		0.45	x	0.71	=	62.71	(79)
Southwest	0.9x	0.77	x	2.42	x	119.01		0.45	x	0.71	=	63.77	(79)
Southwest	0.9x	0.77	x	4.27	x	119.01		0.45	x	0.71	=	112.52	(79)
Southwest	0.9x	0.77	x	2.38	x	118.15		0.45	x	0.71	=	62.26	(79)
Southwest	0.9x	0.77	x	2.42	x	118.15		0.45	x	0.71	=	63.31	(79)
Southwest	0.9x	0.77	x	4.27	x	118.15		0.45	x	0.71	=	111.7	(79)
Southwest	0.9x	0.77	x	2.38	x	113.91		0.45	x	0.71	=	60.03	(79)
Southwest	0.9x	0.77	x	2.42	x	113.91		0.45	x	0.71	=	61.03	(79)
Southwest	0.9x	0.77	x	4.27	x	113.91		0.45	x	0.71	=	107.69	(79)
Southwest	0.9x	0.77	x	2.38	x	104.39		0.45	x	0.71	=	55.01	(79)
Southwest	0.9x	0.77	x	2.42	x	104.39		0.45	x	0.71	=	55.93	(79)
Southwest	0.9x	0.77	x	4.27	x	104.39		0.45	x	0.71	=	98.69	(79)
Southwest	0.9x	0.77	x	2.38	x	92.85		0.45	x	0.71	=	48.93	(79)
Southwest	0.9x	0.77	x	2.42	x	92.85		0.45	x	0.71	=	49.75	(79)
Southwest	0.9x	0.77	x	4.27	x	92.85		0.45	x	0.71	=	87.79	(79)
Southwest	0.9x	0.77	x	2.38	x	69.27		0.45	x	0.71	=	36.5	(79)
Southwest	0.9x	0.77	x	2.42	x	69.27		0.45	x	0.71	=	37.11	(79)
Southwest	0.9x	0.77	x	4.27	x	69.27		0.45	x	0.71	=	65.49	(79)
Southwest	0.9x	0.77	x	2.38	x	44.07		0.45	x	0.71	=	23.22	(79)
Southwest	0.9x	0.77	x	2.42	x	44.07		0.45	x	0.71	=	23.61	(79)
Southwest	0.9x	0.77	x	4.27	x	44.07		0.45	x	0.71	=	41.67	(79)
Southwest	0.9x	0.77	x	2.38	x	31.49		0.45	x	0.71	=	16.59	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	2.42	x	31.49		0.45	x	0.71	=	16.87	(79)
Southwest	0.9x	0.77	x	4.27	x	31.49		0.45	x	0.71	=	29.77	(79)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	93.28	158.89	217.4	269.37	301.71	299.53	288.78	264.65	235.4	175.61	111.73	79.83	(83)
--------	-------	--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.98	555.56	601.56	633.44	645.48	623.69	600.19	581.77	562.83	523.34	482.74	468.21	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.73	0.53	0.38	0.41	0.63	0.9	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.43	20.56	20.73	20.89	20.98	21	21	21	20.99	20.89	20.63	20.4	(87)
--------	-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.3	20.3	20.3	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.31	20.3	(88)
--------	------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.68	0.47	0.32	0.35	0.57	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=	19.54	19.73	19.96	20.18	20.29	20.31	20.31	20.31	20.31	20.19	19.84	19.5	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =	0.56	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.03	20.19	20.39	20.58	20.67	20.69	20.7	20.7	20.69	20.58	20.28	20	(92)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	----	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.03	20.19	20.39	20.58	20.67	20.69	20.7	20.7	20.69	20.58	20.28	20	(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	0.71	0.51	0.35	0.38	0.6	0.88	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	487.44	543.52	569.65	546.98	455.81	315.04	212.38	222.36	339.28	459.68	471.49	465.01	(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=	836.66	811.33	735.27	612.18	469.38	316.11	212.45	222.48	342.92	522.34	692.4	833.2	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	259.82	179.97	123.22	46.95	10.1	0	0	0	0	46.62	159.06	273.93	(98)
--------	--------	--------	--------	-------	------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1099.67	(98)
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Space heating requirement in kWh/m²/year

15.5	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

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)
<i>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.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1099.67	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1154.65	(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		2036.9	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2138.74	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	32.93	(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)
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)		326.3	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	98.6	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0	= 721.47 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 17.09 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 738.57 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		738.57 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 0 (378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	169.35	(379)
Total CO2, kg/year	sum of (376)...(382) =			907.91	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			12.79	(384)
El rating (section 14)				89.51	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 3

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a)	2.4 (2a)	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
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Additional infiltration	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
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if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
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Percentage of windows and doors draught stripped	0 (14)
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Window infiltration	0 (15)
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Infiltration rate	0 (16)
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Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
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Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
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Shelter factor	0.78 (20)
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Infiltration rate incorporating shelter factor	0.12 (21)
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Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Windows Type 4			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Walls	40.7	11.45	29.25	$\times 0.17 =$	4.97		(29)
Total area of elements, m²			40.7				(31)
Party wall			32.57	$\times 0 =$	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 20.15 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 22.15 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	15.17	15.01	14.85	14.03	13.87	13.05	13.05	12.89	13.38	13.87	14.19	14.52

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.33	37.16	37	36.18	36.02	35.2	35.2	35.04	35.53	36.02	36.35	36.67
Average = Sum(39) _{1...12} /12=												36.14 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.53	0.52	0.52	0.51	0.51	0.5	0.5	0.49	0.5	0.51	0.51	0.52		
	Average = Sum(40) _{1...12} /12=												0.51	(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

2.27

(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

88.09

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
	Total = Sum(44) _{1...12} =												1057.12	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
	Total = Sum(45) _{1...12} =												1386.06	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	(62)
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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	(63)
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Output from water heater

(64)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	
Output from water heater (annual) _{1...12}												2036.9	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92	81.73	87.35	80.39	80.3	73.92	73.07	77.32	76.29	83.26	85.41	90.5	(65)
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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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.48	16.41	13.35	10.1	7.55	6.38	6.89	8.96	12.02	15.26	17.81	18.99	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	123.66	121.63	117.4	111.65	107.92	102.67	98.21	103.93	105.96	111.91	118.62	121.63	(72)
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.7	396.67	384.16	364.07	343.77	324.16	311.41	317.12	327.44	347.73	371.02	388.39	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)

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Southeast	0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast	0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast	0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast	0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast	0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast	0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast	0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southwest	0.9x	0.77	x	2.38	x	36.79		0.45	x	0.71	=	19.39	(79)
Southwest	0.9x	0.77	x	2.42	x	36.79		0.45	x	0.71	=	19.71	(79)
Southwest	0.9x	0.77	x	4.27	x	36.79		0.45	x	0.71	=	34.79	(79)
Southwest	0.9x	0.77	x	2.38	x	62.67		0.45	x	0.71	=	33.03	(79)
Southwest	0.9x	0.77	x	2.42	x	62.67		0.45	x	0.71	=	33.58	(79)
Southwest	0.9x	0.77	x	4.27	x	62.67		0.45	x	0.71	=	59.25	(79)
Southwest	0.9x	0.77	x	2.38	x	85.75		0.45	x	0.71	=	45.19	(79)
Southwest	0.9x	0.77	x	2.42	x	85.75		0.45	x	0.71	=	45.95	(79)
Southwest	0.9x	0.77	x	4.27	x	85.75		0.45	x	0.71	=	81.07	(79)
Southwest	0.9x	0.77	x	2.38	x	106.25		0.45	x	0.71	=	55.99	(79)
Southwest	0.9x	0.77	x	2.42	x	106.25		0.45	x	0.71	=	56.93	(79)
Southwest	0.9x	0.77	x	4.27	x	106.25		0.45	x	0.71	=	100.45	(79)
Southwest	0.9x	0.77	x	2.38	x	119.01		0.45	x	0.71	=	62.71	(79)
Southwest	0.9x	0.77	x	2.42	x	119.01		0.45	x	0.71	=	63.77	(79)
Southwest	0.9x	0.77	x	4.27	x	119.01		0.45	x	0.71	=	112.52	(79)
Southwest	0.9x	0.77	x	2.38	x	118.15		0.45	x	0.71	=	62.26	(79)
Southwest	0.9x	0.77	x	2.42	x	118.15		0.45	x	0.71	=	63.31	(79)
Southwest	0.9x	0.77	x	4.27	x	118.15		0.45	x	0.71	=	111.7	(79)
Southwest	0.9x	0.77	x	2.38	x	113.91		0.45	x	0.71	=	60.03	(79)
Southwest	0.9x	0.77	x	2.42	x	113.91		0.45	x	0.71	=	61.03	(79)
Southwest	0.9x	0.77	x	4.27	x	113.91		0.45	x	0.71	=	107.69	(79)
Southwest	0.9x	0.77	x	2.38	x	104.39		0.45	x	0.71	=	55.01	(79)
Southwest	0.9x	0.77	x	2.42	x	104.39		0.45	x	0.71	=	55.93	(79)
Southwest	0.9x	0.77	x	4.27	x	104.39		0.45	x	0.71	=	98.69	(79)
Southwest	0.9x	0.77	x	2.38	x	92.85		0.45	x	0.71	=	48.93	(79)
Southwest	0.9x	0.77	x	2.42	x	92.85		0.45	x	0.71	=	49.75	(79)
Southwest	0.9x	0.77	x	4.27	x	92.85		0.45	x	0.71	=	87.79	(79)
Southwest	0.9x	0.77	x	2.38	x	69.27		0.45	x	0.71	=	36.5	(79)
Southwest	0.9x	0.77	x	2.42	x	69.27		0.45	x	0.71	=	37.11	(79)
Southwest	0.9x	0.77	x	4.27	x	69.27		0.45	x	0.71	=	65.49	(79)
Southwest	0.9x	0.77	x	2.38	x	44.07		0.45	x	0.71	=	23.22	(79)
Southwest	0.9x	0.77	x	2.42	x	44.07		0.45	x	0.71	=	23.61	(79)
Southwest	0.9x	0.77	x	4.27	x	44.07		0.45	x	0.71	=	41.67	(79)
Southwest	0.9x	0.77	x	2.38	x	31.49		0.45	x	0.71	=	16.59	(79)

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Southwest	0.9x	0.77	x	2.42	x	31.49	0.45	x	0.71	=	16.87	(79)
Southwest	0.9x	0.77	x	4.27	x	31.49	0.45	x	0.71	=	29.77	(79)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	93.28	158.89	217.4	269.37	301.71	299.53	288.78	264.65	235.4	175.61	111.73	79.83	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.98	555.56	601.56	633.44	645.48	623.69	600.19	581.77	562.83	523.34	482.74	468.21	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.94	0.85	0.69	0.52	0.36	0.26	0.28	0.44	0.71	0.93	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.79	20.88	20.96	21	21	21	21	21	21	20.99	20.91	20.77	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.5	20.5	20.5	20.51	20.51	20.52	20.52	20.53	20.52	20.51	20.51	20.51	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.93	0.83	0.66	0.49	0.33	0.23	0.25	0.41	0.68	0.91	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.22	20.36	20.46	20.51	20.51	20.52	20.52	20.53	20.52	20.51	20.41	20.2	(90)
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fLA = Living area ÷ (4) = 0.56 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.54	20.65	20.74	20.78	20.78	20.79	20.79	20.79	20.79	20.78	20.69	20.52	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.54	20.65	20.74	20.78	20.78	20.79	20.79	20.79	20.79	20.78	20.69	20.52	(93)
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8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.84	0.67	0.51	0.35	0.25	0.26	0.42	0.69	0.92	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	478.57	516.43	503.67	426.98	327.03	217.87	147.47	153.82	237.57	363.58	443.87	458.71	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	606.03	585.31	526.76	429.79	327.2	217.87	147.47	153.82	237.59	366.64	493.94	598.34	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	94.82	46.29	17.18	2.02	0.12	0	0	0	0	2.27	36.05	103.88	(98)
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 302.64 (99)

Space heating requirement in kWh/m²/year

4.26 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

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Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
<i>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.</i>			
Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		302.64	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	317.77	(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		2036.9	
If DHW from community scheme:			
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2138.74	(310a)
Electricity used for heat distribution	0.01 x [(307a)...(307e) + (310a)...(310e)] =	24.57	(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)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		177.44	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	177.44	(331)
Energy for lighting (calculated in Appendix L)		326.3	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		98.6 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0	= 538.14 (367)
Electrical energy for heat distribution	[(313) x	0.52	= 12.75 (372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)		= 550.89 (373)
CO2 associated with space heating (secondary)	(309) x	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		550.89 (376)
CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	= 92.09 (378)

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CO2 associated with electricity for lighting	(332))) x	0.52	=	169.35	(379)
Total CO2, kg/year	sum of (376)...(382) =			812.33	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.45	(384)
El rating (section 14)				90.61	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 4

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a) x	2.4 (2a) =	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
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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)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (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 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	22.56	9.07	13.49	x 0.17	2.29		(29)
Total area of elements, m²			22.56				(31)
Party wall			36	x 0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 14.32 (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 0.95 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 15.27 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37
Average = Sum(39)_{1...12} /12= 43.37 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61		
Average = Sum(40) _{1...12} /12=													0.61	(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

88.09

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
Total = Sum(44) _{1...12} =													1057.12	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
Total = Sum(45) _{1...12} =													1386.06	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	
Output from water heater (annual) _{1...12}												2036.9	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92	81.73	87.35	80.39	80.3	73.92	73.07	77.32	76.29	83.26	85.41	90.5	(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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.41	17.24	14.02	10.61	7.93	6.7	7.24	9.41	12.63	16.03	18.71	19.95	(67)
--------	-------	-------	-------	-------	------	-----	------	------	-------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	123.66	121.63	117.4	111.65	107.92	102.67	98.21	103.93	105.96	111.91	118.62	121.63	(72)
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.63	397.5	384.84	364.58	344.15	324.48	311.75	317.57	328.04	348.5	371.92	389.34	(73)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.45	x	0.71	=	19.71	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.45	x	0.71	=	34.79	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.45	x	0.71	=	33.58	(77)

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Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.45	x	0.71	=	59.25	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.45	x	0.71	=	45.95	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.45	x	0.71	=	81.07	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.45	x	0.71	=	56.93	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.45	x	0.71	=	100.45	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.45	x	0.71	=	63.77	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.45	x	0.71	=	112.52	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.45	x	0.71	=	63.31	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.45	x	0.71	=	111.7	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.45	x	0.71	=	61.03	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.45	x	0.71	=	107.69	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.45	x	0.71	=	55.93	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.45	x	0.71	=	98.69	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.45	x	0.71	=	49.75	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.45	x	0.71	=	87.79	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.45	x	0.71	=	37.11	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.45	x	0.71	=	65.49	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.45	x	0.71	=	23.61	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.45	x	0.71	=	41.67	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.45	x	0.71	=	16.87	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.45	x	0.71	=	29.77	(77)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 73.89 125.86 172.21 213.38 239 237.27 228.75 209.64 186.47 139.1 88.5 63.23 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 473.52 523.36 557.05 577.96 583.15 561.75 540.51 527.21 514.51 487.61 460.42 452.58 (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	0.85	0.68	0.49	0.35	0.38	0.58	0.86	0.97	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.63 20.73 20.85 20.95 20.99 21 21 21 21 20.95 20.77 20.59 (87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	(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	0.45	0.31	0.33	0.53	0.83	0.97	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.92	20.07	20.23	20.36	20.41	20.42	20.42	20.42	20.42	20.37	20.14	19.87	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.56	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.31	20.43	20.57	20.69	20.74	20.74	20.74	20.74	20.74	20.69	20.49	20.27	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.31	20.43	20.57	20.69	20.74	20.74	20.74	20.74	20.74	20.69	20.49	20.27	(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	0.66	0.47	0.33	0.36	0.56	0.84	0.97	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	467.73	508.65	518.97	481.47	387.53	266.18	179.68	188.34	287.17	410.21	445.81	448.6	(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=	694.58	673.73	610.46	511.35	391.89	266.41	179.69	188.36	288.05	437.79	580.8	697.1	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	168.77	110.93	68.07	21.51	3.24	0	0	0	0	20.52	97.19	184.88	(98)
--------	--------	--------	-------	-------	------	---	---	---	---	-------	-------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	675.11	(98)
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Space heating requirement in kWh/m²/year

9.51	(99)
------	------

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
---	-------

Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)
---	--------

Fraction of total space heat from Community boilers

(302) x (303a) =	1	(304a)
------------------	---	--------

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
---	-------

Distribution loss factor (Table 12c) for community heating system

1.05	(306)
------	-------

Space heating

Annual space heating requirement

kWh/year

675.11	(307a)
--------	--------

Space heat from Community boilers

(98) x (304a) x (305) x (306) =	708.87	(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	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2036.9	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2138.74	(310a)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	28.48	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		90.17	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	90.17	(331)
Energy for lighting (calculated in Appendix L)		342.76	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			98.6 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	= 623.82 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 14.78 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 638.6 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		638.6 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 46.8 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 177.89 (379)
Total CO2, kg/year	sum of (376) ... (382) =		863.29 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		12.17 (384)
EI rating (section 14)			90.02 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 4

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a) x	2.4 (2a) =	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (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 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	22.56	9.07	13.49	x 0.17 =	2.29		(29)
Total area of elements, m²			22.56				(31)
Party wall			36	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 14.32 (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 0.95 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 15.27 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	15.17	15.01	14.85	14.03	13.87	13.05	13.05	12.89	13.38	13.87	14.19	14.52

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	30.45	30.28	30.12	29.3	29.14	28.32	28.32	28.16	28.65	29.14	29.47	29.79
Average = Sum(39) _{1...12} /12=												29.26 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.43	0.43	0.42	0.41	0.41	0.4	0.4	0.4	0.4	0.41	0.42	0.42		
Average = Sum(40) _{1...12} /12=													0.41	(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

88.09

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
Total = Sum(44) _{1...12} =													1057.12	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
Total = Sum(45) _{1...12} =													1386.06	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	
Output from water heater (annual) _{1...12}												2036.9	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92	81.73	87.35	80.39	80.3	73.92	73.07	77.32	76.29	83.26	85.41	90.5	(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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.41	17.24	14.02	10.61	7.93	6.7	7.24	9.41	12.63	16.03	18.71	19.95	(67)
--------	-------	-------	-------	-------	------	-----	------	------	-------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	123.66	121.63	117.4	111.65	107.92	102.67	98.21	103.93	105.96	111.91	118.62	121.63	(72)
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.63	397.5	384.84	364.58	344.15	324.48	311.75	317.57	328.04	348.5	371.92	389.34	(73)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.45	x	0.71	=	19.71	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.45	x	0.71	=	34.79	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.45	x	0.71	=	33.58	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.45	x	0.71	=	59.25	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.45	x	0.71	=	45.95	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.45	x	0.71	=	81.07	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.45	x	0.71	=	56.93	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.45	x	0.71	=	100.45	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.45	x	0.71	=	63.77	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.45	x	0.71	=	112.52	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.45	x	0.71	=	63.31	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.45	x	0.71	=	111.7	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.45	x	0.71	=	61.03	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.45	x	0.71	=	107.69	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.45	x	0.71	=	55.93	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.45	x	0.71	=	98.69	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.45	x	0.71	=	49.75	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.45	x	0.71	=	87.79	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.45	x	0.71	=	37.11	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.45	x	0.71	=	65.49	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.45	x	0.71	=	23.61	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.45	x	0.71	=	41.67	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.45	x	0.71	=	16.87	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.45	x	0.71	=	29.77	(77)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 73.89 125.86 172.21 213.38 239 237.27 228.75 209.64 186.47 139.1 88.5 63.23 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 473.52 523.36 557.05 577.96 583.15 561.75 540.51 527.21 514.51 487.61 460.42 452.58 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.95	0.89	0.77	0.61	0.46	0.32	0.23	0.25	0.38	0.62	0.86	0.96

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.91 20.96 20.99 21 21 21 21 21 21 21 20.98 20.9 (87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.59	20.59	20.59	20.6	20.6	20.61	20.61	20.62	20.61	20.6	20.6	20.59	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.94	0.87	0.75	0.59	0.44	0.3	0.21	0.23	0.36	0.6	0.84	0.95	(89)
--------	------	------	------	------	------	-----	------	------	------	-----	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.47	20.54	20.58	20.6	20.6	20.61	20.61	20.62	20.61	20.6	20.58	20.47	(90)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =	0.56	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.72	20.78	20.81	20.82	20.82	20.83	20.83	20.83	20.83	20.82	20.8	20.71	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.72	20.78	20.81	20.82	20.82	20.83	20.83	20.83	20.83	20.82	20.8	20.71	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.94	0.88	0.77	0.6	0.46	0.31	0.22	0.24	0.37	0.61	0.85	0.96	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	447.13	459.24	426.22	349.06	265.86	176.42	119.77	124.74	192.72	297.63	391.44	432.49	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	499.83	480.81	430.99	349.36	265.87	176.42	119.77	124.74	192.72	297.9	403.67	491.81	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	39.21	14.49	3.55	0.21	0.01	0	0	0	0	0.2	8.81	44.13	(98)
--------	-------	-------	------	------	------	---	---	---	---	-----	------	-------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	110.61	(98)
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Space heating requirement in kWh/m²/year

1.56	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
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Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)
---	--------

Fraction of total space heat from Community boilers

(302) x (303a) =	1	(304a)
------------------	---	--------

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
---	-------

Distribution loss factor (Table 12c) for community heating system

1.05	(306)
------	-------

Space heating

Annual space heating requirement

kWh/year

110.61	(307a)
--------	--------

Space heat from Community boilers

(98) x (304a) x (305) x (306) =	116.14	(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	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2036.9	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2138.74	(310a)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	22.55	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		177.44	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	177.44	(331)
Energy for lighting (calculated in Appendix L)		342.76	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			98.6 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	= 493.97 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 11.7 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		= 505.67 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		505.67 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 92.09 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 177.89 (379)
Total CO2, kg/year	sum of (376) ... (382) =		775.66 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		10.93 (384)
EI rating (section 14)			91.04 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 5

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	63.7 (1a)	2.4 (2a)	152.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	152.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
--	-------

Additional infiltration	0 (10)
-------------------------	--------

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
--	--------

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
---	--------

If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
--	--------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
---------------------	------------------------------------

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
-------------------	---

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
---	--------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
--	-----------

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
---------------------------	--------

Shelter factor	0.78 (20)
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Infiltration rate incorporating shelter factor	0.12 (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

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	39.36	9.07	30.29	x 0.18 =	5.45		(29)
Roof	63.7	0	63.7	x 0.11 =	7.01		(30)
Total area of elements, m²			103.06				(31)
Party wall			15.82	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 24.48 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 573.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.75 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 29.23 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.46	54.46	54.46	54.46	54.46	54.46	54.46	54.46	54.46	54.46	54.46	54.46
Average = Sum(39) _{1...12} /12=												54.46 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85		
Average = Sum(40) _{1...12} /12=													0.85	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.08

(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

83.7

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	92.07	88.72	85.37	82.02	78.68	75.33	75.33	78.68	82.02	85.37	88.72	92.07		
Total = Sum(44) _{1...12} =													1004.36	(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=	136.53	119.41	123.22	107.43	103.08	88.95	82.43	94.58	95.71	111.55	121.76	132.22		
Total = Sum(45) _{1...12} =													1316.88	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.48	17.91	18.48	16.11	15.46	13.34	12.36	14.19	14.36	16.73	18.26	19.83		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.81	169.34	178.5	160.92	158.36	142.44	137.7	149.86	149.21	166.82	175.25	187.5	(62)
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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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	191.81	169.34	178.5	160.92	158.36	142.44	137.7	149.86	149.21	166.82	175.25	187.5	
Output from water heater (annual) _{1...12}												1967.72	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	89.62	79.65	85.19	78.51	78.5	72.37	71.63	75.67	74.62	81.31	83.28	88.19	(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=	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.31	15.37	12.5	9.46	7.07	5.97	6.45	8.39	11.26	14.3	16.69	17.79	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	182.17	184.06	179.3	169.16	156.36	144.32	136.29	134.4	139.16	149.3	162.1	174.13	(68)
--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	-------	-------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	(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=	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	120.45	118.52	114.51	109.05	105.5	100.52	96.27	101.71	103.64	109.29	115.67	118.53	(72)
--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	374.2	372.22	360.57	341.93	323.2	305.07	293.28	298.75	308.32	327.15	348.72	364.71	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.45	x	0.71	=	19.71	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.45	x	0.71	=	34.79	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.45	x	0.71	=	33.58	(77)

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Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.45	x	0.71	=	59.25	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.45	x	0.71	=	45.95	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.45	x	0.71	=	81.07	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.45	x	0.71	=	56.93	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.45	x	0.71	=	100.45	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.45	x	0.71	=	63.77	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.45	x	0.71	=	112.52	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.45	x	0.71	=	63.31	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.45	x	0.71	=	111.7	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.45	x	0.71	=	61.03	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.45	x	0.71	=	107.69	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.45	x	0.71	=	55.93	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.45	x	0.71	=	98.69	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.45	x	0.71	=	49.75	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.45	x	0.71	=	87.79	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.45	x	0.71	=	37.11	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.45	x	0.71	=	65.49	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.45	x	0.71	=	23.61	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.45	x	0.71	=	41.67	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.45	x	0.71	=	16.87	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.45	x	0.71	=	29.77	(77)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 73.89 125.86 172.21 213.38 239 237.27 228.75 209.64 186.47 139.1 88.5 63.23 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 448.09 498.08 532.78 555.31 562.2 542.35 522.03 508.39 494.79 466.25 437.22 427.95 (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	0.93	0.82	0.63	0.46	0.49	0.72	0.93	0.99	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.28 20.4 20.58 20.78 20.93 20.99 21 21 20.97 20.8 20.49 20.24 (87)

DER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.91	0.77	0.56	0.38	0.41	0.65	0.91	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.24	19.42	19.67	19.95	20.14	20.2	20.21	20.21	20.19	19.98	19.56	19.19	(90)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.33	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.59	19.75	19.97	20.22	20.4	20.46	20.47	20.47	20.44	20.25	19.87	19.53	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.59	19.75	19.97	20.22	20.4	20.46	20.47	20.47	20.44	20.25	19.87	19.53	(93)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.91	0.78	0.58	0.4	0.43	0.68	0.91	0.98	0.99	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	444.15	489.29	512.12	503.06	439.07	314.61	210.22	220.86	334.34	424.75	428.67	425.07	(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=	832.42	808.48	733.69	616.54	473.58	319.06	210.6	221.46	345.54	525.47	695.24	835.11	(97)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	288.87	214.5	164.85	81.7	25.68	0	0	0	0	74.94	191.93	305.07	(98)
--------	--------	-------	--------	------	-------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1347.53 (98)

Space heating requirement in kWh/m²/year

21.15	(99)
-------	------

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
---	-------

Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)
---	--------

Fraction of total space heat from Community boilers

(302) x (303a) =

1	(304a)
---	--------

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
---	-------

Distribution loss factor (Table 12c) for community heating system

1.05	(306)
------	-------

Space heating

Annual space heating requirement

kWh/year

1347.53	(307a)
---------	--------

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

1414.91	(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	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		1967.72	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2066.11	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	34.81	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		72.74	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	72.74	(331)
Energy for lighting (calculated in Appendix L)		305.64	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		98.6 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	= 762.58 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 18.07 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 780.64 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		780.64 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	= 37.75 (378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	= 158.63 (379)
Total CO2, kg/year	sum of (376)...(382) =		977.02 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		15.34 (384)
EI rating (section 14)			87.96 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 5

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	63.7 (1a)	2.4 (2a)	152.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	152.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
--	-------

Additional infiltration	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
--	--------

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
--	--------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
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Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
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Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
---	--------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
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Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
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Shelter factor	0.78 (20)
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Infiltration rate incorporating shelter factor	0.12 (21)
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Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	39.36	9.07	30.29	x 0.18 =	5.45		(29)
Roof	63.7	0	63.7	x 0.11 =	7.01		(30)
Total area of elements, m²			103.06				(31)
Party wall			15.82	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 24.48 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 573.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.75 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 29.23 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	13.62	13.47	13.33	12.59	12.45	11.71	11.71	11.57	12.01	12.45	12.74	13.03

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	42.85	42.71	42.56	41.83	41.68	40.95	40.95	40.8	41.24	41.68	41.97	42.27
Average = Sum(39) _{1...12} /12=												41.79 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.67	0.67	0.67	0.66	0.65	0.64	0.64	0.64	0.65	0.65	0.66	0.66		
	Average = Sum(40) _{1...12} /12=												0.66	(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

2.08

(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

83.7

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	92.07	88.72	85.37	82.02	78.68	75.33	75.33	78.68	82.02	85.37	88.72	92.07		
	Total = Sum(44) _{1...12} =												1004.36	(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=	136.53	119.41	123.22	107.43	103.08	88.95	82.43	94.58	95.71	111.55	121.76	132.22		
	Total = Sum(45) _{1...12} =												1316.88	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.48	17.91	18.48	16.11	15.46	13.34	12.36	14.19	14.36	16.73	18.26	19.83		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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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	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.81	169.34	178.5	160.92	158.36	142.44	137.7	149.86	149.21	166.82	175.25	187.5	(62)
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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	(63)
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Output from water heater

(64)m=	191.81	169.34	178.5	160.92	158.36	142.44	137.7	149.86	149.21	166.82	175.25	187.5	
Output from water heater (annual) _{1...12}												1967.72	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	89.62	79.65	85.19	78.51	78.5	72.37	71.63	75.67	74.62	81.31	83.28	88.19	(65)
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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=	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.31	15.37	12.5	9.46	7.07	5.97	6.45	8.39	11.26	14.3	16.69	17.79	(67)
--------	-------	-------	------	------	------	------	------	------	-------	------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	182.17	184.06	179.3	169.16	156.36	144.32	136.29	134.4	139.16	149.3	162.1	174.13	(68)
--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	-------	-------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	(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=	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	120.45	118.52	114.51	109.05	105.5	100.52	96.27	101.71	103.64	109.29	115.67	118.53	(72)
--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	374.2	372.22	360.57	341.93	323.2	305.07	293.28	298.75	308.32	327.15	348.72	364.71	(73)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.45	x	0.71	=	19.71	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.45	x	0.71	=	34.79	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.45	x	0.71	=	33.58	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.45	x	0.71	=	59.25	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.45	x	0.71	=	45.95	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.45	x	0.71	=	81.07	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.45	x	0.71	=	56.93	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.45	x	0.71	=	100.45	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.45	x	0.71	=	63.77	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.45	x	0.71	=	112.52	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.45	x	0.71	=	63.31	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.45	x	0.71	=	111.7	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.45	x	0.71	=	61.03	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.45	x	0.71	=	107.69	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.45	x	0.71	=	55.93	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.45	x	0.71	=	98.69	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.45	x	0.71	=	49.75	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.45	x	0.71	=	87.79	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.45	x	0.71	=	37.11	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.45	x	0.71	=	65.49	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.45	x	0.71	=	23.61	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.45	x	0.71	=	41.67	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.45	x	0.71	=	16.87	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.45	x	0.71	=	29.77	(77)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 73.89 125.86 172.21 213.38 239 237.27 228.75 209.64 186.47 139.1 88.5 63.23 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 448.09 498.08 532.78 555.31 562.2 542.35 522.03 508.39 494.79 466.25 437.22 427.95 (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	0.48	0.35	0.37	0.57	0.85	0.97	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.56 20.68 20.81 20.94 20.99 21 21 21 21 20.94 20.74 20.54 (87)

DER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.36	20.37	20.37	20.38	20.38	20.39	20.39	20.39	20.39	20.38	20.38	20.37	(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	0.44	0.3	0.32	0.52	0.82	0.97	0.99	(89)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.78	19.95	20.14	20.31	20.37	20.39	20.39	20.39	20.39	20.32	20.06	19.76	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.33	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.04	20.19	20.36	20.52	20.58	20.59	20.59	20.59	20.59	20.53	20.28	20.02	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.04	20.19	20.36	20.52	20.58	20.59	20.59	20.59	20.59	20.53	20.28	20.02	(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	0.93	0.82	0.65	0.45	0.31	0.34	0.54	0.83	0.96	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	441.94	482.81	494.3	456.44	365.56	245.15	163.47	171.09	266.74	386.95	421.49	423.48	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	674.52	652.93	590.04	486.05	369.97	245.35	163.47	171.1	267.56	413.79	553.36	668.49	(97)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	173.05	114.32	71.23	21.32	3.28	0	0	0	0	19.97	94.95	182.29	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	680.4	(98)
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Space heating requirement in kWh/m²/year

10.68	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
---	-------

Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1	(303a)
---	--------

Fraction of total space heat from Community boilers

(302) × (303a) =	1	(304a)
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Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
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Distribution loss factor (Table 12c) for community heating system

1.05	(306)
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Space heating

Annual space heating requirement

kWh/year

680.4	(307a)
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Space heat from Community boilers

(98) × (304a) × (305) × (306) =	714.42	(307a)
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Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0	(308)
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DER WorkSheet: New dwelling design stage

Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		1967.72	
If DHW from community scheme:			
Water heat from Community boilers	$(64) \times (303a) \times (305) \times (306) =$	2066.11	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	27.81	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		142.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	142.22	(331)
Energy for lighting (calculated in Appendix L)		305.64	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		
			98.6 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	= 609.12 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 14.43 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 623.55 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		623.55 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 73.81 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 158.63 (379)
Total CO2, kg/year	sum of (376)...(382) =		855.99 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		13.44 (384)
EI rating (section 14)			89.45 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 6

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	82.45 (1a) x	2.4 (2a) =	197.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	197.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 3 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.15 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.12 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			6.16	$\times 1/[1/(1.4) + 0.04] =$	8.17		(27)
Windows Type 4			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 5			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Walls	41.57	15.8	25.77	x 0.17 =	4.38		(29)
Roof	82.45	0	82.45	x 0.11 =	9.07		(30)
Total area of elements, m²			124.02				(31)
Party wall			34.2	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 34.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 742.05 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 39.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88		
Average = Sum(40) _{1...12} /12=													0.88	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.76

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.13	99.38	95.63	91.88	88.13	84.38	84.38	88.13	91.88	95.63	99.38	103.13		
Total = Sum(44) _{1...12} =													1125.1	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.94	133.77	138.03	120.34	115.47	99.64	92.33	105.95	107.22	124.95	136.4	148.12		
Total = Sum(45) _{1...12} =													1475.18	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.94	20.06	20.71	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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	(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	183.69	193.31	173.84	170.75	153.14	147.61	161.23	160.71	180.23	189.89	203.4	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	208.22	183.69	193.31	173.84	170.75	153.14	147.61	161.23	160.71	180.23	189.89	203.4	
Output from water heater (annual) _{1...12}												2126.02	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	95.08	84.42	90.12	82.81	82.62	75.93	74.92	79.45	78.45	85.77	88.15	93.47	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.22	17.96	14.6	11.06	8.27	6.98	7.54	9.8	13.15	16.7	19.49	20.78	(67)
--------	-------	-------	------	-------	------	------	------	-----	-------	------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	224.48	226.81	220.94	208.45	192.67	177.85	167.94	165.61	171.48	183.98	199.75	214.58	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	(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=	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	(71)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water heating gains (Table 5)

(72)m=	127.79	125.62	121.13	115.01	111.04	105.45	100.7	106.79	108.95	115.28	122.43	125.63	(72)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	433.11	431.01	417.29	395.13	372.6	350.89	336.8	342.82	354.2	376.58	402.29	421.61	(73)
--------	--------	--------	--------	--------	-------	--------	-------	--------	-------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Southwest _{0.9x}	0.77	x	6.16	x	36.79		0.45	x	0.71	=	50.18	(79)
Southwest _{0.9x}	0.77	x	6.16	x	62.67		0.45	x	0.71	=	85.48	(79)
Southwest _{0.9x}	0.77	x	6.16	x	85.75		0.45	x	0.71	=	116.96	(79)
Southwest _{0.9x}	0.77	x	6.16	x	106.25		0.45	x	0.71	=	144.92	(79)
Southwest _{0.9x}	0.77	x	6.16	x	119.01		0.45	x	0.71	=	162.32	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	6.16	x	118.15		0.45	x	0.71	=	161.15	(79)
Southwest	0.9x	0.77	x	6.16	x	113.91		0.45	x	0.71	=	155.36	(79)
Southwest	0.9x	0.77	x	6.16	x	104.39		0.45	x	0.71	=	142.38	(79)
Southwest	0.9x	0.77	x	6.16	x	92.85		0.45	x	0.71	=	126.64	(79)
Southwest	0.9x	0.77	x	6.16	x	69.27		0.45	x	0.71	=	94.47	(79)
Southwest	0.9x	0.77	x	6.16	x	44.07		0.45	x	0.71	=	60.11	(79)
Southwest	0.9x	0.77	x	6.16	x	31.49		0.45	x	0.71	=	42.95	(79)
West	0.9x	0.77	x	2.38	x	19.64	x	0.45	x	0.71	=	10.35	(80)
West	0.9x	0.77	x	2.42	x	19.64	x	0.45	x	0.71	=	10.52	(80)
West	0.9x	0.77	x	2.38	x	38.42	x	0.45	x	0.71	=	20.25	(80)
West	0.9x	0.77	x	2.42	x	38.42	x	0.45	x	0.71	=	20.59	(80)
West	0.9x	0.77	x	2.38	x	63.27	x	0.45	x	0.71	=	33.34	(80)
West	0.9x	0.77	x	2.42	x	63.27	x	0.45	x	0.71	=	33.9	(80)
West	0.9x	0.77	x	2.38	x	92.28	x	0.45	x	0.71	=	48.63	(80)
West	0.9x	0.77	x	2.42	x	92.28	x	0.45	x	0.71	=	49.45	(80)
West	0.9x	0.77	x	2.38	x	113.09	x	0.45	x	0.71	=	59.6	(80)
West	0.9x	0.77	x	2.42	x	113.09	x	0.45	x	0.71	=	60.6	(80)
West	0.9x	0.77	x	2.38	x	115.77	x	0.45	x	0.71	=	61.01	(80)
West	0.9x	0.77	x	2.42	x	115.77	x	0.45	x	0.71	=	62.03	(80)
West	0.9x	0.77	x	2.38	x	110.22	x	0.45	x	0.71	=	58.08	(80)
West	0.9x	0.77	x	2.42	x	110.22	x	0.45	x	0.71	=	59.06	(80)
West	0.9x	0.77	x	2.38	x	94.68	x	0.45	x	0.71	=	49.89	(80)
West	0.9x	0.77	x	2.42	x	94.68	x	0.45	x	0.71	=	50.73	(80)
West	0.9x	0.77	x	2.38	x	73.59	x	0.45	x	0.71	=	38.78	(80)
West	0.9x	0.77	x	2.42	x	73.59	x	0.45	x	0.71	=	39.43	(80)
West	0.9x	0.77	x	2.38	x	45.59	x	0.45	x	0.71	=	24.02	(80)
West	0.9x	0.77	x	2.42	x	45.59	x	0.45	x	0.71	=	24.43	(80)
West	0.9x	0.77	x	2.38	x	24.49	x	0.45	x	0.71	=	12.9	(80)
West	0.9x	0.77	x	2.42	x	24.49	x	0.45	x	0.71	=	13.12	(80)
West	0.9x	0.77	x	2.38	x	16.15	x	0.45	x	0.71	=	8.51	(80)
West	0.9x	0.77	x	2.42	x	16.15	x	0.45	x	0.71	=	8.65	(80)
Northwest	0.9x	0.77	x	2.42	x	11.28	x	0.45	x	0.71	=	6.05	(81)
Northwest	0.9x	0.77	x	2.42	x	11.28	x	0.45	x	0.71	=	6.05	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	x	0.45	x	0.71	=	12.31	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	x	0.45	x	0.71	=	12.31	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	x	0.45	x	0.71	=	22.17	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	x	0.45	x	0.71	=	22.17	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	x	0.45	x	0.71	=	36.41	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	x	0.45	x	0.71	=	36.41	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	x	0.45	x	0.71	=	48.95	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	x	0.45	x	0.71	=	48.95	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.45	x	0.71	=	52.18	(81)
Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.45	x	0.71	=	52.18	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.45	x	0.71	=	48.81	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.45	x	0.71	=	48.81	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.45	x	0.71	=	38.91	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.45	x	0.71	=	38.91	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.45	x	0.71	=	27.02	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.45	x	0.71	=	27.02	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.45	x	0.71	=	15.04	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.45	x	0.71	=	15.04	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.45	x	0.71	=	7.61	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.45	x	0.71	=	7.61	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.45	x	0.71	=	4.94	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.45	x	0.71	=	4.94	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.15	150.93	228.55	315.82	380.4	388.55	370.13	320.83	258.88	173	101.35	69.99	(83)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	-----	--------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	516.26	581.94	645.84	710.95	753	739.44	706.93	663.65	613.09	549.58	503.64	491.6	(84)
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	-------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.81	0.61	0.45	0.5	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=	20.17	20.29	20.5	20.75	20.92	20.99	21	21	20.96	20.73	20.39	20.13	(87)
--------	-------	-------	------	-------	-------	-------	----	----	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.76	0.54	0.37	0.41	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=	19.07	19.25	19.55	19.89	20.11	20.18	20.18	20.18	20.15	19.87	19.4	19.01	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =

0.36 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.47	19.63	19.9	20.2	20.41	20.47	20.48	20.48	20.45	20.18	19.76	19.42	(92)
--------	-------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.47	19.63	19.9	20.2	20.41	20.47	20.48	20.48	20.45	20.18	19.76	19.42	(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	0.78	0.57	0.4	0.44	0.72	0.94	0.99	1	(94)
--------	---	------	------	------	------	------	-----	------	------	------	------	---	------

DER WorkSheet: New dwelling design stage

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	513.85	575.97	628.13	650.86	584.47	419.96	280.82	294.74	438.47	517.27	498.27	489.87	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1099.56	1068.02	971.11	819.36	631.29	425.75	281.34	295.78	460.19	694.83	917.72	1103.27	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	435.77	330.66	255.18	121.32	34.83	0	0	0	0	132.11	302	456.37	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	-----	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2068.25 (98)

Space heating requirement in kWh/m²/year

(99)	25.08
------	-------

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

(301)	0
-------	---

Fraction of space heat from community system 1 – (301) =

(302)	1
-------	---

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

(303a)	1
--------	---

Fraction of total space heat from Community boilers

(302) x (303a) =

(304a)	1
--------	---

Factor for control and charging method (Table 4c(3)) for community heating system

(305)	1
-------	---

Distribution loss factor (Table 12c) for community heating system

(306)	1.05
-------	------

Space heating

Annual space heating requirement

(307a)	2068.25
--------	---------

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

(307a)	2171.66
--------	---------

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

(308)	0
-------	---

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

(309)	0
-------	---

Water heating

Annual water heating requirement

(310a)	2126.02
--------	---------

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

(310a)	2232.32
--------	---------

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

(313)	44.04
-------	-------

Cooling System Energy Efficiency Ratio

(314)	0
-------	---

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

(315)	0
-------	---

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

(330a)	65.91
--------	-------

warm air heating system fans

(330b)	0
--------	---

pump for solar water heating

(330g)	0
--------	---

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

(331)	65.91
-------	-------

Energy for lighting (calculated in Appendix L)

(332)	357.08
-------	--------

12b. CO2 Emissions – Community heating scheme

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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DER WorkSheet: New dwelling design stage

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 98.6 (367a)

CO2 associated with heat source 1 [(307b)+(310b)] x 100 ÷ (367b) x 0 = 964.77 (367)

Electrical energy for heat distribution [(313) x 0.52 = 22.86 (372)

Total CO2 associated with community systems (363)...(366) + (368)...(372) = 987.62 (373)

CO2 associated with space heating (secondary) (309) x 0 = 0 (374)

CO2 associated with water from immersion heater or instantaneous heater (312) x 0.22 = 0 (375)

Total CO2 associated with space and water heating (373) + (374) + (375) = 987.62 (376)

CO2 associated with electricity for pumps and fans within dwelling (331)) x 0.52 = 34.21 (378)

CO2 associated with electricity for lighting (332))) x 0.52 = 185.32 (379)

Total CO2, kg/year sum of (376)...(382) = 1207.15 (383)

Dwelling CO2 Emission Rate (383) ÷ (4) = 14.64 (384)

EI rating (section 14) 87.31 (385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 6

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	82.45 (1a)	2.4 (2a)	197.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	197.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
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Additional infiltration	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
--	--------

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
---	--------

If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
--	--------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
---------------------	------------------------------------

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
-------------------	---

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
---	--------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
--	-----------

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
---------------------------	--------

Shelter factor	0.78 (20)
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Infiltration rate incorporating shelter factor	0.12 (21)
--	-----------

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			6.16	$\times 1/[1/(1.4) + 0.04] =$	8.17		(27)
Windows Type 4			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 5			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Walls	41.57	15.8	25.77	x 0.17 =	4.38		(29)
Roof	82.45	0	82.45	x 0.11 =	9.07		(30)
Total area of elements, m²			124.02				(31)
Party wall			34.2	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 34.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 742.05 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 39.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	17.63	17.44	17.25	16.3	16.11	15.16	15.16	14.97	15.54	16.11	16.49	16.87

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 57.48 57.29 57.1 56.15 55.96 55.01 55.01 54.82 55.39 55.96 56.34 56.72 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.7	0.69	0.69	0.68	0.68	0.67	0.67	0.66	0.67	0.68	0.68	0.69		
	Average = Sum(40) _{1...12} /12=												0.68	(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

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.76

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.13	99.38	95.63	91.88	88.13	84.38	84.38	88.13	91.88	95.63	99.38	103.13		
	Total = Sum(44) _{1...12} =												1125.1	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.94	133.77	138.03	120.34	115.47	99.64	92.33	105.95	107.22	124.95	136.4	148.12		
	Total = Sum(45) _{1...12} =												1475.18	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.94	20.06	20.71	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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	(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	183.69	193.31	173.84	170.75	153.14	147.61	161.23	160.71	180.23	189.89	203.4	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	208.22	183.69	193.31	173.84	170.75	153.14	147.61	161.23	160.71	180.23	189.89	203.4	
Output from water heater (annual) _{1...12}												2126.02	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	95.08	84.42	90.12	82.81	82.62	75.93	74.92	79.45	78.45	85.77	88.15	93.47	(65)
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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=	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.22	17.96	14.6	11.06	8.27	6.98	7.54	9.8	13.15	16.7	19.49	20.78	(67)
--------	-------	-------	------	-------	------	------	------	-----	-------	------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	224.48	226.81	220.94	208.45	192.67	177.85	167.94	165.61	171.48	183.98	199.75	214.58	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	(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=	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	(71)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water heating gains (Table 5)

(72)m=	127.79	125.62	121.13	115.01	111.04	105.45	100.7	106.79	108.95	115.28	122.43	125.63	(72)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	433.11	431.01	417.29	395.13	372.6	350.89	336.8	342.82	354.2	376.58	402.29	421.61	(73)
--------	--------	--------	--------	--------	-------	--------	-------	--------	-------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest _{0.9x}	0.77	x	6.16	x	36.79		0.45	x	0.71	=	50.18	(79)
Southwest _{0.9x}	0.77	x	6.16	x	62.67		0.45	x	0.71	=	85.48	(79)
Southwest _{0.9x}	0.77	x	6.16	x	85.75		0.45	x	0.71	=	116.96	(79)
Southwest _{0.9x}	0.77	x	6.16	x	106.25		0.45	x	0.71	=	144.92	(79)
Southwest _{0.9x}	0.77	x	6.16	x	119.01		0.45	x	0.71	=	162.32	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	6.16	x	118.15		0.45	x	0.71	=	161.15	(79)
Southwest	0.9x	0.77	x	6.16	x	113.91		0.45	x	0.71	=	155.36	(79)
Southwest	0.9x	0.77	x	6.16	x	104.39		0.45	x	0.71	=	142.38	(79)
Southwest	0.9x	0.77	x	6.16	x	92.85		0.45	x	0.71	=	126.64	(79)
Southwest	0.9x	0.77	x	6.16	x	69.27		0.45	x	0.71	=	94.47	(79)
Southwest	0.9x	0.77	x	6.16	x	44.07		0.45	x	0.71	=	60.11	(79)
Southwest	0.9x	0.77	x	6.16	x	31.49		0.45	x	0.71	=	42.95	(79)
West	0.9x	0.77	x	2.38	x	19.64	x	0.45	x	0.71	=	10.35	(80)
West	0.9x	0.77	x	2.42	x	19.64	x	0.45	x	0.71	=	10.52	(80)
West	0.9x	0.77	x	2.38	x	38.42	x	0.45	x	0.71	=	20.25	(80)
West	0.9x	0.77	x	2.42	x	38.42	x	0.45	x	0.71	=	20.59	(80)
West	0.9x	0.77	x	2.38	x	63.27	x	0.45	x	0.71	=	33.34	(80)
West	0.9x	0.77	x	2.42	x	63.27	x	0.45	x	0.71	=	33.9	(80)
West	0.9x	0.77	x	2.38	x	92.28	x	0.45	x	0.71	=	48.63	(80)
West	0.9x	0.77	x	2.42	x	92.28	x	0.45	x	0.71	=	49.45	(80)
West	0.9x	0.77	x	2.38	x	113.09	x	0.45	x	0.71	=	59.6	(80)
West	0.9x	0.77	x	2.42	x	113.09	x	0.45	x	0.71	=	60.6	(80)
West	0.9x	0.77	x	2.38	x	115.77	x	0.45	x	0.71	=	61.01	(80)
West	0.9x	0.77	x	2.42	x	115.77	x	0.45	x	0.71	=	62.03	(80)
West	0.9x	0.77	x	2.38	x	110.22	x	0.45	x	0.71	=	58.08	(80)
West	0.9x	0.77	x	2.42	x	110.22	x	0.45	x	0.71	=	59.06	(80)
West	0.9x	0.77	x	2.38	x	94.68	x	0.45	x	0.71	=	49.89	(80)
West	0.9x	0.77	x	2.42	x	94.68	x	0.45	x	0.71	=	50.73	(80)
West	0.9x	0.77	x	2.38	x	73.59	x	0.45	x	0.71	=	38.78	(80)
West	0.9x	0.77	x	2.42	x	73.59	x	0.45	x	0.71	=	39.43	(80)
West	0.9x	0.77	x	2.38	x	45.59	x	0.45	x	0.71	=	24.02	(80)
West	0.9x	0.77	x	2.42	x	45.59	x	0.45	x	0.71	=	24.43	(80)
West	0.9x	0.77	x	2.38	x	24.49	x	0.45	x	0.71	=	12.9	(80)
West	0.9x	0.77	x	2.42	x	24.49	x	0.45	x	0.71	=	13.12	(80)
West	0.9x	0.77	x	2.38	x	16.15	x	0.45	x	0.71	=	8.51	(80)
West	0.9x	0.77	x	2.42	x	16.15	x	0.45	x	0.71	=	8.65	(80)
Northwest	0.9x	0.77	x	2.42	x	11.28	x	0.45	x	0.71	=	6.05	(81)
Northwest	0.9x	0.77	x	2.42	x	11.28	x	0.45	x	0.71	=	6.05	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	x	0.45	x	0.71	=	12.31	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	x	0.45	x	0.71	=	12.31	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	x	0.45	x	0.71	=	22.17	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	x	0.45	x	0.71	=	22.17	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	x	0.45	x	0.71	=	36.41	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	x	0.45	x	0.71	=	36.41	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	x	0.45	x	0.71	=	48.95	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	x	0.45	x	0.71	=	48.95	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.45	x	0.71	=	52.18	(81)
Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.45	x	0.71	=	52.18	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.45	x	0.71	=	48.81	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.45	x	0.71	=	48.81	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.45	x	0.71	=	38.91	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.45	x	0.71	=	38.91	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.45	x	0.71	=	27.02	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.45	x	0.71	=	27.02	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.45	x	0.71	=	15.04	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.45	x	0.71	=	15.04	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.45	x	0.71	=	7.61	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.45	x	0.71	=	7.61	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.45	x	0.71	=	4.94	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.45	x	0.71	=	4.94	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.15	150.93	228.55	315.82	380.4	388.55	370.13	320.83	258.88	173	101.35	69.99	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	516.26	581.94	645.84	710.95	753	739.44	706.93	663.65	613.09	549.58	503.64	491.6	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.87	0.68	0.48	0.34	0.38	0.62	0.91	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.45	20.57	20.74	20.92	20.99	21	21	21	21	20.9	20.64	20.42	(87)
--------	-------	-------	-------	-------	-------	----	----	----	----	------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.34	20.35	20.35	20.36	20.36	20.37	20.37	20.37	20.37	20.36	20.36	20.35	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.95	0.84	0.64	0.43	0.29	0.33	0.56	0.88	0.98	1	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.6	19.78	20.03	20.27	20.35	20.37	20.37	20.37	20.36	20.25	19.9	19.57	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =

0.36 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.91	20.07	20.29	20.51	20.58	20.6	20.6	20.6	20.59	20.49	20.17	19.88	(92)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.91	20.07	20.29	20.51	20.58	20.6	20.6	20.6	20.59	20.49	20.17	19.88	(93)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.84	0.65	0.45	0.31	0.35	0.58	0.89	0.98	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

DER WorkSheet: New dwelling design stage

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	513.02	572.74	614.99	600.18	490.29	329.68	219.97	230.23	357.41	488.86	495.03	489.34	(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=	897.11	868.85	787.32	651.68	497.01	329.98	219.99	230.26	359.64	553.17	736.31	889.55	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	285.76	198.98	128.21	37.08	5.01	0	0	0	0	47.85	173.72	297.76	
--------	--------	--------	--------	-------	------	---	---	---	---	-------	--------	--------	--

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1174.38 (98)

Space heating requirement in kWh/m²/year

14.24 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers

1 (303a)

Fraction of total space heat from Community boilers

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

Annual space heating requirement

1174.38

Space heat from Community boilers

(98) x (304a) x (305) x (306) =

1233.1 (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

2126.02

If DHW from community scheme:

Water heat from Community boilers

(64) x (303a) x (305) x (306) =

2232.32 (310a)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

34.65 (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

184.08 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

184.08 (331)

Energy for lighting (calculated in Appendix L)

357.08 (332)

12b. CO2 Emissions – Community heating scheme

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
--------------------	-------------------------------	--------------------------

DER WorkSheet: New dwelling design stage

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

98.6 (367a)

CO2 associated with heat source 1

$[(307b) + (310b)] \times 100 \div (367b) \times$

0

= 759.16 (367)

Electrical energy for heat distribution

$[(313) \times$

0.52

= 17.99 (372)

Total CO2 associated with community systems

$(363) \dots (366) + (368) \dots (372)$

= 777.14 (373)

CO2 associated with space heating (secondary)

$(309) \times$

0

= 0 (374)

CO2 associated with water from immersion heater or instantaneous heater (312) x

0.22

= 0 (375)

Total CO2 associated with space and water heating

$(373) + (374) + (375) =$

777.14 (376)

CO2 associated with electricity for pumps and fans within dwelling (331) x

0.52

= 95.54 (378)

CO2 associated with electricity for lighting

$(332)) \times$

0.52

= 185.32 (379)

Total CO2, kg/year

sum of (376) ... (382) =

1058 (383)

Dwelling CO2 Emission Rate

$(383) \div (4) =$

12.83 (384)

EI rating (section 14)

88.88 (385)

DRAFT

Appendix C - Step Three – 'Clean' Output Document and Energy Report Figures

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 1

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour		
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)		
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)		
Number of intermittent fans							0	x 10 =	0 (7a)		
Number of passive vents							0	x 10 =	0 (7b)		
Number of flueless gas fires							0	x 40 =	0 (7c)		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)											
Number of storeys in the dwelling (ns)											0 (9)
Additional infiltration										[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction											0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35											
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0											0 (12)
If no draught lobby, enter 0.05, else enter 0											0 (13)
Percentage of windows and doors draught stripped											0 (14)
Window infiltration										0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate										(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area											3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)											0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used											
Number of sides sheltered											3 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor										(21) = (18) x (20) =	0.12 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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

	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

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=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1.5	3.225		(26)
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		(27)
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Floor			43.96	0.1	4.396		(28)
Walls	65.46	10.73	54.73	0.17	9.3		(29)
Total area of elements, m²			109.42				(31)
Party wall			65.46	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 28.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 33.3 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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DER WorkSheet: New dwelling design stage

(38)m=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
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 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84	68.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (39)

Average = Sum(39)_{1...12} /12=

68.84

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
------	------	------	------	------	------	------	------	------	------	------	------

 (40)

Average = Sum(40)_{1...12} /12=

0.78

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.6

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

95.86

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44
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 (44)

Total = Sum(44)_{1...12} =

1150.31

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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
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 (45)

Total = Sum(45)_{1...12} =

1508.23

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
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 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

Temperature factor from Table 2b

0

Energy lost from water storage, kWh/year

(48) x (49) =

110

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

If community heating see section 4.3

Volume factor from Table 2a

1.03

Temperature factor from Table 2b

0.6

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

Enter (50) or (54) in (55)

1.03

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

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
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(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
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(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2159.07

(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=	96.22	85.42	91.15	83.71	83.48	76.67	75.61	80.24	79.24	86.7	89.16	94.57
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(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=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.26	21.55	17.53	13.27	9.92	8.37	9.05	11.76	15.79	20.04	23.39	24.94
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
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(71)

Water heating gains (Table 5)

(72)m=	129.32	127.11	122.51	116.26	112.2	106.48	101.63	107.85	110.06	116.53	123.84	127.12
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	450.73	448.24	433.47	409.86	385.93	363.13	348.57	355.07	367.46	391.28	418.46	438.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Southwest0.9x	0.77	4.12	36.79	0.45	0.71	33.56	(79)
Southwest0.9x	0.77	2.23	36.79	0.45	0.71	18.17	(79)

DER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	2.23	x	36.79	0.45	x	0.71	=	18.17	(79)
Southwest0.9x	0.77	x	4.12	x	62.67	0.45	x	0.71	=	57.17	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.45	x	0.71	=	30.95	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.45	x	0.71	=	30.95	(79)
Southwest0.9x	0.77	x	4.12	x	85.75	0.45	x	0.71	=	78.23	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.45	x	0.71	=	42.34	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.45	x	0.71	=	42.34	(79)
Southwest0.9x	0.77	x	4.12	x	106.25	0.45	x	0.71	=	96.93	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.45	x	0.71	=	52.46	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.45	x	0.71	=	52.46	(79)
Southwest0.9x	0.77	x	4.12	x	119.01	0.45	x	0.71	=	108.56	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.45	x	0.71	=	58.76	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.45	x	0.71	=	58.76	(79)
Southwest0.9x	0.77	x	4.12	x	118.15	0.45	x	0.71	=	107.78	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.45	x	0.71	=	58.34	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.45	x	0.71	=	58.34	(79)
Southwest0.9x	0.77	x	4.12	x	113.91	0.45	x	0.71	=	103.91	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.45	x	0.71	=	56.24	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.45	x	0.71	=	56.24	(79)
Southwest0.9x	0.77	x	4.12	x	104.39	0.45	x	0.71	=	95.23	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.45	x	0.71	=	51.54	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.45	x	0.71	=	51.54	(79)
Southwest0.9x	0.77	x	4.12	x	92.85	0.45	x	0.71	=	84.7	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.45	x	0.71	=	45.85	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.45	x	0.71	=	45.85	(79)
Southwest0.9x	0.77	x	4.12	x	69.27	0.45	x	0.71	=	63.19	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.45	x	0.71	=	34.2	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.45	x	0.71	=	34.2	(79)
Southwest0.9x	0.77	x	4.12	x	44.07	0.45	x	0.71	=	40.2	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.45	x	0.71	=	21.76	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.45	x	0.71	=	21.76	(79)
Southwest0.9x	0.77	x	4.12	x	31.49	0.45	x	0.71	=	28.72	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.45	x	0.71	=	15.55	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.45	x	0.71	=	15.55	(79)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 69.9 119.06 162.91 201.85 226.09 224.45 216.4 198.31 176.39 131.59 83.72 59.82 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 520.63 567.3 596.37 611.71 612.02 587.59 564.97 553.38 543.85 522.87 502.18 498.64 (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
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DER WorkSheet: New dwelling design stage

(86)m=	1	1	0.99	0.97	0.89	0.72	0.53	0.57	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=	20.28	20.38	20.53	20.72	20.89	20.98	21	21	20.96	20.76	20.48	20.25	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.95	0.86	0.65	0.45	0.48	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=	19.3	19.44	19.66	19.93	20.16	20.25	20.27	20.27	20.24	19.99	19.58	19.25	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.64	19.77	19.97	20.21	20.42	20.51	20.53	20.53	20.49	20.26	19.9	19.6	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.64	19.77	19.97	20.21	20.42	20.51	20.53	20.53	20.49	20.26	19.9	19.6	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.95	0.86	0.67	0.48	0.51	0.77	0.95	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	518.63	562.99	586	582.72	529.38	396.58	269.46	282.66	416.16	497.97	497.7	497.2	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m × [(93)m – (96)m]

(97)m=	1056.36	1023.88	927.45	778.9	600.25	407.04	270.33	284.05	440.07	665.11	881.25	1060.33	(97)
--------	---------	---------	--------	-------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	400.07	309.71	254.04	141.25	52.73	0	0	0	0	124.36	276.15	418.97	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1977.28	(98)
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Space heating requirement in kWh/m²/year

22.49	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
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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 CHP	0.6	(303a)
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Fraction of community heat from heat source 2	0.4	(303b)
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Fraction of total space heat from Community CHP	(302) × (303a) =	0.6	(304a)
---	------------------	-----	--------

Fraction of total space heat from community heat source 2	(302) × (303b) =	0.4	(304b)
---	------------------	-----	--------

Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
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DER WorkSheet: New dwelling design stage

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

kWh/year

Annual space heating requirement

1977.28

Space heat from Community CHP

$(98) \times (304a) \times (305) \times (306) =$

1245.69 (307a)

Space heat from heat source 2

$(98) \times (304b) \times (305) \times (306) =$

830.46 (307b)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

$(98) \times (301) \times 100 \div (308) =$

0 (309)

Water heating

Annual water heating requirement

2159.07

If DHW from community scheme:

Water heat from Community CHP

$(64) \times (303a) \times (305) \times (306) =$

1360.22 (310a)

Water heat from heat source 2

$(64) \times (303b) \times (305) \times (306) =$

906.81 (310b)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

43.43 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

105.91 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

$= (330a) + (330b) + (330g) =$

105.91 (331)

Energy for lighting (calculated in Appendix L)

428.52 (332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit

34.6 (361)

Heat efficiency of CHP unit

55.6 (362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	$(307a) \times 100 \div (362) =$	2240.45	x	0.22		483.94	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	775.19	x	0.52		-402.33	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2446.43	x	0.22		528.43	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	846.47	x	0.52		-439.32	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					98.6	(367b)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$			0.22	=	380.58	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	22.54	(372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$				=	573.84	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					573.84	(376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	54.96	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	222.4	(379)
Total CO2, kg/year	sum of (376)...(382) =			851.21	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			9.68	(384)
El rating (section 14)				91.42	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 1

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour		
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)		
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)		
Number of intermittent fans							0	x 10 =	0 (7a)		
Number of passive vents							0	x 10 =	0 (7b)		
Number of flueless gas fires							0	x 40 =	0 (7c)		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)											
Number of storeys in the dwelling (ns)									0 (9)		
Additional infiltration								[(9)-1]x0.1 =	0 (10)		
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction									0 (11)		
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35											
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0									0 (12)		
If no draught lobby, enter 0.05, else enter 0									0 (13)		
Percentage of windows and doors draught stripped									0 (14)		
Window infiltration							0.25 - [0.2 x (14) ÷ 100] =		0 (15)		
Infiltration rate							(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)		
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area									3 (17)		
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)									0.15 (18)		
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used											
Number of sides sheltered									3 (19)		
Shelter factor							(20) = 1 - [0.075 x (19)] =		0.78 (20)		
Infiltration rate incorporating shelter factor							(21) = (18) x (20) =		0.12 (21)		

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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

	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.27	0.27	0.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26
---------	------	------	------	------	------	------	------	------	------	------	------	------

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.27	0.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26
--------	------	------	------	------	------	------	------	------	------	------	------	------

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1.5	3.225		(26)
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		(27)
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Floor			43.96	0.1	4.396		(28)
Walls	65.46	10.73	54.73	0.17	9.3		(29)
Total area of elements, m²			109.42				(31)
Party wall			65.46	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) =

28.3 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

Indicative Value: Medium

250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

33.3 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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DER WorkSheet: New dwelling design stage

(38)m=

19.19	18.98	18.78	17.74	17.54	16.5	16.5	16.3	16.92	17.54	17.95	18.36
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 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

52.49	52.28	52.08	51.04	50.84	49.81	49.81	49.6	50.22	50.84	51.25	51.66
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Average = Sum(39)_{1...12} /12=

50.99 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.6	0.59	0.59	0.58	0.58	0.57	0.57	0.56	0.57	0.58	0.58	0.59
-----	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} /12=

0.58 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.6 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

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=

105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Total = Sum(44)_{1...12} =

1150.31 (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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1508.23 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

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=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2159.07

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=	96.22	85.42	91.15	83.71	83.48	76.67	75.61	80.24	79.24	86.7	89.16	94.57
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(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=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.26	21.55	17.53	13.27	9.92	8.37	9.05	11.76	15.79	20.04	23.39	24.94
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	129.32	127.11	122.51	116.26	112.2	106.48	101.63	107.85	110.06	116.53	123.84	127.12
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	450.73	448.24	433.47	409.86	385.93	363.13	348.57	355.07	367.46	391.28	418.46	438.82
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Southwest0.9x	0.77	4.12	36.79	0.45	0.71	33.56	(79)
Southwest0.9x	0.77	2.23	36.79	0.45	0.71	18.17	(79)

DER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	2.23	x	36.79	0.45	x	0.71	=	18.17	(79)
Southwest0.9x	0.77	x	4.12	x	62.67	0.45	x	0.71	=	57.17	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.45	x	0.71	=	30.95	(79)
Southwest0.9x	0.77	x	2.23	x	62.67	0.45	x	0.71	=	30.95	(79)
Southwest0.9x	0.77	x	4.12	x	85.75	0.45	x	0.71	=	78.23	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.45	x	0.71	=	42.34	(79)
Southwest0.9x	0.77	x	2.23	x	85.75	0.45	x	0.71	=	42.34	(79)
Southwest0.9x	0.77	x	4.12	x	106.25	0.45	x	0.71	=	96.93	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.45	x	0.71	=	52.46	(79)
Southwest0.9x	0.77	x	2.23	x	106.25	0.45	x	0.71	=	52.46	(79)
Southwest0.9x	0.77	x	4.12	x	119.01	0.45	x	0.71	=	108.56	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.45	x	0.71	=	58.76	(79)
Southwest0.9x	0.77	x	2.23	x	119.01	0.45	x	0.71	=	58.76	(79)
Southwest0.9x	0.77	x	4.12	x	118.15	0.45	x	0.71	=	107.78	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.45	x	0.71	=	58.34	(79)
Southwest0.9x	0.77	x	2.23	x	118.15	0.45	x	0.71	=	58.34	(79)
Southwest0.9x	0.77	x	4.12	x	113.91	0.45	x	0.71	=	103.91	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.45	x	0.71	=	56.24	(79)
Southwest0.9x	0.77	x	2.23	x	113.91	0.45	x	0.71	=	56.24	(79)
Southwest0.9x	0.77	x	4.12	x	104.39	0.45	x	0.71	=	95.23	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.45	x	0.71	=	51.54	(79)
Southwest0.9x	0.77	x	2.23	x	104.39	0.45	x	0.71	=	51.54	(79)
Southwest0.9x	0.77	x	4.12	x	92.85	0.45	x	0.71	=	84.7	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.45	x	0.71	=	45.85	(79)
Southwest0.9x	0.77	x	2.23	x	92.85	0.45	x	0.71	=	45.85	(79)
Southwest0.9x	0.77	x	4.12	x	69.27	0.45	x	0.71	=	63.19	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.45	x	0.71	=	34.2	(79)
Southwest0.9x	0.77	x	2.23	x	69.27	0.45	x	0.71	=	34.2	(79)
Southwest0.9x	0.77	x	4.12	x	44.07	0.45	x	0.71	=	40.2	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.45	x	0.71	=	21.76	(79)
Southwest0.9x	0.77	x	2.23	x	44.07	0.45	x	0.71	=	21.76	(79)
Southwest0.9x	0.77	x	4.12	x	31.49	0.45	x	0.71	=	28.72	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.45	x	0.71	=	15.55	(79)
Southwest0.9x	0.77	x	2.23	x	31.49	0.45	x	0.71	=	15.55	(79)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 69.9 119.06 162.91 201.85 226.09 224.45 216.4 198.31 176.39 131.59 83.72 59.82 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 520.63 567.3 596.37 611.71 612.02 587.59 564.97 553.38 543.85 522.87 502.18 498.64 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DER WorkSheet: New dwelling design stage

(86)m=	1	0.99	0.97	0.9	0.75	0.54	0.39	0.41	0.63	0.9	0.99	1	(86)
--------	---	------	------	-----	------	------	------	------	------	-----	------	---	------

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.57	20.67	20.79	20.92	20.99	21	21	21	21	20.93	20.74	20.56	(87)
--------	-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.43	20.43	20.44	20.45	20.45	20.46	20.46	20.46	20.46	20.45	20.45	20.44	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.88	0.72	0.5	0.34	0.36	0.59	0.88	0.98	1	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.86	20	20.17	20.36	20.44	20.46	20.46	20.46	20.45	20.38	20.11	19.84	(90)
--------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.11	20.23	20.39	20.56	20.63	20.65	20.65	20.65	20.65	20.58	20.34	20.1	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.11	20.23	20.39	20.56	20.63	20.65	20.65	20.65	20.65	20.58	20.34	20.1	(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	0.99	0.96	0.89	0.73	0.51	0.36	0.38	0.6	0.89	0.98	1	(94)

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	517.32	559.08	573.93	542.59	445.71	301.08	201.8	210.94	327.45	463.14	492.85	496.29	(95)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	830.09	801.73	723.49	595.21	454.1	301.4	201.81	210.96	328.79	507.15	678.38	821.37	(97)
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	232.7	163.06	111.28	37.89	6.25	0	0	0	0	32.74	133.58	241.86	
--------	-------	--------	--------	-------	------	---	---	---	---	-------	--------	--------	--

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	959.35	(98)
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Space heating requirement in kWh/m²/year

10.91	(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 CHP	0.6	(303a)
-------------------------------------	-----	--------

Fraction of community heat from heat source 2	0.4	(303b)
---	-----	--------

Fraction of total space heat from Community CHP	(302) x (303a) =	0.6	(304a)
---	------------------	-----	--------

Fraction of total space heat from community heat source 2	(302) x (303b) =	0.4	(304b)
---	------------------	-----	--------

Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
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DER WorkSheet: New dwelling design stage

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

kWh/year

Annual space heating requirement

959.35

Space heat from Community CHP

$(98) \times (304a) \times (305) \times (306) =$

604.39 (307a)

Space heat from heat source 2

$(98) \times (304b) \times (305) \times (306) =$

402.93 (307b)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

$(98) \times (301) \times 100 \div (308) =$

0 (309)

Water heating

Annual water heating requirement

2159.07

If DHW from community scheme:

Water heat from Community CHP

$(64) \times (303a) \times (305) \times (306) =$

1360.22 (310a)

Water heat from heat source 2

$(64) \times (303b) \times (305) \times (306) =$

906.81 (310b)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

32.74 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

200.38 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

$= (330a) + (330b) + (330g) =$

200.38 (331)

Energy for lighting (calculated in Appendix L)

428.52 (332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit

34.6 (361)

Heat efficiency of CHP unit

55.6 (362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	$(307a) \times 100 \div (362) =$	1087.03	x	0.22		234.8	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	376.11	x	0.52		-195.2	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2446.43	x	0.22		528.43	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	846.47	x	0.52		-439.32	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					98.6	(367b)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$			0.22	=	286.92	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	16.99	(372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$				=	432.62	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					432.62	(376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	104	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	222.4	(379)
Total CO2, kg/year	sum of (376)...(382) =			759.02	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			8.63	(384)
El rating (section 14)				92.35	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 2

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)	
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)	
Number of intermittent fans							0	x 10 =	0 (7a)	
Number of passive vents							0	x 10 =	0 (7b)	
Number of flueless gas fires							0	x 40 =	0 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0 ÷ (5) = 0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)										
Number of storeys in the dwelling (ns)									0 (9)	
Additional infiltration								[(9)-1]x0.1 =	0 (10)	
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction									0 (11)	
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35										
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0									0 (12)	
If no draught lobby, enter 0.05, else enter 0									0 (13)	
Percentage of windows and doors draught stripped									0 (14)	
Window infiltration							0.25 - [0.2 x (14) ÷ 100] =		0 (15)	
Infiltration rate							(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)	
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area									3 (17)	
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)									0.15 (18)	
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used										
Number of sides sheltered									3 (19)	
Shelter factor							(20) = 1 - [0.075 x (19)] =		0.78 (20)	
Infiltration rate incorporating shelter factor							(21) = (18) x (20) =		0.12 (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

	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

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=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1.5	3.225		(26)
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		(27)
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		(27)
Floor			43.96	0.1	4.396		(28)
Walls	28.71	10.73	17.98	0.17	3.06		(29)
Total area of elements, m²			72.67				(31)
Party wall			102.21	0	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

22.05 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

Indicative Value: Medium

250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

3.75 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

25.8 (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=

35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34	61.34
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Average = Sum(39)_{1...12} /12=

61.34 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Average = Sum(40)_{1...12} /12=

0.7 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.6 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.86 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Total = Sum(44)_{1...12} =

1150.31 (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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1508.23 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

(48) x (49) =

110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a

1.03 (52)

Temperature factor from Table 2b

0.6 (53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03 (54)

Enter (50) or (54) in (55)

1.03 (55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (57)

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=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2159.07

(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m=	96.22	85.42	91.15	83.71	83.48	76.67	75.61	80.24	79.24	86.7	89.16	94.57
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(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=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.26	21.55	17.53	13.27	9.92	8.37	9.05	11.76	15.79	20.04	23.39	24.94
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

(71)

Water heating gains (Table 5)

(72)m=	129.32	127.11	122.51	116.26	112.2	106.48	101.63	107.85	110.06	116.53	123.84	127.12
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	450.73	448.24	433.47	409.86	385.93	363.13	348.57	355.07	367.46	391.28	418.46	438.82
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(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Northwest 0.9x	0.77	4.12	11.28	0.45	0.71	10.29	(81)
Northwest 0.9x	0.77	2.23	11.28	0.45	0.71	5.57	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.23	x	11.28	x	0.45	x	0.71	=	5.57	(81)
Northwest 0.9x	0.77	x	4.12	x	22.97	x	0.45	x	0.71	=	20.95	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.45	x	0.71	=	11.34	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.45	x	0.71	=	11.34	(81)
Northwest 0.9x	0.77	x	4.12	x	41.38	x	0.45	x	0.71	=	37.75	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.45	x	0.71	=	20.43	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.45	x	0.71	=	20.43	(81)
Northwest 0.9x	0.77	x	4.12	x	67.96	x	0.45	x	0.71	=	61.99	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.45	x	0.71	=	33.55	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.45	x	0.71	=	33.55	(81)
Northwest 0.9x	0.77	x	4.12	x	91.35	x	0.45	x	0.71	=	83.33	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.45	x	0.71	=	45.1	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.45	x	0.71	=	45.1	(81)
Northwest 0.9x	0.77	x	4.12	x	97.38	x	0.45	x	0.71	=	88.84	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.45	x	0.71	=	48.08	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.45	x	0.71	=	48.08	(81)
Northwest 0.9x	0.77	x	4.12	x	91.1	x	0.45	x	0.71	=	83.1	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.45	x	0.71	=	44.98	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.45	x	0.71	=	44.98	(81)
Northwest 0.9x	0.77	x	4.12	x	72.63	x	0.45	x	0.71	=	66.25	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.45	x	0.71	=	35.86	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.45	x	0.71	=	35.86	(81)
Northwest 0.9x	0.77	x	4.12	x	50.42	x	0.45	x	0.71	=	45.99	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.45	x	0.71	=	24.9	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.45	x	0.71	=	24.9	(81)
Northwest 0.9x	0.77	x	4.12	x	28.07	x	0.45	x	0.71	=	25.6	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.45	x	0.71	=	13.86	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.45	x	0.71	=	13.86	(81)
Northwest 0.9x	0.77	x	4.12	x	14.2	x	0.45	x	0.71	=	12.95	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.45	x	0.71	=	7.01	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.45	x	0.71	=	7.01	(81)
Northwest 0.9x	0.77	x	4.12	x	9.21	x	0.45	x	0.71	=	8.41	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.45	x	0.71	=	4.55	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.45	x	0.71	=	4.55	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	21.43	43.63	78.61	129.1	173.53	185	173.07	137.97	95.79	53.32	26.97	17.5	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	472.16	491.87	512.08	538.96	559.46	548.14	521.64	493.04	463.24	444.6	445.43	456.32	(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
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DER WorkSheet: New dwelling design stage

(86)m=	1	1	0.99	0.97	0.89	0.7	0.52	0.57	0.84	0.98	1	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.36	20.42	20.56	20.75	20.92	20.99	21	21	20.96	20.76	20.52	20.33	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	20.34	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.86	0.63	0.44	0.49	0.79	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.47	19.56	19.76	20.03	20.26	20.34	20.34	20.34	20.31	20.06	19.71	19.43	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.78	19.87	20.04	20.29	20.49	20.57	20.58	20.58	20.54	20.31	20	19.75	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.78	19.87	20.04	20.29	20.49	20.57	20.58	20.58	20.54	20.31	20	19.75	(93)
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8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.96	0.87	0.66	0.47	0.52	0.8	0.97	0.99	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	471.02	489.92	507.12	519.94	485.27	360.33	243.5	255.29	372.03	431.46	443	455.47	(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 × [(93)m – (96)m]

(97)m=	949.86	918.23	830.83	698.54	539.37	366.09	243.89	256.12	395.13	595.67	791.45	953.97	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	356.26	287.83	240.84	128.59	40.25	0	0	0	0	122.17	250.89	370.89	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	1797.72	(98)
---	---------	------

Space heating requirement in kWh/m²/year

20.45	(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 CHP

0.6	(303a)
-----	--------

Fraction of community heat from heat source 2

0.4	(303b)
-----	--------

Fraction of total space heat from Community CHP

(302) × (303a) =	0.6	(304a)
------------------	-----	--------

Fraction of total space heat from community heat source 2

(302) × (303b) =	0.4	(304b)
------------------	-----	--------

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
---	-------

DER WorkSheet: New dwelling design stage

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

kWh/year

Annual space heating requirement

1797.72

Space heat from Community CHP

$(98) \times (304a) \times (305) \times (306) =$

1132.56 (307a)

Space heat from heat source 2

$(98) \times (304b) \times (305) \times (306) =$

755.04 (307b)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

$(98) \times (301) \times 100 \div (308) =$

0 (309)

Water heating

Annual water heating requirement

2159.07

If DHW from community scheme:

Water heat from Community CHP

$(64) \times (303a) \times (305) \times (306) =$

1360.22 (310a)

Water heat from heat source 2

$(64) \times (303b) \times (305) \times (306) =$

906.81 (310b)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

41.55 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

105.91 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

$= (330a) + (330b) + (330g) =$

105.91 (331)

Energy for lighting (calculated in Appendix L)

428.52 (332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit

34.6 (361)

Heat efficiency of CHP unit

55.6 (362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	$(307a) \times 100 \div (362) =$	2036.98	x	0.22		439.99	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	704.8	x	0.52		-365.79	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2446.43	x	0.22		528.43	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	846.47	x	0.52		-439.32	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					98.6	(367b)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$			0.22	=	364.06	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	21.56	(372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$				=	548.93	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					548.93	(376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	54.96	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	222.4	(379)
Total CO2, kg/year	sum of (376)...(382) =			826.3	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			9.4	(384)
El rating (section 14)				91.67	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 2

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	43.96 (1a)	x	2.4 (2a)	=	105.5 (3a)
First floor	43.96 (1b)	x	2.5 (2b)	=	109.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	87.92 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.4 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour		
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)		
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)		
Number of intermittent fans							0	x 10 =	0 (7a)		
Number of passive vents							0	x 10 =	0 (7b)		
Number of flueless gas fires							0	x 40 =	0 (7c)		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										0 ÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)											
Number of storeys in the dwelling (ns)											0 (9)
Additional infiltration										[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction											0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35											
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0											0 (12)
If no draught lobby, enter 0.05, else enter 0											0 (13)
Percentage of windows and doors draught stripped											0 (14)
Window infiltration										0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate										(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area											3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)											0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used											
Number of sides sheltered											3 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor										(21) = (18) x (20) =	0.12 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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

	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
--	------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.27	0.27	0.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26
---------	------	------	------	------	------	------	------	------	------	------	------	------

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.27	0.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26
--------	------	------	------	------	------	------	------	------	------	------	------	------

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.15	1.5	3.225		
Windows Type 1			4.12	$\times 1/[1/(1.4) + 0.04]$	5.46		
Windows Type 2			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		
Windows Type 3			2.23	$\times 1/[1/(1.4) + 0.04]$	2.96		
Floor			43.96	0.1	4.396		
Walls	28.71	10.73	17.98	0.17	3.06		
Total area of elements, m²			72.67				
Party wall			102.21	0	0		

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

22.05 (33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

Indicative Value: Medium

250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

3.75 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) =

25.8 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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(38)m=

19.19	18.98	18.78	17.74	17.54	16.5	16.5	16.3	16.92	17.54	17.95	18.36
-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

44.99	44.79	44.58	43.55	43.34	42.31	42.31	42.1	42.72	43.34	43.75	44.17
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

Average = Sum(39)_{1...12} /12=

43.5

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

0.51	0.51	0.51	0.5	0.49	0.48	0.48	0.48	0.49	0.49	0.5	0.5
------	------	------	-----	------	------	------	------	------	------	-----	-----

Average = Sum(40)_{1...12} /12=

0.49

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

2.6

(42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

95.86

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
105.44	101.61	97.78	93.94	90.11	86.27	86.27	90.11	93.94	97.78	101.61	105.44

Total = Sum(44)_{1...12} =

1150.31

 (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=

156.37	136.76	141.13	123.04	118.06	101.88	94.4	108.33	109.62	127.75	139.45	151.44
--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1508.23

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.46	20.51	21.17	18.46	17.71	15.28	14.16	16.25	16.44	19.16	20.92	22.72
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
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 (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=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
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(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=	211.65	186.69	196.4	176.53	173.34	155.37	149.68	163.61	163.12	183.03	192.95	206.71
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

2159.07

(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=	96.22	85.42	91.15	83.71	83.48	76.67	75.61	80.24	79.24	86.7	89.16	94.57
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(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=	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81	129.81

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	24.26	21.55	17.53	13.27	9.92	8.37	9.05	11.76	15.79	20.04	23.39	24.94
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	235.2	237.64	231.49	218.4	201.87	186.33	175.96	173.52	179.67	192.76	209.29	224.82
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98	35.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85	-103.85
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(71)

Water heating gains (Table 5)

(72)m=	129.32	127.11	122.51	116.26	112.2	106.48	101.63	107.85	110.06	116.53	123.84	127.12
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	450.73	448.24	433.47	409.86	385.93	363.13	348.57	355.07	367.46	391.28	418.46	438.82
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(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)	
Northwest 0.9x	0.77	4.12	11.28	0.45	0.71	10.29	(81)
Northwest 0.9x	0.77	2.23	11.28	0.45	0.71	5.57	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.23	x	11.28	x	0.45	x	0.71	=	5.57	(81)
Northwest 0.9x	0.77	x	4.12	x	22.97	x	0.45	x	0.71	=	20.95	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.45	x	0.71	=	11.34	(81)
Northwest 0.9x	0.77	x	2.23	x	22.97	x	0.45	x	0.71	=	11.34	(81)
Northwest 0.9x	0.77	x	4.12	x	41.38	x	0.45	x	0.71	=	37.75	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.45	x	0.71	=	20.43	(81)
Northwest 0.9x	0.77	x	2.23	x	41.38	x	0.45	x	0.71	=	20.43	(81)
Northwest 0.9x	0.77	x	4.12	x	67.96	x	0.45	x	0.71	=	61.99	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.45	x	0.71	=	33.55	(81)
Northwest 0.9x	0.77	x	2.23	x	67.96	x	0.45	x	0.71	=	33.55	(81)
Northwest 0.9x	0.77	x	4.12	x	91.35	x	0.45	x	0.71	=	83.33	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.45	x	0.71	=	45.1	(81)
Northwest 0.9x	0.77	x	2.23	x	91.35	x	0.45	x	0.71	=	45.1	(81)
Northwest 0.9x	0.77	x	4.12	x	97.38	x	0.45	x	0.71	=	88.84	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.45	x	0.71	=	48.08	(81)
Northwest 0.9x	0.77	x	2.23	x	97.38	x	0.45	x	0.71	=	48.08	(81)
Northwest 0.9x	0.77	x	4.12	x	91.1	x	0.45	x	0.71	=	83.1	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.45	x	0.71	=	44.98	(81)
Northwest 0.9x	0.77	x	2.23	x	91.1	x	0.45	x	0.71	=	44.98	(81)
Northwest 0.9x	0.77	x	4.12	x	72.63	x	0.45	x	0.71	=	66.25	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.45	x	0.71	=	35.86	(81)
Northwest 0.9x	0.77	x	2.23	x	72.63	x	0.45	x	0.71	=	35.86	(81)
Northwest 0.9x	0.77	x	4.12	x	50.42	x	0.45	x	0.71	=	45.99	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.45	x	0.71	=	24.9	(81)
Northwest 0.9x	0.77	x	2.23	x	50.42	x	0.45	x	0.71	=	24.9	(81)
Northwest 0.9x	0.77	x	4.12	x	28.07	x	0.45	x	0.71	=	25.6	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.45	x	0.71	=	13.86	(81)
Northwest 0.9x	0.77	x	2.23	x	28.07	x	0.45	x	0.71	=	13.86	(81)
Northwest 0.9x	0.77	x	4.12	x	14.2	x	0.45	x	0.71	=	12.95	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.45	x	0.71	=	7.01	(81)
Northwest 0.9x	0.77	x	2.23	x	14.2	x	0.45	x	0.71	=	7.01	(81)
Northwest 0.9x	0.77	x	4.12	x	9.21	x	0.45	x	0.71	=	8.41	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.45	x	0.71	=	4.55	(81)
Northwest 0.9x	0.77	x	2.23	x	9.21	x	0.45	x	0.71	=	4.55	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	21.43	43.63	78.61	129.1	173.53	185	173.07	137.97	95.79	53.32	26.97	17.5	(83)
--------	-------	-------	-------	-------	--------	-----	--------	--------	-------	-------	-------	------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	472.16	491.87	512.08	538.96	559.46	548.14	521.64	493.04	463.24	444.6	445.43	456.32	(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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

DER WorkSheet: New dwelling design stage

(86)m=	1	0.99	0.98	0.9	0.71	0.49	0.36	0.39	0.63	0.92	0.99	1	(86)
--------	---	------	------	-----	------	------	------	------	------	------	------	---	------

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.66	20.72	20.82	20.95	21	21	21	21	21	20.95	20.8	20.65	(87)
--------	-------	-------	-------	-------	----	----	----	----	----	-------	------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.51	20.51	20.51	20.53	20.53	20.54	20.54	20.53	20.53	20.52	20.52	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.88	0.68	0.46	0.32	0.35	0.59	0.9	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	-----	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.05	20.14	20.29	20.47	20.52	20.54	20.54	20.53	20.47	20.26	20.05	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.36	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.27	20.34	20.48	20.64	20.69	20.7	20.7	20.7	20.7	20.64	20.45	20.26	(92)
--------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.27	20.34	20.48	20.64	20.69	20.7	20.7	20.7	20.7	20.64	20.45	20.26	(93)
--------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.89	0.69	0.47	0.33	0.37	0.61	0.9	0.98	1	(94)

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	469.75	487.2	498.01	477.46	386.87	258.12	173.56	181.18	281.3	401.08	438.64	454.52	(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 × [(93)m – (96)m]

(97)m=	718.44	691.69	623.23	511.24	389.67	258.17	173.56	181.19	281.9	435.17	584.13	709.42	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	185.02	137.41	93.16	24.32	2.09	0	0	0	0	25.36	104.76	189.65	(98)
--------	--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)1...5,9...12 =	761.78	(99)
---	--------	------

Space heating requirement in kWh/m²/year

8.66	(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 CHP

0.6	(303a)
-----	--------

Fraction of community heat from heat source 2

0.4	(303b)
-----	--------

Fraction of total space heat from Community CHP

(302) × (303a) =	0.6	(304a)
------------------	-----	--------

Fraction of total space heat from community heat source 2

(302) × (303b) =	0.4	(304b)
------------------	-----	--------

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
---	-------

DER WorkSheet: New dwelling design stage

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Space heating

kWh/year

Annual space heating requirement

761.78

Space heat from Community CHP

$$(98) \times (304a) \times (305) \times (306) =$$

479.92

(307a)

Space heat from heat source 2

$$(98) \times (304b) \times (305) \times (306) =$$

319.95

(307b)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0

(308)

Space heating requirement from secondary/supplementary system

$$(98) \times (301) \times 100 \div (308) =$$

0

(309)

Water heating

Annual water heating requirement

2159.07

If DHW from community scheme:

Water heat from Community CHP

$$(64) \times (303a) \times (305) \times (306) =$$

1360.22

(310a)

Water heat from heat source 2

$$(64) \times (303b) \times (305) \times (306) =$$

906.81

(310b)

Electricity used for heat distribution

$$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$$

30.67

(313)

Cooling System Energy Efficiency Ratio

0

(314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$$= (107) \div (314) =$$

0

(315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

200.38

(330a)

warm air heating system fans

0

(330b)

pump for solar water heating

0

(330g)

Total electricity for the above, kWh/year

$$= (330a) + (330b) + (330g) =$$

200.38

(331)

Energy for lighting (calculated in Appendix L)

428.52

(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit

34.6

(361)

Heat efficiency of CHP unit

55.6

(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	$(307a) \times 100 \div (362) =$	863.16	x	0.22		186.44	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	298.65	x	0.52		-155	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2446.43	x	0.22		528.43	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	846.47	x	0.52		-439.32	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					98.6	(367b)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$			0.22	=	268.74	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	15.92	(372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$				=	405.21	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					405.21	(376)

DER WorkSheet: New dwelling design stage

CO2 associated with electricity for pumps and fans within dwelling	(331) x	0.52	=	104	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	222.4	(379)
Total CO2, kg/year	sum of (376)...(382) =			731.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			8.32	(384)
El rating (section 14)				92.62	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 3

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a) x	2.4 (2a) =	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
---	--	------------------------------------

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
--	------------------------------------

Additional infiltration	0 [(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 0.25 - [0.2 x (14) ÷ 100] =	0 (15)
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Infiltration rate	0 (8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
-------------------	---	-------------------------------------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
---	-------------------------------------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
--	--

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
---------------------------	-------------------------------------

Shelter factor	0.78 (20) = 1 - [0.075 x (19)] =
----------------	---

Infiltration rate incorporating shelter factor	0.12 (21) = (18) x (20) =
--	--

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Windows Type 4			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Walls	40.7	11.45	29.25	$\times 0.17 =$	4.97		(29)
Total area of elements, m²			40.7				(31)
Party wall			32.57	$\times 0 =$	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 20.15 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 22.15 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	50.25	50.25	50.25	50.25	50.25	50.25	50.25	50.25	50.25	50.25	50.25	50.25
Average = Sum(39) _{1...12} /12=												50.25 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71		
Average = Sum(40) _{1...12} /12=													0.71	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.27

(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

88.09

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
Total = Sum(44) _{1...12} =													1057.12	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
Total = Sum(45) _{1...12} =													1386.06	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	
Output from water heater (annual) _{1...12}												2036.9	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92	81.73	87.35	80.39	80.3	73.92	73.07	77.32	76.29	83.26	85.41	90.5	(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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.48	16.41	13.35	10.1	7.55	6.38	6.89	8.96	12.02	15.26	17.81	18.99	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	123.66	121.63	117.4	111.65	107.92	102.67	98.21	103.93	105.96	111.91	118.62	121.63	(72)
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.7	396.67	384.16	364.07	343.77	324.16	311.41	317.12	327.44	347.73	371.02	388.39	(73)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)

DER WorkSheet: New dwelling design stage

Southeast	0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast	0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast	0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast	0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast	0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast	0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast	0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southwest	0.9x	0.77	x	2.38	x	36.79		0.45	x	0.71	=	19.39	(79)
Southwest	0.9x	0.77	x	2.42	x	36.79		0.45	x	0.71	=	19.71	(79)
Southwest	0.9x	0.77	x	4.27	x	36.79		0.45	x	0.71	=	34.79	(79)
Southwest	0.9x	0.77	x	2.38	x	62.67		0.45	x	0.71	=	33.03	(79)
Southwest	0.9x	0.77	x	2.42	x	62.67		0.45	x	0.71	=	33.58	(79)
Southwest	0.9x	0.77	x	4.27	x	62.67		0.45	x	0.71	=	59.25	(79)
Southwest	0.9x	0.77	x	2.38	x	85.75		0.45	x	0.71	=	45.19	(79)
Southwest	0.9x	0.77	x	2.42	x	85.75		0.45	x	0.71	=	45.95	(79)
Southwest	0.9x	0.77	x	4.27	x	85.75		0.45	x	0.71	=	81.07	(79)
Southwest	0.9x	0.77	x	2.38	x	106.25		0.45	x	0.71	=	55.99	(79)
Southwest	0.9x	0.77	x	2.42	x	106.25		0.45	x	0.71	=	56.93	(79)
Southwest	0.9x	0.77	x	4.27	x	106.25		0.45	x	0.71	=	100.45	(79)
Southwest	0.9x	0.77	x	2.38	x	119.01		0.45	x	0.71	=	62.71	(79)
Southwest	0.9x	0.77	x	2.42	x	119.01		0.45	x	0.71	=	63.77	(79)
Southwest	0.9x	0.77	x	4.27	x	119.01		0.45	x	0.71	=	112.52	(79)
Southwest	0.9x	0.77	x	2.38	x	118.15		0.45	x	0.71	=	62.26	(79)
Southwest	0.9x	0.77	x	2.42	x	118.15		0.45	x	0.71	=	63.31	(79)
Southwest	0.9x	0.77	x	4.27	x	118.15		0.45	x	0.71	=	111.7	(79)
Southwest	0.9x	0.77	x	2.38	x	113.91		0.45	x	0.71	=	60.03	(79)
Southwest	0.9x	0.77	x	2.42	x	113.91		0.45	x	0.71	=	61.03	(79)
Southwest	0.9x	0.77	x	4.27	x	113.91		0.45	x	0.71	=	107.69	(79)
Southwest	0.9x	0.77	x	2.38	x	104.39		0.45	x	0.71	=	55.01	(79)
Southwest	0.9x	0.77	x	2.42	x	104.39		0.45	x	0.71	=	55.93	(79)
Southwest	0.9x	0.77	x	4.27	x	104.39		0.45	x	0.71	=	98.69	(79)
Southwest	0.9x	0.77	x	2.38	x	92.85		0.45	x	0.71	=	48.93	(79)
Southwest	0.9x	0.77	x	2.42	x	92.85		0.45	x	0.71	=	49.75	(79)
Southwest	0.9x	0.77	x	4.27	x	92.85		0.45	x	0.71	=	87.79	(79)
Southwest	0.9x	0.77	x	2.38	x	69.27		0.45	x	0.71	=	36.5	(79)
Southwest	0.9x	0.77	x	2.42	x	69.27		0.45	x	0.71	=	37.11	(79)
Southwest	0.9x	0.77	x	4.27	x	69.27		0.45	x	0.71	=	65.49	(79)
Southwest	0.9x	0.77	x	2.38	x	44.07		0.45	x	0.71	=	23.22	(79)
Southwest	0.9x	0.77	x	2.42	x	44.07		0.45	x	0.71	=	23.61	(79)
Southwest	0.9x	0.77	x	4.27	x	44.07		0.45	x	0.71	=	41.67	(79)
Southwest	0.9x	0.77	x	2.38	x	31.49		0.45	x	0.71	=	16.59	(79)

DER WorkSheet: New dwelling design stage

Southwest 0.9x

0.77

 x

2.42

 x

31.49

0.45

 x

0.71

 =

16.87

 (79)

Southwest 0.9x

0.77

 x

4.27

 x

31.49

0.45

 x

0.71

 =

29.77

 (79)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

93.28	158.89	217.4	269.37	301.71	299.53	288.78	264.65	235.4	175.61	111.73	79.83
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 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

491.98	555.56	601.56	633.44	645.48	623.69	600.19	581.77	562.83	523.34	482.74	468.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.95	0.86	0.71	0.51	0.37	0.4	0.61	0.88	0.98	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

20.49	20.62	20.77	20.91	20.98	21	21	21	20.99	20.91	20.68	20.46
-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33	20.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.98	0.94	0.84	0.66	0.46	0.31	0.34	0.55	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=

19.66	19.84	20.06	20.24	20.32	20.33	20.33	20.33	20.33	20.24	19.92	19.6
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (90)

fLA = Living area ÷ (4) =

0.56

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

20.13	20.27	20.45	20.61	20.69	20.7	20.7	20.7	20.7	20.61	20.34	20.08
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

20.13	20.27	20.45	20.61	20.69	20.7	20.7	20.7	20.7	20.61	20.34	20.08
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=

0.99	0.98	0.94	0.85	0.68	0.49	0.34	0.37	0.58	0.86	0.97	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

486.87	541.74	564.68	537.18	442.02	305.97	206.22	216.23	329.12	452.63	470.14	464.7
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=

795.29	772.62	701.27	588.64	451.68	306.71	206.26	216.31	331.68	503.28	665.44	797.93
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

229.47	155.15	101.62	37.06	7.18	0	0	0	0	37.68	140.62	247.93
--------	--------	--------	-------	------	---	---	---	---	-------	--------	--------

 (98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

956.71

 (98)

Space heating requirement in kWh/m²/year

13.48

 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

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)
<i>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.</i>			
Fraction of heat from Community CHP		0.6	(303a)
Fraction of community heat from heat source 2		0.4	(303b)
Fraction of total space heat from Community CHP	$(302) \times (303a) =$	0.6	(304a)
Fraction of total space heat from community heat source 2	$(302) \times (303b) =$	0.4	(304b)
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		956.71	
Space heat from Community CHP	$(98) \times (304a) \times (305) \times (306) =$	602.73	(307a)
Space heat from heat source 2	$(98) \times (304b) \times (305) \times (306) =$	401.82	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2036.9	
If DHW from community scheme:			
Water heat from Community CHP	$(64) \times (303a) \times (305) \times (306) =$	1283.24	(310a)
Water heat from heat source 2	$(64) \times (303b) \times (305) \times (306) =$	855.5	(310b)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	31.43	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		90.17	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	90.17	(331)
Energy for lighting (calculated in Appendix L)		326.3	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														</
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DER WorkSheet: New dwelling design stage

Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			98.6	(367b)
CO2 associated with heat source 2	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	=	275.44	(368)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	16.31	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	415.31	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			415.31	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	46.8	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	169.35	(379)
Total CO2, kg/year	sum of (376)...(382) =			631.46	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			8.9	(384)
EI rating (section 14)				92.7	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 3

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a)	2.4 (2a)	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
--	-------

Additional infiltration	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
--	--------

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
--	--------

Window infiltration	0 (15)
---------------------	--------

Infiltration rate	0 (16)
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Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
---	--------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
--	-----------

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
---------------------------	--------

Shelter factor	0.78 (20)
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Infiltration rate incorporating shelter factor	0.12 (21)
--	-----------

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Windows Type 4			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Walls	40.7	11.45	29.25	$\times 0.17 =$	4.97		(29)
Total area of elements, m²			40.7				(31)
Party wall			32.57	$\times 0 =$	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 20.15 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 22.15 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	15.17	15.01	14.85	14.03	13.87	13.05	13.05	12.89	13.38	13.87	14.19	14.52

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	37.33	37.16	37	36.18	36.02	35.2	35.2	35.04	35.53	36.02	36.35	36.67
Average = Sum(39) _{1...12} /12=												36.14 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.53	0.52	0.52	0.51	0.51	0.5	0.5	0.49	0.5	0.51	0.51	0.52		
Average = Sum(40) _{1...12} /12=													0.51	(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

2.27

(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

88.09

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
Total = Sum(44) _{1...12} =													1057.12	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
Total = Sum(45) _{1...12} =													1386.06	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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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	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	(62)
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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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	
Output from water heater (annual) _{1...12}												2036.9	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92	81.73	87.35	80.39	80.3	73.92	73.07	77.32	76.29	83.26	85.41	90.5	(65)
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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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.48	16.41	13.35	10.1	7.55	6.38	6.89	8.96	12.02	15.26	17.81	18.99	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	123.66	121.63	117.4	111.65	107.92	102.67	98.21	103.93	105.96	111.91	118.62	121.63	(72)
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.7	396.67	384.16	364.07	343.77	324.16	311.41	317.12	327.44	347.73	371.02	388.39	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)

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Southeast	0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast	0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast	0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast	0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast	0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast	0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast	0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southwest	0.9x	0.77	x	2.38	x	36.79		0.45	x	0.71	=	19.39	(79)
Southwest	0.9x	0.77	x	2.42	x	36.79		0.45	x	0.71	=	19.71	(79)
Southwest	0.9x	0.77	x	4.27	x	36.79		0.45	x	0.71	=	34.79	(79)
Southwest	0.9x	0.77	x	2.38	x	62.67		0.45	x	0.71	=	33.03	(79)
Southwest	0.9x	0.77	x	2.42	x	62.67		0.45	x	0.71	=	33.58	(79)
Southwest	0.9x	0.77	x	4.27	x	62.67		0.45	x	0.71	=	59.25	(79)
Southwest	0.9x	0.77	x	2.38	x	85.75		0.45	x	0.71	=	45.19	(79)
Southwest	0.9x	0.77	x	2.42	x	85.75		0.45	x	0.71	=	45.95	(79)
Southwest	0.9x	0.77	x	4.27	x	85.75		0.45	x	0.71	=	81.07	(79)
Southwest	0.9x	0.77	x	2.38	x	106.25		0.45	x	0.71	=	55.99	(79)
Southwest	0.9x	0.77	x	2.42	x	106.25		0.45	x	0.71	=	56.93	(79)
Southwest	0.9x	0.77	x	4.27	x	106.25		0.45	x	0.71	=	100.45	(79)
Southwest	0.9x	0.77	x	2.38	x	119.01		0.45	x	0.71	=	62.71	(79)
Southwest	0.9x	0.77	x	2.42	x	119.01		0.45	x	0.71	=	63.77	(79)
Southwest	0.9x	0.77	x	4.27	x	119.01		0.45	x	0.71	=	112.52	(79)
Southwest	0.9x	0.77	x	2.38	x	118.15		0.45	x	0.71	=	62.26	(79)
Southwest	0.9x	0.77	x	2.42	x	118.15		0.45	x	0.71	=	63.31	(79)
Southwest	0.9x	0.77	x	4.27	x	118.15		0.45	x	0.71	=	111.7	(79)
Southwest	0.9x	0.77	x	2.38	x	113.91		0.45	x	0.71	=	60.03	(79)
Southwest	0.9x	0.77	x	2.42	x	113.91		0.45	x	0.71	=	61.03	(79)
Southwest	0.9x	0.77	x	4.27	x	113.91		0.45	x	0.71	=	107.69	(79)
Southwest	0.9x	0.77	x	2.38	x	104.39		0.45	x	0.71	=	55.01	(79)
Southwest	0.9x	0.77	x	2.42	x	104.39		0.45	x	0.71	=	55.93	(79)
Southwest	0.9x	0.77	x	4.27	x	104.39		0.45	x	0.71	=	98.69	(79)
Southwest	0.9x	0.77	x	2.38	x	92.85		0.45	x	0.71	=	48.93	(79)
Southwest	0.9x	0.77	x	2.42	x	92.85		0.45	x	0.71	=	49.75	(79)
Southwest	0.9x	0.77	x	4.27	x	92.85		0.45	x	0.71	=	87.79	(79)
Southwest	0.9x	0.77	x	2.38	x	69.27		0.45	x	0.71	=	36.5	(79)
Southwest	0.9x	0.77	x	2.42	x	69.27		0.45	x	0.71	=	37.11	(79)
Southwest	0.9x	0.77	x	4.27	x	69.27		0.45	x	0.71	=	65.49	(79)
Southwest	0.9x	0.77	x	2.38	x	44.07		0.45	x	0.71	=	23.22	(79)
Southwest	0.9x	0.77	x	2.42	x	44.07		0.45	x	0.71	=	23.61	(79)
Southwest	0.9x	0.77	x	4.27	x	44.07		0.45	x	0.71	=	41.67	(79)
Southwest	0.9x	0.77	x	2.38	x	31.49		0.45	x	0.71	=	16.59	(79)

DER WorkSheet: New dwelling design stage

Southwest 0.9x

0.77

 x

2.42

 x

31.49

0.45

 x

0.71

 =

16.87

 (79)

Southwest 0.9x

0.77

 x

4.27

 x

31.49

0.45

 x

0.71

 =

29.77

 (79)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

93.28	158.89	217.4	269.37	301.71	299.53	288.78	264.65	235.4	175.61	111.73	79.83
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 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

491.98	555.56	601.56	633.44	645.48	623.69	600.19	581.77	562.83	523.34	482.74	468.21
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 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.98	0.94	0.85	0.69	0.52	0.36	0.26	0.28	0.44	0.71	0.93	0.98

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

20.79	20.88	20.96	21	21	21	21	21	21	20.99	20.91	20.77
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 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

20.5	20.5	20.5	20.51	20.51	20.52	20.52	20.53	20.52	20.51	20.51	20.51
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 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.97	0.93	0.83	0.66	0.49	0.33	0.23	0.25	0.41	0.68	0.91	0.98
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 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

20.22	20.36	20.46	20.51	20.51	20.52	20.52	20.53	20.52	20.51	20.41	20.2
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 (90)

fLA = Living area ÷ (4) =

0.56

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

20.54	20.65	20.74	20.78	20.78	20.79	20.79	20.79	20.79	20.78	20.69	20.52
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 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

20.54	20.65	20.74	20.78	20.78	20.79	20.79	20.79	20.79	20.78	20.69	20.52
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 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, hm:

(94)m=

0.97	0.93	0.84	0.67	0.51	0.35	0.25	0.26	0.42	0.69	0.92	0.98
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

478.57	516.43	503.67	426.98	327.03	217.87	147.47	153.82	237.57	363.58	443.87	458.71
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 (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
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 (96)

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=

606.03	585.31	526.76	429.79	327.2	217.87	147.47	153.82	237.59	366.64	493.94	598.34
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

94.82	46.29	17.18	2.02	0.12	0	0	0	0	2.27	36.05	103.88
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

302.64

 (98)

Space heating requirement in kWh/m²/year

4.26

 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

DER WorkSheet: New dwelling design stage

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)
<i>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.</i>			
Fraction of heat from Community CHP		0.6	(303a)
Fraction of community heat from heat source 2		0.4	(303b)
Fraction of total space heat from Community CHP	$(302) \times (303a) =$	0.6	(304a)
Fraction of total space heat from community heat source 2	$(302) \times (303b) =$	0.4	(304b)
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		302.64	
Space heat from Community CHP	$(98) \times (304a) \times (305) \times (306) =$	190.66	(307a)
Space heat from heat source 2	$(98) \times (304b) \times (305) \times (306) =$	127.11	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2036.9	
If DHW from community scheme:			
Water heat from Community CHP	$(64) \times (303a) \times (305) \times (306) =$	1283.24	(310a)
Water heat from heat source 2	$(64) \times (303b) \times (305) \times (306) =$	855.5	(310b)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	24.57	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		177.44	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	177.44	(331)
Energy for lighting (calculated in Appendix L)		326.3	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										</
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DER WorkSheet: New dwelling design stage

Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			98.6	(367b)
CO2 associated with heat source 2	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.22	=	215.26	(368)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	12.75	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	324.57	(373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			324.57	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331)) \times$	0.52	=	92.09	(378)
CO2 associated with electricity for lighting	$(332))) \times$	0.52	=	169.35	(379)
Total CO2, kg/year	sum of (376)...(382) =			586.01	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			8.26	(384)
EI rating (section 14)				93.23	(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 4

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a)	2.4 (2a)	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)					0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					3 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.12 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	22.56	9.07	13.49	x 0.17 =	2.29		(29)
Total area of elements, m²			22.56				(31)
Party wall			36	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 14.32 (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 0.95 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 15.27 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37 43.37
Average = Sum(39)_{1...12} /12= 43.37 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61		
Average = Sum(40) _{1...12} /12=												0.61	(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

88.09

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9	
Total = Sum(44) _{1...12} =												1057.12	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17	
Total = Sum(45) _{1...12} =												1386.06	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
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Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
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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	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	(62)
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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	(63)
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Output from water heater

(64)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	
Output from water heater (annual) _{1...12}												2036.9	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92	81.73	87.35	80.39	80.3	73.92	73.07	77.32	76.29	83.26	85.41	90.5	(65)
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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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.41	17.24	14.02	10.61	7.93	6.7	7.24	9.41	12.63	16.03	18.71	19.95	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	123.66	121.63	117.4	111.65	107.92	102.67	98.21	103.93	105.96	111.91	118.62	121.63	(72)
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.63	397.5	384.84	364.58	344.15	324.48	311.75	317.57	328.04	348.5	371.92	389.34	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.45	x	0.71	=	19.71	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.45	x	0.71	=	34.79	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.45	x	0.71	=	33.58	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.45	x	0.71	=	59.25	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.45	x	0.71	=	45.95	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.45	x	0.71	=	81.07	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.45	x	0.71	=	56.93	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.45	x	0.71	=	100.45	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.45	x	0.71	=	63.77	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.45	x	0.71	=	112.52	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.45	x	0.71	=	63.31	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.45	x	0.71	=	111.7	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.45	x	0.71	=	61.03	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.45	x	0.71	=	107.69	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.45	x	0.71	=	55.93	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.45	x	0.71	=	98.69	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.45	x	0.71	=	49.75	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.45	x	0.71	=	87.79	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.45	x	0.71	=	37.11	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.45	x	0.71	=	65.49	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.45	x	0.71	=	23.61	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.45	x	0.71	=	41.67	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.45	x	0.71	=	16.87	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.45	x	0.71	=	29.77	(77)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 73.89 125.86 172.21 213.38 239 237.27 228.75 209.64 186.47 139.1 88.5 63.23 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 473.52 523.36 557.05 577.96 583.15 561.75 540.51 527.21 514.51 487.61 460.42 452.58 (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	0.85	0.68	0.49	0.35	0.38	0.58	0.86	0.97	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.63 20.73 20.85 20.95 20.99 21 21 21 21 20.95 20.77 20.59 (87)

DER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	20.42	(88)
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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	0.45	0.31	0.33	0.53	0.83	0.97	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.92	20.07	20.23	20.36	20.41	20.42	20.42	20.42	20.42	20.37	20.14	19.87	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.56	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.31	20.43	20.57	20.69	20.74	20.74	20.74	20.74	20.74	20.69	20.49	20.27	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.31	20.43	20.57	20.69	20.74	20.74	20.74	20.74	20.74	20.69	20.49	20.27	(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	0.66	0.47	0.33	0.36	0.56	0.84	0.97	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	467.73	508.65	518.97	481.47	387.53	266.18	179.68	188.34	287.17	410.21	445.81	448.6	(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)
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Heat loss rate for mean internal temperature, Lm, W = [(39)m × ((93)m – (96)m)]

(97)m=	694.58	673.73	610.46	511.35	391.89	266.41	179.69	188.36	288.05	437.79	580.8	697.1	(97)
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Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	168.77	110.93	68.07	21.51	3.24	0	0	0	0	20.52	97.19	184.88	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	675.11	(98)
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Space heating requirement in kWh/m²/year

9.51	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
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Fraction of space heat from community system 1 – (301) =

1	(302)
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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 CHP

0.6	(303a)
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Fraction of community heat from heat source 2

0.4	(303b)
-----	--------

Fraction of total space heat from Community CHP

(302) × (303a) =

0.6	(304a)
-----	--------

Fraction of total space heat from community heat source 2

(302) × (303b) =

0.4	(304b)
-----	--------

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
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Distribution loss factor (Table 12c) for community heating system

1.05	(306)
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Space heating

Annual space heating requirement

kWh/year

675.11	
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DER WorkSheet: New dwelling design stage

Space heat from Community CHP	$(98) \times (304a) \times (305) \times (306) =$	425.32	(307a)
Space heat from heat source 2	$(98) \times (304b) \times (305) \times (306) =$	283.55	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2036.9	
If DHW from community scheme:			
Water heat from Community CHP	$(64) \times (303a) \times (305) \times (306) =$	1283.24	(310a)
Water heat from heat source 2	$(64) \times (303b) \times (305) \times (306) =$	855.5	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	28.48	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		90.17	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	90.17	(331)
Energy for lighting (calculated in Appendix L)		342.76	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		34.6	(361)
Heat efficiency of CHP unit		55.6	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	$(307a) \times 100 \div (362) =$	764.97	x	0.22		165.23	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	264.68	x	0.52		-137.37	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2307.99	x	0.22		498.53	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	798.57	x	0.52		-414.46	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					98.6	(367b)
CO2 associated with heat source 2	$[(307b)+(310b)] \times 100 \div (367b) \times$			0.22	=	249.53	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	14.78	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$				=	376.24	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					376.24	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$			0.52	=	46.8	(378)
CO2 associated with electricity for lighting	$(332) \times$			0.52	=	177.89	(379)
Total CO2, kg/year	sum of (376)...(382) =					600.93	(383)

DER WorkSheet: New dwelling design stage

Dwelling CO2 Emission Rate (383) ÷ (4) =
EI rating (section 14)

8.47

(384)

93.06

(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 4

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	70.96 (1a)	2.4 (2a)	170.3 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	170.3 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
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Additional infiltration	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
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if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
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Percentage of windows and doors draught stripped	0 (14)
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Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
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Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
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Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
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Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
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Shelter factor	0.78 (20)
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Infiltration rate incorporating shelter factor	0.12 (21)
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Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	22.56	9.07	13.49	x 0.17 =	2.29		(29)
Total area of elements, m²			22.56				(31)
Party wall			36	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 14.32 (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 0.95 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 15.27 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	15.17	15.01	14.85	14.03	13.87	13.05	13.05	12.89	13.38	13.87	14.19	14.52

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 30.45 30.28 30.12 29.3 29.14 28.32 28.32 28.16 28.65 29.14 29.47 29.79
Average = Sum(39)_{1...12} /12= 29.26 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.43	0.43	0.42	0.41	0.41	0.4	0.4	0.4	0.4	0.41	0.42	0.42		
Average = Sum(40) _{1...12} /12=													0.41	(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

88.09

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.9	93.38	89.86	86.33	82.81	79.28	79.28	82.81	86.33	89.86	93.38	96.9		
Total = Sum(44) _{1...12} =													1057.12	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.7	125.68	129.7	113.07	108.49	93.62	86.76	99.55	100.74	117.41	128.16	139.17		
Total = Sum(45) _{1...12} =													1386.06	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.85	19.45	16.96	16.27	14.04	13.01	14.93	15.11	17.61	19.22	20.88		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	198.98	175.61	184.97	166.57	163.77	147.12	142.03	154.83	154.24	172.68	181.65	194.45	
Output from water heater (annual) _{1...12}												2036.9	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	92	81.73	87.35	80.39	80.3	73.92	73.07	77.32	76.29	83.26	85.41	90.5	(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=	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	113.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.41	17.24	14.02	10.61	7.93	6.7	7.24	9.41	12.63	16.03	18.71	19.95	(67)
--------	-------	-------	-------	-------	------	-----	------	------	-------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.53	201.6	196.38	185.27	171.25	158.07	149.27	147.2	152.42	163.52	177.55	190.72	(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=	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	-90.77	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	123.66	121.63	117.4	111.65	107.92	102.67	98.21	103.93	105.96	111.91	118.62	121.63	(72)
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	399.63	397.5	384.84	364.58	344.15	324.48	311.75	317.57	328.04	348.5	371.92	389.34	(73)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.45	x	0.71	=	19.71	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.45	x	0.71	=	34.79	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.45	x	0.71	=	33.58	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.45	x	0.71	=	59.25	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.45	x	0.71	=	45.95	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.45	x	0.71	=	81.07	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.45	x	0.71	=	56.93	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.45	x	0.71	=	100.45	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.45	x	0.71	=	63.77	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.45	x	0.71	=	112.52	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.45	x	0.71	=	63.31	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.45	x	0.71	=	111.7	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.45	x	0.71	=	61.03	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.45	x	0.71	=	107.69	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.45	x	0.71	=	55.93	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.45	x	0.71	=	98.69	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.45	x	0.71	=	49.75	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.45	x	0.71	=	87.79	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.45	x	0.71	=	37.11	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.45	x	0.71	=	65.49	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.45	x	0.71	=	23.61	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.45	x	0.71	=	41.67	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.45	x	0.71	=	16.87	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.45	x	0.71	=	29.77	(77)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 73.89 125.86 172.21 213.38 239 237.27 228.75 209.64 186.47 139.1 88.5 63.23 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 473.52 523.36 557.05 577.96 583.15 561.75 540.51 527.21 514.51 487.61 460.42 452.58 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.95	0.89	0.77	0.61	0.46	0.32	0.23	0.25	0.38	0.62	0.86	0.96

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.91 20.96 20.99 21 21 21 21 21 21 21 20.98 20.9 (87)

DER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.59	20.59	20.59	20.6	20.6	20.61	20.61	20.62	20.61	20.6	20.6	20.59	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.94	0.87	0.75	0.59	0.44	0.3	0.21	0.23	0.36	0.6	0.84	0.95	(89)
--------	------	------	------	------	------	-----	------	------	------	-----	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	20.47	20.54	20.58	20.6	20.6	20.61	20.61	20.62	20.61	20.6	20.58	20.47	(90)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =	0.56	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.72	20.78	20.81	20.82	20.82	20.83	20.83	20.83	20.83	20.82	20.8	20.71	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.72	20.78	20.81	20.82	20.82	20.83	20.83	20.83	20.83	20.82	20.8	20.71	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.94	0.88	0.77	0.6	0.46	0.31	0.22	0.24	0.37	0.61	0.85	0.96	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	447.13	459.24	426.22	349.06	265.86	176.42	119.77	124.74	192.72	297.63	391.44	432.49	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	499.83	480.81	430.99	349.36	265.87	176.42	119.77	124.74	192.72	297.9	403.67	491.81	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	39.21	14.49	3.55	0.21	0.01	0	0	0	0	0.2	8.81	44.13	(98)
--------	-------	-------	------	------	------	---	---	---	---	-----	------	-------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	110.61	(98)
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Space heating requirement in kWh/m²/year

1.56	(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 CHP

0.6	(303a)
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Fraction of community heat from heat source 2

0.4	(303b)
-----	--------

Fraction of total space heat from Community CHP

(302) x (303a) =	0.6	(304a)
------------------	-----	--------

Fraction of total space heat from community heat source 2

(302) x (303b) =	0.4	(304b)
------------------	-----	--------

Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
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Distribution loss factor (Table 12c) for community heating system

1.05	(306)
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Space heating

Annual space heating requirement

kWh/year	110.61
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DER WorkSheet: New dwelling design stage

Space heat from Community CHP	$(98) \times (304a) \times (305) \times (306) =$	69.69	(307a)
Space heat from heat source 2	$(98) \times (304b) \times (305) \times (306) =$	46.46	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		2036.9	
If DHW from community scheme:			
Water heat from Community CHP	$(64) \times (303a) \times (305) \times (306) =$	1283.24	(310a)
Water heat from heat source 2	$(64) \times (303b) \times (305) \times (306) =$	855.5	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	22.55	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		177.44	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	177.44	(331)
Energy for lighting (calculated in Appendix L)		342.76	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		34.6	(361)
Heat efficiency of CHP unit		55.6	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	$(307a) \times 100 \div (362) =$	125.33	x	0.22		27.07	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	43.37	x	0.52		-22.51	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2307.99	x	0.22		498.53	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	798.57	x	0.52		-414.46	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					98.6	(367b)
CO2 associated with heat source 2	$[(307b)+(310b)] \times 100 \div (367b) \times$			0.22	=	197.59	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	11.7	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$				=	297.93	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					297.93	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$			0.52	=	92.09	(378)
CO2 associated with electricity for lighting	$(332) \times$			0.52	=	177.89	(379)
Total CO2, kg/year	sum of (376)...(382) =					567.91	(383)

DER WorkSheet: New dwelling design stage

Dwelling CO2 Emission Rate (383) ÷ (4) =
EI rating (section 14)

8

(384)

93.44

(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 5

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	63.7 (1a)	2.4 (2a)	152.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	152.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
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Additional infiltration	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
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if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
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Percentage of windows and doors draught stripped	0 (14)
--	--------

Window infiltration	0 (15)
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Infiltration rate	0 (16)
-------------------	--------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
---	--------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
--	-----------

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
---------------------------	--------

Shelter factor	0.78 (20)
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Infiltration rate incorporating shelter factor	0.12 (21)
--	-----------

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	39.36	9.07	30.29	x 0.18 =	5.45		(29)
Roof	63.7	0	63.7	x 0.11 =	7.01		(30)
Total area of elements, m²			103.06				(31)
Party wall			15.82	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 24.48 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 573.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 29.48 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23	25.23

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	54.71	54.71	54.71	54.71	54.71	54.71	54.71	54.71	54.71	54.71	54.71	54.71
Average = Sum(39) _{1...12} /12=												54.71 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86		
	Average = Sum(40) _{1...12} /12=												0.86	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.08

(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

83.7

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	92.07	88.72	85.37	82.02	78.68	75.33	75.33	78.68	82.02	85.37	88.72	92.07		
	Total = Sum(44) _{1...12} =												1004.36	(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=	136.53	119.41	123.22	107.43	103.08	88.95	82.43	94.58	95.71	111.55	121.76	132.22		
	Total = Sum(45) _{1...12} =												1316.88	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.48	17.91	18.48	16.11	15.46	13.34	12.36	14.19	14.36	16.73	18.26	19.83		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.81	169.34	178.5	160.92	158.36	142.44	137.7	149.86	149.21	166.82	175.25	187.5	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	191.81	169.34	178.5	160.92	158.36	142.44	137.7	149.86	149.21	166.82	175.25	187.5	
Output from water heater (annual) _{1...12}												1967.72	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	89.62	79.65	85.19	78.51	78.5	72.37	71.63	75.67	74.62	81.31	83.28	88.19	(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=	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.31	15.37	12.5	9.46	7.07	5.97	6.45	8.39	11.26	14.3	16.69	17.79	(67)
--------	-------	-------	------	------	------	------	------	------	-------	------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	182.17	184.06	179.3	169.16	156.36	144.32	136.29	134.4	139.16	149.3	162.1	174.13	(68)
--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	-------	-------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	(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=	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	120.45	118.52	114.51	109.05	105.5	100.52	96.27	101.71	103.64	109.29	115.67	118.53	(72)
--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	374.2	372.22	360.57	341.93	323.2	305.07	293.28	298.75	308.32	327.15	348.72	364.71	(73)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.45	x	0.71	=	19.71	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.45	x	0.71	=	34.79	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.45	x	0.71	=	33.58	(77)

DER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.45	x	0.71	=	59.25	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.45	x	0.71	=	45.95	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.45	x	0.71	=	81.07	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.45	x	0.71	=	56.93	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.45	x	0.71	=	100.45	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.45	x	0.71	=	63.77	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.45	x	0.71	=	112.52	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.45	x	0.71	=	63.31	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.45	x	0.71	=	111.7	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.45	x	0.71	=	61.03	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.45	x	0.71	=	107.69	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.45	x	0.71	=	55.93	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.45	x	0.71	=	98.69	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.45	x	0.71	=	49.75	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.45	x	0.71	=	87.79	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.45	x	0.71	=	37.11	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.45	x	0.71	=	65.49	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.45	x	0.71	=	23.61	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.45	x	0.71	=	41.67	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.45	x	0.71	=	16.87	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.45	x	0.71	=	29.77	(77)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 73.89 125.86 172.21 213.38 239 237.27 228.75 209.64 186.47 139.1 88.5 63.23 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 448.09 498.08 532.78 555.31 562.2 542.35 522.03 508.39 494.79 466.25 437.22 427.95 (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	0.93	0.82	0.63	0.46	0.49	0.73	0.93	0.99	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.27 20.4 20.57 20.77 20.92 20.99 21 21 20.97 20.79 20.49 20.23 (87)

DER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	(88)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.91	0.77	0.56	0.38	0.41	0.66	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=	19.23	19.41	19.66	19.94	20.13	20.19	20.2	20.2	20.18	19.97	19.55	19.18	(90)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.33	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.58	19.74	19.96	20.21	20.39	20.46	20.46	20.46	20.44	20.24	19.86	19.53	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.58	19.74	19.96	20.21	20.39	20.46	20.46	20.46	20.44	20.24	19.86	19.53	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.91	0.78	0.58	0.4	0.44	0.68	0.91	0.98	0.99	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	444.18	489.35	512.31	503.57	440.1	315.75	211.05	221.72	335.39	425.15	428.73	425.08	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	835.72	811.69	736.61	619.01	475.53	320.39	211.44	222.35	346.96	527.56	697.99	838.42	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	291.31	216.61	166.88	83.11	26.36	0	0	0	0	76.19	193.86	307.53	(98)
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Total per year (kWh/year) = Sum(98)1...5,9...12 =	1361.84	(98)
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Space heating requirement in kWh/m²/year

21.38	(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 CHP

0.6	(303a)
-----	--------

Fraction of community heat from heat source 2

0.4	(303b)
-----	--------

Fraction of total space heat from Community CHP

(302) x (303a) =	0.6	(304a)
------------------	-----	--------

Fraction of total space heat from community heat source 2

(302) x (303b) =	0.4	(304b)
------------------	-----	--------

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

Annual space heating requirement

kWh/year	1361.84
----------	---------

DER WorkSheet: New dwelling design stage

Space heat from Community CHP	$(98) \times (304a) \times (305) \times (306) =$	857.96	(307a)
Space heat from heat source 2	$(98) \times (304b) \times (305) \times (306) =$	571.97	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		1967.72	
If DHW from community scheme:			
Water heat from Community CHP	$(64) \times (303a) \times (305) \times (306) =$	1239.66	(310a)
Water heat from heat source 2	$(64) \times (303b) \times (305) \times (306) =$	826.44	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	34.96	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		75.16	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	75.16	(331)
Energy for lighting (calculated in Appendix L)		305.64	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		34.6	(361)
Heat efficiency of CHP unit		55.6	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	$(307a) \times 100 \div (362) =$	1543.1	x	0.22		333.31	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	533.91	x	0.52		-277.1	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2229.61	x	0.22		481.6	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	771.45	x	0.52		-400.38	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					98.6	(367b)
CO2 associated with heat source 2	$[(307b)+(310b)] \times 100 \div (367b) \times$			0.22	=	306.35	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	18.14	(372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$				=	461.92	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					461.92	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$			0.52	=	39.01	(378)
CO2 associated with electricity for lighting	$(332) \times$			0.52	=	158.63	(379)
Total CO2, kg/year	sum of (376)...(382) =					659.56	(383)

DER WorkSheet: New dwelling design stage

Dwelling CO2 Emission Rate (383) ÷ (4) =
EI rating (section 14)

10.35

(384)

91.87

(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 5

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	63.7 (1a)	2.4 (2a)	152.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	152.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
---	--	------------------------------------

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) (9)

Additional infiltration [(9)-1]x0.1 = (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (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 (12)

If no draught lobby, enter 0.05, else enter 0 (13)

Percentage of windows and doors draught stripped (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered (19)

Shelter factor (20) = 1 - [0.075 x (19)] = (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			4.27	$\times 1/[1/(1.4) + 0.04] =$	5.66		(27)
Walls	39.36	9.07	30.29	x 0.18 =	5.45		(29)
Roof	63.7	0	63.7	x 0.11 =	7.01		(30)
Total area of elements, m²			103.06				(31)
Party wall			15.82	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 24.48 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 573.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 29.48 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	13.62	13.47	13.33	12.59	12.45	11.71	11.71	11.57	12.01	12.45	12.74	13.03

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	43.1	42.96	42.81	42.08	41.93	41.2	41.2	41.05	41.49	41.93	42.22	42.52
Average = Sum(39) _{1...12} /12=												42.04

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.68	0.67	0.67	0.66	0.66	0.65	0.65	0.64	0.65	0.66	0.66	0.67		
	Average = Sum(40) _{1...12} /12=												0.66	(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

2.08

(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

83.7

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	92.07	88.72	85.37	82.02	78.68	75.33	75.33	78.68	82.02	85.37	88.72	92.07		
	Total = Sum(44) _{1...12} =												1004.36	(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=	136.53	119.41	123.22	107.43	103.08	88.95	82.43	94.58	95.71	111.55	121.76	132.22		
	Total = Sum(45) _{1...12} =												1316.88	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.48	17.91	18.48	16.11	15.46	13.34	12.36	14.19	14.36	16.73	18.26	19.83		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.81	169.34	178.5	160.92	158.36	142.44	137.7	149.86	149.21	166.82	175.25	187.5	(62)
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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	(63)
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Output from water heater

(64)m=	191.81	169.34	178.5	160.92	158.36	142.44	137.7	149.86	149.21	166.82	175.25	187.5	
Output from water heater (annual) _{1...12}												1967.72	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	89.62	79.65	85.19	78.51	78.5	72.37	71.63	75.67	74.62	81.31	83.28	88.19	(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=	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	104.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.31	15.37	12.5	9.46	7.07	5.97	6.45	8.39	11.26	14.3	16.69	17.79	(67)
--------	-------	-------	------	------	------	------	------	------	-------	------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	182.17	184.06	179.3	169.16	156.36	144.32	136.29	134.4	139.16	149.3	162.1	174.13	(68)
--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	-------	-------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	(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=	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	-83.36	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	120.45	118.52	114.51	109.05	105.5	100.52	96.27	101.71	103.64	109.29	115.67	118.53	(72)
--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	374.2	372.22	360.57	341.93	323.2	305.07	293.28	298.75	308.32	327.15	348.72	364.71	(73)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.38	x	36.79	x	0.45	x	0.71	=	19.39	(77)
Southeast 0.9x	0.77	x	2.42	x	36.79	x	0.45	x	0.71	=	19.71	(77)
Southeast 0.9x	0.77	x	4.27	x	36.79	x	0.45	x	0.71	=	34.79	(77)
Southeast 0.9x	0.77	x	2.38	x	62.67	x	0.45	x	0.71	=	33.03	(77)
Southeast 0.9x	0.77	x	2.42	x	62.67	x	0.45	x	0.71	=	33.58	(77)

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Southeast 0.9x	0.77	x	4.27	x	62.67	x	0.45	x	0.71	=	59.25	(77)
Southeast 0.9x	0.77	x	2.38	x	85.75	x	0.45	x	0.71	=	45.19	(77)
Southeast 0.9x	0.77	x	2.42	x	85.75	x	0.45	x	0.71	=	45.95	(77)
Southeast 0.9x	0.77	x	4.27	x	85.75	x	0.45	x	0.71	=	81.07	(77)
Southeast 0.9x	0.77	x	2.38	x	106.25	x	0.45	x	0.71	=	55.99	(77)
Southeast 0.9x	0.77	x	2.42	x	106.25	x	0.45	x	0.71	=	56.93	(77)
Southeast 0.9x	0.77	x	4.27	x	106.25	x	0.45	x	0.71	=	100.45	(77)
Southeast 0.9x	0.77	x	2.38	x	119.01	x	0.45	x	0.71	=	62.71	(77)
Southeast 0.9x	0.77	x	2.42	x	119.01	x	0.45	x	0.71	=	63.77	(77)
Southeast 0.9x	0.77	x	4.27	x	119.01	x	0.45	x	0.71	=	112.52	(77)
Southeast 0.9x	0.77	x	2.38	x	118.15	x	0.45	x	0.71	=	62.26	(77)
Southeast 0.9x	0.77	x	2.42	x	118.15	x	0.45	x	0.71	=	63.31	(77)
Southeast 0.9x	0.77	x	4.27	x	118.15	x	0.45	x	0.71	=	111.7	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.45	x	0.71	=	60.03	(77)
Southeast 0.9x	0.77	x	2.42	x	113.91	x	0.45	x	0.71	=	61.03	(77)
Southeast 0.9x	0.77	x	4.27	x	113.91	x	0.45	x	0.71	=	107.69	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.45	x	0.71	=	55.01	(77)
Southeast 0.9x	0.77	x	2.42	x	104.39	x	0.45	x	0.71	=	55.93	(77)
Southeast 0.9x	0.77	x	4.27	x	104.39	x	0.45	x	0.71	=	98.69	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.45	x	0.71	=	48.93	(77)
Southeast 0.9x	0.77	x	2.42	x	92.85	x	0.45	x	0.71	=	49.75	(77)
Southeast 0.9x	0.77	x	4.27	x	92.85	x	0.45	x	0.71	=	87.79	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.45	x	0.71	=	36.5	(77)
Southeast 0.9x	0.77	x	2.42	x	69.27	x	0.45	x	0.71	=	37.11	(77)
Southeast 0.9x	0.77	x	4.27	x	69.27	x	0.45	x	0.71	=	65.49	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	x	0.45	x	0.71	=	23.22	(77)
Southeast 0.9x	0.77	x	2.42	x	44.07	x	0.45	x	0.71	=	23.61	(77)
Southeast 0.9x	0.77	x	4.27	x	44.07	x	0.45	x	0.71	=	41.67	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	x	0.45	x	0.71	=	16.59	(77)
Southeast 0.9x	0.77	x	2.42	x	31.49	x	0.45	x	0.71	=	16.87	(77)
Southeast 0.9x	0.77	x	4.27	x	31.49	x	0.45	x	0.71	=	29.77	(77)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 73.89 125.86 172.21 213.38 239 237.27 228.75 209.64 186.47 139.1 88.5 63.23 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 448.09 498.08 532.78 555.31 562.2 542.35 522.03 508.39 494.79 466.25 437.22 427.95 (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	0.85	0.68	0.49	0.35	0.37	0.58	0.86	0.97	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.55 20.67 20.81 20.94 20.99 21 21 21 21 20.94 20.74 20.53 (87)

DER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.36	20.36	20.37	20.38	20.38	20.39	20.39	20.39	20.38	20.38	20.37	20.37	(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	0.44	0.3	0.32	0.53	0.82	0.97	0.99	(89)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.77	19.94	20.13	20.31	20.37	20.39	20.39	20.39	20.38	20.32	20.05	19.75	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.33	(91)
---------------------------	------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.03	20.18	20.36	20.52	20.57	20.59	20.59	20.59	20.59	20.52	20.28	20.01	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.03	20.18	20.36	20.52	20.57	20.59	20.59	20.59	20.59	20.52	20.28	20.01	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.82	0.65	0.45	0.31	0.34	0.54	0.83	0.96	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	442.03	483.07	494.97	457.91	367.38	246.53	164.37	172.04	268.2	388.15	421.77	423.54	(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=	678.02	656.34	593.17	488.74	372.06	246.75	164.38	172.06	269.08	416.08	556.3	672.01	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	175.58	116.44	73.06	22.2	3.48	0	0	0	0	20.78	96.87	184.86	(98)
--------	--------	--------	-------	------	------	---	---	---	---	-------	-------	--------	------

Total per year (kWh/year) = Sum(98)1...5,9...12 =	693.26	(98)
---	--------	------

Space heating requirement in kWh/m²/year

10.88	(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 CHP

0.6	(303a)
-----	--------

Fraction of community heat from heat source 2

0.4	(303b)
-----	--------

Fraction of total space heat from Community CHP

(302) x (303a) =	0.6	(304a)
------------------	-----	--------

Fraction of total space heat from community heat source 2

(302) x (303b) =	0.4	(304b)
------------------	-----	--------

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

Annual space heating requirement

kWh/year	693.26
----------	--------

DER WorkSheet: New dwelling design stage

Space heat from Community CHP	$(98) \times (304a) \times (305) \times (306) =$	436.75	(307a)
Space heat from heat source 2	$(98) \times (304b) \times (305) \times (306) =$	291.17	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)

Water heating

Annual water heating requirement		1967.72	
If DHW from community scheme:			
Water heat from Community CHP	$(64) \times (303a) \times (305) \times (306) =$	1239.66	(310a)
Water heat from heat source 2	$(64) \times (303b) \times (305) \times (306) =$	826.44	(310b)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	27.94	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		142.22	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	142.22	(331)
Energy for lighting (calculated in Appendix L)		305.64	(332)

12b. CO2 Emissions – Community heating scheme

Electrical efficiency of CHP unit		34.6	(361)
Heat efficiency of CHP unit		55.6	(362)

		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating from CHP)	$(307a) \times 100 \div (362) =$	785.53	x	0.22		169.67	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	271.79	x	0.52		-141.06	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2229.61	x	0.22		481.6	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	771.45	x	0.52		-400.38	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel					98.6	(367b)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$			0.22	=	244.83	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	14.5	(372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$				=	369.16	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					369.16	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$			0.52	=	73.81	(378)
CO2 associated with electricity for lighting	$(332) \times$			0.52	=	158.63	(379)
Total CO2, kg/year	sum of (376) ... (382) =					601.6	(383)

DER WorkSheet: New dwelling design stage

Dwelling CO2 Emission Rate (383) ÷ (4) =
EI rating (section 14)

9.44

(384)

92.58

(385)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 6

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	82.45 (1a)	2.4 (2a)	197.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	197.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0 (9)
--	-------

Additional infiltration	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
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if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
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Window infiltration	0 (15)
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Infiltration rate	0 (16)
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Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
---	--------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
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Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	3 (19)
---------------------------	--------

Shelter factor	0.78 (20)
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Infiltration rate incorporating shelter factor	0.12 (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

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			6.16	$\times 1/[1/(1.4) + 0.04] =$	8.17		(27)
Windows Type 4			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 5			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Walls	41.57	15.8	25.77	x 0.17 =	4.38		(29)
Roof	82.45	0	82.45	x 0.11 =	9.07		(30)
Total area of elements, m²			124.02				(31)
Party wall			34.2	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 34.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 742.05 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 39.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65	32.65

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 72.5 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88		
Average = Sum(40) _{1...12} /12=													0.88	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.76

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.13	99.38	95.63	91.88	88.13	84.38	84.38	88.13	91.88	95.63	99.38	103.13		
Total = Sum(44) _{1...12} =													1125.1	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.94	133.77	138.03	120.34	115.47	99.64	92.33	105.95	107.22	124.95	136.4	148.12		
Total = Sum(45) _{1...12} =													1475.18	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.94	20.06	20.71	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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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	(61)
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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	183.69	193.31	173.84	170.75	153.14	147.61	161.23	160.71	180.23	189.89	203.4	(62)
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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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	208.22	183.69	193.31	173.84	170.75	153.14	147.61	161.23	160.71	180.23	189.89	203.4	
Output from water heater (annual) _{1...12}												2126.02	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	95.08	84.42	90.12	82.81	82.62	75.93	74.92	79.45	78.45	85.77	88.15	93.47	(65)
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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=	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.22	17.96	14.6	11.06	8.27	6.98	7.54	9.8	13.15	16.7	19.49	20.78	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	224.48	226.81	220.94	208.45	192.67	177.85	167.94	165.61	171.48	183.98	199.75	214.58	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	(71)
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Water heating gains (Table 5)

(72)m=	127.79	125.62	121.13	115.01	111.04	105.45	100.7	106.79	108.95	115.28	122.43	125.63	(72)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	433.11	431.01	417.29	395.13	372.6	350.89	336.8	342.82	354.2	376.58	402.29	421.61	(73)
--------	--------	--------	--------	--------	-------	--------	-------	--------	-------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest _{0.9x}	0.77	x	6.16	x	36.79		0.45	x	0.71	=	50.18	(79)
Southwest _{0.9x}	0.77	x	6.16	x	62.67		0.45	x	0.71	=	85.48	(79)
Southwest _{0.9x}	0.77	x	6.16	x	85.75		0.45	x	0.71	=	116.96	(79)
Southwest _{0.9x}	0.77	x	6.16	x	106.25		0.45	x	0.71	=	144.92	(79)
Southwest _{0.9x}	0.77	x	6.16	x	119.01		0.45	x	0.71	=	162.32	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	6.16	x	118.15		0.45	x	0.71	=	161.15	(79)
Southwest	0.9x	0.77	x	6.16	x	113.91		0.45	x	0.71	=	155.36	(79)
Southwest	0.9x	0.77	x	6.16	x	104.39		0.45	x	0.71	=	142.38	(79)
Southwest	0.9x	0.77	x	6.16	x	92.85		0.45	x	0.71	=	126.64	(79)
Southwest	0.9x	0.77	x	6.16	x	69.27		0.45	x	0.71	=	94.47	(79)
Southwest	0.9x	0.77	x	6.16	x	44.07		0.45	x	0.71	=	60.11	(79)
Southwest	0.9x	0.77	x	6.16	x	31.49		0.45	x	0.71	=	42.95	(79)
West	0.9x	0.77	x	2.38	x	19.64	x	0.45	x	0.71	=	10.35	(80)
West	0.9x	0.77	x	2.42	x	19.64	x	0.45	x	0.71	=	10.52	(80)
West	0.9x	0.77	x	2.38	x	38.42	x	0.45	x	0.71	=	20.25	(80)
West	0.9x	0.77	x	2.42	x	38.42	x	0.45	x	0.71	=	20.59	(80)
West	0.9x	0.77	x	2.38	x	63.27	x	0.45	x	0.71	=	33.34	(80)
West	0.9x	0.77	x	2.42	x	63.27	x	0.45	x	0.71	=	33.9	(80)
West	0.9x	0.77	x	2.38	x	92.28	x	0.45	x	0.71	=	48.63	(80)
West	0.9x	0.77	x	2.42	x	92.28	x	0.45	x	0.71	=	49.45	(80)
West	0.9x	0.77	x	2.38	x	113.09	x	0.45	x	0.71	=	59.6	(80)
West	0.9x	0.77	x	2.42	x	113.09	x	0.45	x	0.71	=	60.6	(80)
West	0.9x	0.77	x	2.38	x	115.77	x	0.45	x	0.71	=	61.01	(80)
West	0.9x	0.77	x	2.42	x	115.77	x	0.45	x	0.71	=	62.03	(80)
West	0.9x	0.77	x	2.38	x	110.22	x	0.45	x	0.71	=	58.08	(80)
West	0.9x	0.77	x	2.42	x	110.22	x	0.45	x	0.71	=	59.06	(80)
West	0.9x	0.77	x	2.38	x	94.68	x	0.45	x	0.71	=	49.89	(80)
West	0.9x	0.77	x	2.42	x	94.68	x	0.45	x	0.71	=	50.73	(80)
West	0.9x	0.77	x	2.38	x	73.59	x	0.45	x	0.71	=	38.78	(80)
West	0.9x	0.77	x	2.42	x	73.59	x	0.45	x	0.71	=	39.43	(80)
West	0.9x	0.77	x	2.38	x	45.59	x	0.45	x	0.71	=	24.02	(80)
West	0.9x	0.77	x	2.42	x	45.59	x	0.45	x	0.71	=	24.43	(80)
West	0.9x	0.77	x	2.38	x	24.49	x	0.45	x	0.71	=	12.9	(80)
West	0.9x	0.77	x	2.42	x	24.49	x	0.45	x	0.71	=	13.12	(80)
West	0.9x	0.77	x	2.38	x	16.15	x	0.45	x	0.71	=	8.51	(80)
West	0.9x	0.77	x	2.42	x	16.15	x	0.45	x	0.71	=	8.65	(80)
Northwest	0.9x	0.77	x	2.42	x	11.28	x	0.45	x	0.71	=	6.05	(81)
Northwest	0.9x	0.77	x	2.42	x	11.28	x	0.45	x	0.71	=	6.05	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	x	0.45	x	0.71	=	12.31	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	x	0.45	x	0.71	=	12.31	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	x	0.45	x	0.71	=	22.17	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	x	0.45	x	0.71	=	22.17	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	x	0.45	x	0.71	=	36.41	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	x	0.45	x	0.71	=	36.41	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	x	0.45	x	0.71	=	48.95	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	x	0.45	x	0.71	=	48.95	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.45	x	0.71	=	52.18	(81)
Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.45	x	0.71	=	52.18	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.45	x	0.71	=	48.81	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.45	x	0.71	=	48.81	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.45	x	0.71	=	38.91	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.45	x	0.71	=	38.91	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.45	x	0.71	=	27.02	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.45	x	0.71	=	27.02	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.45	x	0.71	=	15.04	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.45	x	0.71	=	15.04	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.45	x	0.71	=	7.61	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.45	x	0.71	=	7.61	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.45	x	0.71	=	4.94	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.45	x	0.71	=	4.94	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.15	150.93	228.55	315.82	380.4	388.55	370.13	320.83	258.88	173	101.35	69.99	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	516.26	581.94	645.84	710.95	753	739.44	706.93	663.65	613.09	549.58	503.64	491.6	(84)
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	-------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.81	0.61	0.45	0.5	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=	20.17	20.29	20.5	20.75	20.92	20.99	21	21	20.96	20.73	20.39	20.13	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	20.19	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.76	0.54	0.37	0.41	0.69	0.94	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.07	19.25	19.55	19.89	20.11	20.18	20.18	20.18	20.15	19.87	19.4	19.01	(90)
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fLA = Living area ÷ (4) =

0.36 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.47	19.63	19.9	20.2	20.41	20.47	20.48	20.48	20.45	20.18	19.76	19.42	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.47	19.63	19.9	20.2	20.41	20.47	20.48	20.48	20.45	20.18	19.76	19.42	(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	0.78	0.57	0.4	0.44	0.72	0.94	0.99	1	(94)
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DER WorkSheet: New dwelling design stage

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	513.85	575.97	628.13	650.86	584.47	419.96	280.82	294.74	438.47	517.27	498.27	489.87	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1099.56	1068.02	971.11	819.36	631.29	425.75	281.34	295.78	460.19	694.83	917.72	1103.27	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	435.77	330.66	255.18	121.32	34.83	0	0	0	0	132.11	302	456.37	(98)
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Total per year (kWh/year) = Sum(98)_{1...59...12} = 2068.25 (98)

Space heating requirement in kWh/m²/year

(99)	25.08	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

(301)	0	(301)
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Fraction of space heat from community system 1 – (301) =

(302)	1	(302)
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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 CHP

(303a)	0.6	(303a)
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Fraction of community heat from heat source 2

(303b)	0.4	(303b)
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Fraction of total space heat from Community CHP

(304a)	(302) x (303a) = 0.6	(304a)
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Fraction of total space heat from community heat source 2

(304b)	(302) x (303b) = 0.4	(304b)
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Factor for control and charging method (Table 4c(3)) for community heating system

(305)	1	(305)
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Distribution loss factor (Table 12c) for community heating system

(306)	1.05	(306)
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Space heating

kWh/year

Annual space heating requirement

	2068.25	
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Space heat from Community CHP

(307a)	(98) x (304a) x (305) x (306) = 1303	(307a)
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Space heat from heat source 2

(307b)	(98) x (304b) x (305) x (306) = 868.66	(307b)
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Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

(308)	0	(308)
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Space heating requirement from secondary/supplementary system

(309)	(98) x (301) x 100 ÷ (308) = 0	(309)
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Water heating

Annual water heating requirement

	2126.02	
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If DHW from community scheme:

Water heat from Community CHP

(310a)	(64) x (303a) x (305) x (306) = 1339.39	(310a)
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Water heat from heat source 2

(310b)	(64) x (303b) x (305) x (306) = 892.93	(310b)
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Electricity used for heat distribution

(313)	0.01 x [(307a)...(307e) + (310a)...(310e)] = 44.04	(313)
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Cooling System Energy Efficiency Ratio

(314)	0	(314)
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Space cooling (if there is a fixed cooling system, if not enter 0)

(315)	= (107) ÷ (314) = 0	(315)
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Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

(330a)	97.29	(330a)
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warm air heating system fans

(330b)	0	(330b)
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DER WorkSheet: New dwelling design stage

pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$				97.29	(331)
Energy for lighting (calculated in Appendix L)					357.08	(332)
12b. CO2 Emissions – Community heating scheme						
Electrical efficiency of CHP unit					34.6	(361)
Heat efficiency of CHP unit					55.6	(362)
		Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating from CHP	$(307a) \times 100 \div (362) =$	2343.52	x	0.22		506.2 (363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	810.86	x	0.52		-420.83 (364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2408.98	x	0.22		520.34 (365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	833.51	x	0.52		-432.59 (366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				98.6	(367b)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$			0.22	=	385.91 (368)
Electrical energy for heat distribution	$[(313) \times$			0.52	=	22.86 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$				=	581.88 (373)
CO2 associated with space heating (secondary)	$(309) \times$			0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	=	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$					581.88 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$			0.52	=	50.49 (378)
CO2 associated with electricity for lighting	$(332) \times$			0.52	=	185.32 (379)
Total CO2, kg/year	sum of (376) ... (382) =					817.69 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$					9.92 (384)
EI rating (section 14)						91.4 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.1.24

Property Address: Flat 6

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	82.45 (1a) x	2.4 (2a) =	197.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	197.88 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 3 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.15 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.12 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

75.65 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.27 0.27 0.26 0.25 0.25 0.23 0.23 0.23 0.24 0.25 0.25 0.26 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 3			6.16	$\times 1/[1/(1.4) + 0.04] =$	8.17		(27)
Windows Type 4			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Windows Type 5			2.42	$\times 1/[1/(1.4) + 0.04] =$	3.21		(27)
Walls	41.57	15.8	25.77	x 0.17 =	4.38		(29)
Roof	82.45	0	82.45	x 0.11 =	9.07		(30)
Total area of elements, m²			124.02				(31)
Party wall			34.2	x 0 =	0		(32)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ 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) = 34.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 742.05 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 39.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	17.63	17.44	17.25	16.3	16.11	15.16	15.16	14.97	15.54	16.11	16.49	16.87

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m= 57.48 57.29 57.1 56.15 55.96 55.01 55.01 54.82 55.39 55.96 56.34 56.72 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.7	0.69	0.69	0.68	0.68	0.67	0.67	0.66	0.67	0.68	0.68	0.69		
	Average = Sum(40) _{1...12} /12=												0.68	(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

2.51

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

93.76

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
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Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.13	99.38	95.63	91.88	88.13	84.38	84.38	88.13	91.88	95.63	99.38	103.13		
	Total = Sum(44) _{1...12} =												1125.1	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.94	133.77	138.03	120.34	115.47	99.64	92.33	105.95	107.22	124.95	136.4	148.12		
	Total = Sum(45) _{1...12} =												1475.18	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.94	20.06	20.71	18.05	17.32	14.95	13.85	15.89	16.08	18.74	20.46	22.22		(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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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	(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	183.69	193.31	173.84	170.75	153.14	147.61	161.23	160.71	180.23	189.89	203.4	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	208.22	183.69	193.31	173.84	170.75	153.14	147.61	161.23	160.71	180.23	189.89	203.4	
Output from water heater (annual) _{1...12}												2126.02	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	95.08	84.42	90.12	82.81	82.62	75.93	74.92	79.45	78.45	85.77	88.15	93.47	(65)
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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=	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	125.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.22	17.96	14.6	11.06	8.27	6.98	7.54	9.8	13.15	16.7	19.49	20.78	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	224.48	226.81	220.94	208.45	192.67	177.85	167.94	165.61	171.48	183.98	199.75	214.58	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	35.54	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	-100.31	(71)
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Water heating gains (Table 5)

(72)m=	127.79	125.62	121.13	115.01	111.04	105.45	100.7	106.79	108.95	115.28	122.43	125.63	(72)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	433.11	431.01	417.29	395.13	372.6	350.89	336.8	342.82	354.2	376.58	402.29	421.61	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest _{0.9x}	0.77	x	6.16	x	36.79		0.45	x	0.71	=	50.18	(79)
Southwest _{0.9x}	0.77	x	6.16	x	62.67		0.45	x	0.71	=	85.48	(79)
Southwest _{0.9x}	0.77	x	6.16	x	85.75		0.45	x	0.71	=	116.96	(79)
Southwest _{0.9x}	0.77	x	6.16	x	106.25		0.45	x	0.71	=	144.92	(79)
Southwest _{0.9x}	0.77	x	6.16	x	119.01		0.45	x	0.71	=	162.32	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	6.16	x	118.15		0.45	x	0.71	=	161.15	(79)
Southwest	0.9x	0.77	x	6.16	x	113.91		0.45	x	0.71	=	155.36	(79)
Southwest	0.9x	0.77	x	6.16	x	104.39		0.45	x	0.71	=	142.38	(79)
Southwest	0.9x	0.77	x	6.16	x	92.85		0.45	x	0.71	=	126.64	(79)
Southwest	0.9x	0.77	x	6.16	x	69.27		0.45	x	0.71	=	94.47	(79)
Southwest	0.9x	0.77	x	6.16	x	44.07		0.45	x	0.71	=	60.11	(79)
Southwest	0.9x	0.77	x	6.16	x	31.49		0.45	x	0.71	=	42.95	(79)
West	0.9x	0.77	x	2.38	x	19.64	x	0.45	x	0.71	=	10.35	(80)
West	0.9x	0.77	x	2.42	x	19.64	x	0.45	x	0.71	=	10.52	(80)
West	0.9x	0.77	x	2.38	x	38.42	x	0.45	x	0.71	=	20.25	(80)
West	0.9x	0.77	x	2.42	x	38.42	x	0.45	x	0.71	=	20.59	(80)
West	0.9x	0.77	x	2.38	x	63.27	x	0.45	x	0.71	=	33.34	(80)
West	0.9x	0.77	x	2.42	x	63.27	x	0.45	x	0.71	=	33.9	(80)
West	0.9x	0.77	x	2.38	x	92.28	x	0.45	x	0.71	=	48.63	(80)
West	0.9x	0.77	x	2.42	x	92.28	x	0.45	x	0.71	=	49.45	(80)
West	0.9x	0.77	x	2.38	x	113.09	x	0.45	x	0.71	=	59.6	(80)
West	0.9x	0.77	x	2.42	x	113.09	x	0.45	x	0.71	=	60.6	(80)
West	0.9x	0.77	x	2.38	x	115.77	x	0.45	x	0.71	=	61.01	(80)
West	0.9x	0.77	x	2.42	x	115.77	x	0.45	x	0.71	=	62.03	(80)
West	0.9x	0.77	x	2.38	x	110.22	x	0.45	x	0.71	=	58.08	(80)
West	0.9x	0.77	x	2.42	x	110.22	x	0.45	x	0.71	=	59.06	(80)
West	0.9x	0.77	x	2.38	x	94.68	x	0.45	x	0.71	=	49.89	(80)
West	0.9x	0.77	x	2.42	x	94.68	x	0.45	x	0.71	=	50.73	(80)
West	0.9x	0.77	x	2.38	x	73.59	x	0.45	x	0.71	=	38.78	(80)
West	0.9x	0.77	x	2.42	x	73.59	x	0.45	x	0.71	=	39.43	(80)
West	0.9x	0.77	x	2.38	x	45.59	x	0.45	x	0.71	=	24.02	(80)
West	0.9x	0.77	x	2.42	x	45.59	x	0.45	x	0.71	=	24.43	(80)
West	0.9x	0.77	x	2.38	x	24.49	x	0.45	x	0.71	=	12.9	(80)
West	0.9x	0.77	x	2.42	x	24.49	x	0.45	x	0.71	=	13.12	(80)
West	0.9x	0.77	x	2.38	x	16.15	x	0.45	x	0.71	=	8.51	(80)
West	0.9x	0.77	x	2.42	x	16.15	x	0.45	x	0.71	=	8.65	(80)
Northwest	0.9x	0.77	x	2.42	x	11.28	x	0.45	x	0.71	=	6.05	(81)
Northwest	0.9x	0.77	x	2.42	x	11.28	x	0.45	x	0.71	=	6.05	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	x	0.45	x	0.71	=	12.31	(81)
Northwest	0.9x	0.77	x	2.42	x	22.97	x	0.45	x	0.71	=	12.31	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	x	0.45	x	0.71	=	22.17	(81)
Northwest	0.9x	0.77	x	2.42	x	41.38	x	0.45	x	0.71	=	22.17	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	x	0.45	x	0.71	=	36.41	(81)
Northwest	0.9x	0.77	x	2.42	x	67.96	x	0.45	x	0.71	=	36.41	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	x	0.45	x	0.71	=	48.95	(81)
Northwest	0.9x	0.77	x	2.42	x	91.35	x	0.45	x	0.71	=	48.95	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.45	x	0.71	=	52.18	(81)
Northwest 0.9x	0.77	x	2.42	x	97.38	x	0.45	x	0.71	=	52.18	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.45	x	0.71	=	48.81	(81)
Northwest 0.9x	0.77	x	2.42	x	91.1	x	0.45	x	0.71	=	48.81	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.45	x	0.71	=	38.91	(81)
Northwest 0.9x	0.77	x	2.42	x	72.63	x	0.45	x	0.71	=	38.91	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.45	x	0.71	=	27.02	(81)
Northwest 0.9x	0.77	x	2.42	x	50.42	x	0.45	x	0.71	=	27.02	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.45	x	0.71	=	15.04	(81)
Northwest 0.9x	0.77	x	2.42	x	28.07	x	0.45	x	0.71	=	15.04	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.45	x	0.71	=	7.61	(81)
Northwest 0.9x	0.77	x	2.42	x	14.2	x	0.45	x	0.71	=	7.61	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.45	x	0.71	=	4.94	(81)
Northwest 0.9x	0.77	x	2.42	x	9.21	x	0.45	x	0.71	=	4.94	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	83.15	150.93	228.55	315.82	380.4	388.55	370.13	320.83	258.88	173	101.35	69.99	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	516.26	581.94	645.84	710.95	753	739.44	706.93	663.65	613.09	549.58	503.64	491.6	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.87	0.68	0.48	0.34	0.38	0.62	0.91	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.45	20.57	20.74	20.92	20.99	21	21	21	21	20.9	20.64	20.42	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.34	20.35	20.35	20.36	20.36	20.37	20.37	20.37	20.37	20.36	20.36	20.35	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.95	0.84	0.64	0.43	0.29	0.33	0.56	0.88	0.98	1	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.6	19.78	20.03	20.27	20.35	20.37	20.37	20.37	20.36	20.25	19.9	19.57	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =

0.36 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.91	20.07	20.29	20.51	20.58	20.6	20.6	20.6	20.59	20.49	20.17	19.88	(92)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.91	20.07	20.29	20.51	20.58	20.6	20.6	20.6	20.59	20.49	20.17	19.88	(93)
--------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.84	0.65	0.45	0.31	0.35	0.58	0.89	0.98	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

DER WorkSheet: New dwelling design stage

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	513.02	572.74	614.99	600.18	490.29	329.68	219.97	230.23	357.41	488.86	495.03	489.34	(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=	897.11	868.85	787.32	651.68	497.01	329.98	219.99	230.26	359.64	553.17	736.31	889.55	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	285.76	198.98	128.21	37.08	5.01	0	0	0	0	47.85	173.72	297.76	(98)
--------	--------	--------	--------	-------	------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...59...12} = 1174.38 (98)

Space heating requirement in kWh/m²/year

14.24	(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 CHP

0.6	(303a)
-----	--------

Fraction of community heat from heat source 2

0.4	(303b)
-----	--------

Fraction of total space heat from Community CHP

(302) x (303a) = 0.6 (304a)

Fraction of total space heat from community heat source 2

(302) x (303b) = 0.4 (304b)

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

1174.38	
---------	--

Space heat from Community CHP

(98) x (304a) x (305) x (306) = 739.86 (307a)

Space heat from heat source 2

(98) x (304b) x (305) x (306) = 493.24 (307b)

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

2126.02	
---------	--

If DHW from community scheme:

Water heat from Community CHP

(64) x (303a) x (305) x (306) = 1339.39 (310a)

Water heat from heat source 2

(64) x (303b) x (305) x (306) = 892.93 (310b)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] = 34.65 (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

184.08	(330a)
--------	--------

warm air heating system fans

0	(330b)
---	--------

DER WorkSheet: New dwelling design stage

pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$				184.08	(331)
Energy for lighting (calculated in Appendix L)					357.08	(332)
12b. CO2 Emissions – Community heating scheme						
Electrical efficiency of CHP unit					34.6	(361)
Heat efficiency of CHP unit					55.6	(362)
		Energy kWh/year		Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP	$(307a) \times 100 \div (362) =$	1330.68	x	0.22	287.43	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	460.41	x	0.52	-238.96	(364)
Water heated by CHP	$(310a) \times 100 \div (362) =$	2408.98	x	0.22	520.34	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	833.51	x	0.52	-432.59	(366)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				98.6	(367b)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$			0.22	= 303.66	(368)
Electrical energy for heat distribution	$[(313) \times$			0.52	= 17.99	(372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$				= 457.87	(373)
CO2 associated with space heating (secondary)	$(309) \times$			0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$			0.22	= 0	(375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$				457.87	(376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$			0.52	= 95.54	(378)
CO2 associated with electricity for lighting	$(332) \times$			0.52	= 185.32	(379)
Total CO2, kg/year	sum of (376) ... (382) =				738.73	(383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$				8.96	(384)
EI rating (section 14)					92.23	(385)

Appendix D - Step Four – 'Green' Output Document and Energy Report Figures

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 09:15:44 2016

Administrative information

Building Details

Address: Cafe/Restaurant, East Block, Kenavon Drive,
READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	91.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	91.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	78.6
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Cafe) - Eat & Drink_W_8
Floor	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Cafe) - Eat & Drink_G_9
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.6	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Main Multipoint BF

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.76	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
0 Ground (Cafe) - Eat & Drink	-	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - Food Prep	-	-	-	-	-	-	-	-	1	-	-	N/A
0 Ground (Cafe) - WC	-	-	0.5	-	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - Food Prep	YES
0 Ground (Cafe) - WC	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Cafe) - Eat & Drink	-	90	90	349

General lighting and display lighting		Luminous efficacy [lm/W]		
Zone name		Luminaire	Lamp	Display lamp
	Standard value	60	60	22
0 Ground (Cafe) - Food Prep		-	90	-
0 Ground (Cafe) - WC		-	90	-
				General lighting [W]
				156
				27

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Cafe) - Eat & Drink	NO (-10.2%)	NO
0 Ground (Cafe) - Food Prep	N/A	N/A
0 Ground (Cafe) - WC	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	156.9	156.9
External area [m ²]	256.1	256.1
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	5
Average conductance [W/K]	127.39	104.3
Average U-value [W/m ² K]	0.5	0.41
Alpha value* [%]	17.23	17.31

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	19.67	25.82
Cooling	21.47	31.93
Auxiliary	22.79	14.1
Lighting	29.14	56.39
Hot water	140.19	123.41
Equipment*	126.49	126.49
TOTAL **	233.26	251.65

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	624.3	639.7
Primary energy* [kWh/m ²]	456.76	534.4
Total emissions [kg/m ²]	78.6	91.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	277.8	346.5	19.7	21.5	22.8	3.92	4.48	4	6
Notional	225.9	413.8	25.8	31.9	14.1	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Cafe) - Eat & Drink_W_8
Floor	0.2	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.15	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Cafe) - Eat & Drink_G_9
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]			U _{i-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 09:19:43 2016

Administrative information

Building Details

Address: Cafe, West Block, Kenavon Drive, READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	91.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	91.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	78.6
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Cafe) - Eat & Drink_W_6
Floor	0.25	0.13	0.13	0 Ground (Cafe) - Food Prep_S_3
Roof	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Cafe) - Eat & Drink_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.6	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Main Multipoint BF

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.76	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
0 Ground (Cafe) - Food Prep	-	-	-	-	-	-	-	-	1	-	-	N/A
0 Ground (Cafe) - Eat & Drink	-	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - WCs	-	-	0.5	-	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Cafe) - Food Prep	YES
0 Ground (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - WCs	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Cafe) - Food Prep	-	90	-	156

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
0 Ground (Cafe) - Eat & Drink		-	90	90	347
0 Ground (Cafe) - WCs		-	90	-	27

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Cafe) - Food Prep	N/A	N/A
0 Ground (Cafe) - Eat & Drink	NO (-7.7%)	NO
0 Ground (Cafe) - WCs	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	156.4	156.4
External area [m ²]	255.3	255.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	5
Average conductance [W/K]	127.13	103.95
Average U-value [W/m ² K]	0.5	0.41
Alpha value* [%]	17.23	17.31

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	19.36	25.49
Cooling	21.81	32.23
Auxiliary	22.86	14.14
Lighting	29.12	56.37
Hot water	140.14	123.36
Equipment*	126.52	126.52
TOTAL **	233.29	251.59

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	625.52	640.69
Primary energy* [kWh/m ²]	456.95	534.3
Total emissions [kg/m ²]	78.6	91.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	273.4	352.1	19.4	21.8	22.9	3.92	4.48	4	6
Notional	222.9	417.7	25.5	32.2	14.1	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Cafe) - Eat & Drink_W_6
Floor	0.2	0.13	0 Ground (Cafe) - Food Prep_S_3
Roof	0.15	0.13	0 Ground (Cafe) - Eat & Drink_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Cafe) - Eat & Drink_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 11:09:58 2016

Administrative information

Building Details

Address: Cafe/Restaurant, Middle Block, Kenavon Drive,
READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	86.5
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	86.5
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	72.6
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	1 First (Cafe) - Eat & Drink_W_6
Floor	0.25	0.13	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.6	1.6	1 First (Cafe) - Eat & Drink_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.6	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Gas-fired condensing water heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	0.015
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
1 First (Cafe) - Eat & Drink		-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - Eat & Drink		-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Cafe) - Food Prep		-	-	-	-	-	-	-	-	1	-	N/A
0 Ground (Cafe) - WCs		-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
1 First (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - Eat & Drink	YES
0 Ground (Cafe) - Food Prep	YES
0 Ground (Cafe) - WCs	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
	Standard value	60	60	22
1 First (Cafe) - Eat & Drink	-	90	90	810

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
0 Ground (Cafe) - Eat & Drink		-	90	90	649
0 Ground (Cafe) - Food Prep		-	90	-	572
0 Ground (Cafe) - WCs		-	90	-	69

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 First (Cafe) - Eat & Drink	NO (-55.3%)	NO
0 Ground (Cafe) - Eat & Drink	NO (-12.9%)	NO
0 Ground (Cafe) - Food Prep	N/A	N/A
0 Ground (Cafe) - WCs	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	657.8	657.8
External area [m ²]	641.5	641.5
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	3
Average conductance [W/K]	378.7	321.19
Average U-value [W/m ² K]	0.59	0.5
Alpha value* [%]	12.49	15.4

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	14.78	21.45
Cooling	18.08	31.87
Auxiliary	23.72	14.64
Lighting	27.84	50.42
Hot water	133.14	123.02
Equipment*	127.18	127.18
TOTAL**	217.57	241.39

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	500.56	600.6
Primary energy* [kWh/m ²]	421.61	504.39
Total emissions [kg/m ²]	72.6	86.5

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	208.7	291.9	14.8	18.1	23.7	3.92	4.48	4	6
Notional	187.6	413	21.4	31.9	14.6	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	1 First (Cafe) - Eat & Drink_W_6
Floor	0.2	0.13	0 Ground (Cafe) - Eat & Drink_S_3
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.6	1 First (Cafe) - Eat & Drink_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 10:36:09 2016

Administrative information

Building Details

Address: Nursery, Middle Block, Kenavon Drive,
READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	15.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	15.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	15
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Nursery) - Teaching_W_9
Floor	0.25	0.13	0.13	0 Ground (Nursery) - Teaching_S_3
Roof	0.25	0.13	0.13	0 Ground (Nursery) - Teaching_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Nursery) - Teaching_G_10
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.6	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- DHW instantaneous electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
0 Ground (Nursery) - Teaching	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Nursery) - WCs	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Nursery) - Teaching	YES
0 Ground (Nursery) - WCs	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Nursery) - Teaching	90	-	-	1287
0 Ground (Nursery) - WCs	-	90	-	48

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Nursery) - Teaching	NO (-39.7%)	NO
0 Ground (Nursery) - WCs	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	280.4	280.4
External area [m ²]	572.7	572.7
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	3
Average conductance [W/K]	165.21	256.35
Average U-value [W/m ² K]	0.29	0.45
Alpha value* [%]	19.19	15.99

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
100	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.04	6.52
Cooling	5.28	6.61
Auxiliary	0.54	0.65
Lighting	7.28	8.1
Hot water	12.72	14.72
Equipment*	14.09	14.09
TOTAL**	28.86	36.59

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	128.13	142.72
Primary energy* [kWh/m ²]	88.6	81.65
Total emissions [kg/m ²]	15	15.8

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	42.9	85.2	3	5.3	0.5	3.92	4.48	4	6
Notional	57	85.7	6.5	6.6	0.6	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Nursery) - Teaching_W_9
Floor	0.2	0.13	0 Ground (Nursery) - Teaching_S_3
Roof	0.15	0.13	0 Ground (Nursery) - Teaching_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Nursery) - Teaching_G_10
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Project name

Shell and Core

Kenavon

As designed

Date: Fri Aug 19 09:25:48 2016

Administrative information

Building Details

Address: Retail, West Block, Kenavon Drive, READING,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	40.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	40.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	28.1
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	0 Ground (Retail) - Sales_W_10
Floor	0.25	0.13	0.13	0 Ground (Retail) - Sales_S_3
Roof	0.25	0.13	0.13	0 Ground (Retail) - Sales_R_5
Windows***, roof windows, and rooflights	2.2	1.6	1.6	0 Ground (Retail) - Sales_G_11
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.6	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- DHW instantaneous electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
0 Ground (Retail) - Sales	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground (Retail) - WC	-	-	0.5	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
0 Ground (Retail) - Sales	YES
0 Ground (Retail) - WC	YES

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
0 Ground (Retail) - Sales	-	90	90	3979
0 Ground (Retail) - WC	-	90	-	36

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0 Ground (Retail) - Sales	NO (-6.8%)	NO
0 Ground (Retail) - WC	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	406.9	406.9
External area [m ²]	640.3	640.3
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	7	3
Average conductance [W/K]	189.59	261.69
Average U-value [W/m ² K]	0.3	0.41
Alpha value* [%]	14.67	13.12

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.52	4.6
Cooling	11.91	17.05
Auxiliary	0.17	0.2
Lighting	37.87	56.3
Hot water	1.68	1.94
Equipment*	20.25	20.25
TOTAL**	54.15	80.09

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	227.88	261.16
Primary energy* [kWh/m ²]	166.23	236.05
Total emissions [kg/m ²]	28.1	40.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	35.6	192.3	2.5	11.9	0.2	3.92	4.48	4	6
Notional	40.2	221	4.6	17	0.2	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	0 Ground (Retail) - Sales_W_10
Floor	0.2	0.13	0 Ground (Retail) - Sales_S_3
Roof	0.15	0.13	0 Ground (Retail) - Sales_R_5
Windows, roof windows, and rooflights	1.5	1.6	0 Ground (Retail) - Sales_G_11
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)] U _{i-Min} = Minimum individual element U-values [W/(m²K)] * There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	7

Appendix E - Renewable Technologies; Description, Benefits and Limitations

Domestic Solar Hot Water Heating



Solar thermal or solar hot water (SHW) systems use a collector which is generally mounted on the roof, and typically contains a water glycol mixture which is heated by the sun. The heated liquid is then passed through a coil in a hot water storage cylinder. The water in the cylinder is then further heated (if required) by a boiler or electric immersion heater. The free energy obtained from the sun can be used to offset the amount of energy required for providing domestic hot water, and will reduce both running costs (due to the fuel being displaced electricity, natural gas, Liquefied Petroleum Gas (LPG) or oil) and the

associated CO₂ emissions.

These systems are not good enough to provide space heating in the UK due to the climate but are among the most cost-effective renewable energy systems that can be installed to assist with domestic hot water demand.

Solar water heating could be installed by utilising either evacuated tube type panels or flat plate collectors mounted on the roof of the building.

Reasons for Excluding this Technology for this Site

SHW only contributes to the water heating demand of the property and has reduced effectiveness during the winter months. Consequently they do not supply sufficient carbon reduction. This technology is not considered suitable for this project and is not investigated further.

The technology cannot produce a material contribution to the energy needs of a commercial development such as this, as the demand for hot water is for occasional hand washing which represents a very small proportion of the total demand. It is quite possible that the energy consumed by the solar circuit pump would be greater than the energy used by instantaneous water heaters to provide the same amount of hot water. For these reasons solar thermal panels are only suitable for specific commercial applications which have a quantifiable demand for hot water that can be matched to the output characteristic of a solar thermal system.



Biomass Boilers

Biomass heating is the combustion of a biomass fuel such as wood in a boiler to supply space heating and hot water. Biomass fuel is biological in origin and, when from sustainable sources, is regarded as renewable.

The most common fuel is wood, supplied in three forms; logs, chips and compressed wood pellets.

Any biomass heating system requires the following main components:

- Fuel storage;
- One or more boilers;
- One or more heat accumulators;
- A chimney stack or flue;
- A heat meter.

Sufficient fuel must be stored on-site to maintain operations in between deliveries. The amount will depend on circumstances, but is typically not less than a week of operation at full load.

The store must keep the fuel dry. Wet fuel will cause the boiler to malfunction.

The design of the store will depend on the fuel selected; logs can be kept in a simple shed, chips in a storage bay and pellets in an enclosed hopper.

Typical solutions are silos similar to animal feed storage or partitioned sections in an enclosed barn, outhouse, or commodity store.

Access is needed for deliveries and some is needed to convey the fuel to the boiler on demand.

There are two main types of boiler – continuously fuelled and batch fuelled. Continuously fuelled boilers use wood chip or pellet fuels and can be made fully automatic.

The space requirement for biomass plant, equipment and associated fuel storage is significant and given the footprint of the building and its central Reading location the site has limited off-street loading and delivery areas. Biomass requires frequent and regular deliveries of fuel which would impact on local transportation due to site servicing constraints and would therefore not be suitable for this redevelopment.

Reasons for Excluding this Technology for this Site

There are many discussions at this time with regards to the suitability of biomass within the Reading region due to the Clean Air Act Requirements and the viability of clean biomass systems has not yet been proven.

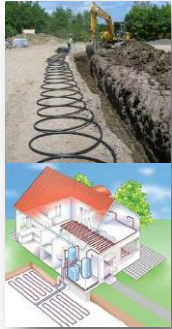
Therefore the inclusion of biomass has not been deemed appropriate and is not considered further.

Storage limitations dictate whether it is physically feasible to include within the development's renewable energy strategy; a large dry space for storing the fuel would be required to hold several months' worth of fuel. In addition, a fuel supplier would need to be within reasonable vicinity; otherwise the emissions associated with delivery will significantly reduce the on-site carbon savings.

Biomass boilers do not operate in the same way as gas and oil boilers. They have a more limited operating range and cannot respond as rapidly to changes in demand. Short operating cycles are not recommended. The use of a hot water tank or accumulator in the system to balance the output of the boiler and the demand of the heating system is highly recommended. The necessary volume depends on the type of boiler and the character of the heating system. Pellet boilers have a good operating range and a relatively small tank would be used. Log boilers have little range and a large tank that can absorb the energy contained within one or more charges of wood is necessary.

Biomass boilers are combustion appliances and are subject to regulation on placing height and the quantity of pollutant emissions. This should be discussed with the Environmental Health Officer of the Local Authority.

Ground Source Heat Pumps



Ground source heat pumps can be used to provide heating and or cooling to the building. Whilst ground source does rely on fossil fuels (indirectly) to provide the energy source, they are considered renewable given their high coefficient of performance and hence reduced fossil fuel reliance.

This can be one of four methods:

- 1 Closed horizontal loops, generally comprising a number of flow and return horizontal coiled loops sometimes called 'slinkies'.
- 2 Closed vertical loops, generally comprising a number of flow and return vertical loops to approximately 100m.
- 3 Open loop, generally comprising of an abstraction and rejection well.
- 4 Abstraction only open loop, comprising of an abstraction well with water rejected to either the local sewer systems or river/water course.

Reasons for Excluding this Technology for this Site

In order to provide the anticipated heating and cooling boreholes would be required with sufficient distance needed between them. With the site having limited external areas, ground source heat pumps are deemed not suitable for this project and have not been considered further.

Existing services within the ground would prohibit the installation of a borehole type heat pump, please refer to the utilities report. Space limitations prohibit the installation of a 'slinky' type heat pump.

Wind Turbines

This section covers both large scale and micro wind solutions.

Large-scale wind generation systems have capacities over 100kW and are usually used to power larger developments such as, larger scale housing, industrial estates and hotels with many rooms. These systems cannot be roof mounted due to their size and weight.

Reasons for Excluding this Technology for this Site

Due to the large capital cost and surroundings, large-scale wind turbine systems are not considered viable at this project.

It is difficult to obtain predictable or large amounts of wind energy in city centre locations, as they require non-turbulent, horizontal air streams to be most effective. Surrounding buildings, trees, etc can cause significant issues with regards to micro and large-scale installations unless the rotors are positioned at a considerable height.

Micro wind turbine technology has been found to be extremely difficult to achieve a contribution economically. A significant number of units would be required to provide any reasonable energy savings which would have serious visual impact implications.

Tall buildings give their own specific problems in that the building act as a spoiler, pushing wind upwards and over the turbine, reducing effectiveness considerably.

Additional considerations with large and micro wind solutions are the potential issues from stroboscopic light, topple distance, noise, impact on wildlife and structural enhancements which all raise major concerns given the building central Reading location.

Given the building location in central Reading and its close proximity to nearby buildings, achieving an acceptable solution that will provide sufficient renewable contribution as well as overcome the installation impacts is unlikely and therefore has not been considered for this project.

Photovoltaic Panels (PV)



PV systems convert energy from the sun into electricity through semi-conductor cells. A cell consists of two thin layers of different semi-conducting materials, usually based on silicon. When light shines on the cell, a difference in energy is created – otherwise known as voltage. This voltage is used to produce a direct current (DC), which can be used directly or converted into alternating current (AC). AC can be exported to the local electricity network/national grid. The brighter the sunlight, the more power is produced. Shading from other objects (such as nearby buildings and trees) will affect performance and PV cells are more likely to show a drop in output than solar thermal panels. As with solar hot water, the panels should face as close to due south as possible and be unshaded for most of the day. An individual PV cell only produces a small amount of power, therefore they are usually connected together to form a module. Modules can then be linked to form an array and sized to meet the required demand.

Reasons for Excluding this Technology for this Site

The carbon savings required by the local authority have been met by the use of a fabric first approach and a centralised energy centre using a combined heat and power unit. Therefore a photovoltaic system has not been considered for the proposed development.



T +44 20 7422 7800
A 3rd Floor Eldon House
2 Eldon Street
London, EC2M 7LS

www.mlmggroup.com