295-297 HIGH HOLBORN

ENERGY STATEMENT ADDENDUM

1 BACKGROUND

This document forms an addendum to the Energy Statement R02 dated March 2017 prepared by Scotch Partners. It should be read in conjunction with the Energy Statement R02 and all other documents forming part of the planning application

The energy strategy has been updated in line with changes to the building services strategy for the proposed development. Following discussions with UK Power Networks it has been agreed that a substation would not be required as part of the development. Therefore the available power supply for the development is reduced. As such the reliance on electrical supply to meet the heating and hot water demand via air sourced heat pumps (ASHP) is no longer possible. Instead, it is proposed to use a mix of electric ASHP, gas boilers and gas driven ASHP.

The following sections describe the revisions to the energy strategy and provides a summary of the overall CO_2 emissions reduction predicted for the proposed development, the updated carbon offset payment and portion of the developments energy provided by renewable energy.

2 REVISED STRATEGY

The energy strategy for the proposed development continues to follow the same energy hierarchy as the Energy Statement and has been developed in line with Camden Council Policy. At each stage of the hierarchy the proposed development's CO_2 emissions have been evaluated and the percentage reduction achieved reported.

Regulated energy use and the associated CO_2 emissions have been calculated using Part L energy assessment software Stroma FSAP 2012 v1.0.4.7 for the domestic elements, and DesignBuilder 5.0.3.007 SBEM engine version 5.2.g.3 for the non-domestic elements.

All total development CO_2 emissions reported are based on the outputs from the SBEM BRUKL reports and SAP worksheets using the Building Emissions Rate (BER), Dwelling Emissions Rate (DER) and Target Emission Rate (TER). Where the TER from the 'Be Lean' scenario is used to represent the energy use of the Building Regulations Part L compliant development baseline, hereafter referred to as the 'notional development'. Total development figures are then calculated as an area weighted average.

Unregulated emissions for the domestic units have been estimated using the BREDEM 2012 Domestic Energy Model Version 1.0 calculations for 'Appliance' and 'Cooking' energy consumption. Notional unregulated emissions for the non-domestic elements have been taken from the SBEM BRUKL report as the 'equipment' load.

2.1 "BE LEAN" – REDUCE ENERGY DEMAND

No changes have been made to the "Be Lean" strategy, lean measures are therefore as per the Energy Statement R02.

Through the application of the "Be Lean" measures, a CO_2 emissions reduction of 13.4% could be achieved over the notional development baseline.

2.2 “BE CLEAN” – SUPPLY ENERGY EFFICIENTLY

No changes have been made to the “Be Clean” strategy, clean measures are therefore as per the Energy Statement R02.

2.3 “BE GREEN” – USE RENEWABLE ENERGY

No changes have been made to the number of PV (photovoltaic) panels and the cooling strategy for the domestic and non-domestic elements.

The space heating strategy for the non-domestic elements has been changed from being entirely served by electric ASHP to a mix of gas boilers and electric ASHP.

The space heating and hot water strategy for the domestic elements have also been changed. Previously the domestic elements were entirely served by individual electric ASHP. The proposed strategy uses a community heating and hot water system fed by a gas driven ASHP.

The SCOP (seasonal coefficient of performance) of the gas driven ASHP and all other building services inputs are given in Appendix 1.

2.3.1 BREAKDOWN OF DOMESTIC AND NON-DOMESTIC EMISSIONS SAVINGS

Table 2.1 lists the domestic and non-domestic CO_2 emission reductions after each stage of the energy hierarchy following the changes in heating and hot water systems described above. Through measures applied the domestic elements achieves a 32.5% reduction in CO_2 and the non-domestic elements show 35.1% reduction over the notional development baseline.

Table 2.1 - Domestic and Non-Domestic Regulated CO2 Emissions and Savings

	Domestic		Non-Domestic	
	CO_2 Emissions (tCO_2/annum)	Percentage CO_2 Emissions Savings	CO_2 Emissions (tCO_2/annum)	Percentage CO_2 Emissions Savings
Building Regulations 2013 Part L Compliant Development	17.031		25.976	
Savings from “Be Lean”	0.308	1.8%	5.474	21.1%
Savings from “Be Clean”	0.000	0.0%	0.000	0.0%
Savings from “Be Green”	5.230	30.7%	3.650	14.0%
Cumulative Savings	**5.537**	**32.5%**	**9.124**	**35.1%**

2.3.2 TOTAL DEVELOPMENT EMISSIONS SAVINGS AND OFF-SET PAYMENT

Table 2.2 lists the development’s total regulated CO_2 emissions and CO_2 savings, and Table 2.3 gives the updated off-set payment. The development achieves a 34.1% reduction in CO_2 over the notional development baseline. The development’s total regulated CO_2 emissions have reduced from 51tCO_2 as per the Energy Statement R02 to 43tCO_2. The estimated CO_2 offset payment has reduced from £27,756 to £20,688.

Table 2.2 - Development Total Regulated CO_2 Emissions, Savings

	Total regulated emissions (tCO_2/annum)	CO_2 savings (tCO_2/annum)	Percentage Savings
Part L 2013 Compliant Baseline	43.007		
After “Be Lean”	37.225	5.782	13.4%
After “Be Clean”	37.225	0.000	0.0%
After “Be Green”	28.346	8.879	20.6%
Cumulative Development Savings		**14.661**	**34.1%**

Table 2.3 - Development Off-set Payment

30 Year Cumulative Savings from Offset	344.799 tCO_2	
Offset Payment	£20,688	** Based on £60/tCO_2 as per "GLA Guidance on Preparing Energy Statements" March 2016*

3 CONCLUSION

Scotch Partners have prepared this Energy Statement Addendum for the proposed development at 295-297 High Holborn to identify the impact of changes to the building services strategy proposed. The energy strategy for the proposed development continues to follow the same energy hierarchy as the Energy Statement in line with Camden Council Policy.

The building services strategy has been changed in line with there no longer being a requirement for a substation. This has reduced the available on-site electrical supply. Reliance on electrically driven ASHP has therefore been reduced by using gas fired condensing boilers and gas driven ASHP to meet some of the heat demand.

Through a range of "Be Lean", "Be Clean" and "Be Green" measures the Development achieves an overall 34.1% reduction in CO_2 over a Building Regulations Part L 2013 compliant development. It has been estimated that the proposed development could produce 5.5% of its regulated energy use through PV power generation.

APPENDIX 1 – SBEM & SAP MODEL INPUTS

FABRIC PERFORMANCE

	Non-Domestic	Domestic
Air Permeability	$3m^3/hm^2$@50Pa	$3m^3/hm^2$@50Pa
Roof U-value	$0.13W/m^2K$	$0.12W/m^2K$
Floor over commercial U-value	-	$0.065W/m^2K$
Basement Floor U-value	$0.13W/m^2K$	-
External Wall U-value	$0.18W/m^2K$	$0.18W/m^2K$
Basement Wall U-value	Adiabatic	-
Window U-value	$1.4\ W/m^2K$	$1.4\ W/m^2K$
Frame Fraction/Factor	0.11	1
G-value T Solar	0.28	0.63
L Solar	0.71	-

LIGHTING

	Office	Toilet/Stairs/Stores	Retail	Plant Room
Lamp & Ballast Efficacy	LED 100lm/W	LED 100lm/W	LED 100lm/W	LED 100lm/W
Light Output Ratio	1	1	1	1
Photoelectric Control	Dimming Addressable	-	-	-
Occupancy Sensing	Auto-on-off	Auto-on-off	-	-
Display Lighting	-	-	LED 100lm/W	-

VENTILATION

	Office	Retail	Domestic
Main Areas	Mechanical SFP – 1.06 Thermal Wheel 0.714	Mechanical SFP – 1.37 Thermal Wheel 0.714	MVHR Nuaire MRXBOX
Toilet/Store/Plant	Local mechanical extract SFP – 0.4		

HEATING & COOLING

	Non-Domestic	Domestic
Office and Retail	Split VRF Electric ASHP SCOP – 4.65 SEER – 4.39 EER – 3.91	Community Heating Scheme Gas ASHP Community Boiler SCOP – 1.32 Daikin VRV EER – 3.53
Toilet/Store/Stairs/Plant	Gas LTHW Boiler SCOP – 0.95	

DOMESTIC HOT WATER

	Non-Domestic	Domestic
DHW Throughout	Instant Electric	From main heating system

RENEWABLE ENERGY

	Non-Domestic	Domestic
PV on roof	10 No. 0.32kWp panels	10 No. 0.32kWp panels

APPENDIX 2 – DATA SOURCES

MODEL GEOMETRY INPUTS

	Comment	
Architect	Independent Architects	
SBEM Site Location	London	

MODEL HVAC INPUTS

	Comment	
M&E Consultant	Scotch Partners LLP	

REFERENCE DOCUMENTATION

	Comment
Local Planning Policy	CPG 3 Planning Guidance on Sustainability
Building Regulations	Approved Document L2A
Building Regulations	Approved Document L1A

APPENDIX 3 – SBEM BRUKL LEAN

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

295 High Holborn

As designed

Date: Tue Aug 08 12:31:57 2017

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	24.2
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	24.2
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	19.1
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 fixed building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	3. 1st Offices - Toilet_W_10
Floor	0.25	0.13	0.13	1 - Basement - Refuse_S_3
Roof	0.25	0.13	0.13	3. 1st Offices - Toilet_R_4
Windows***, roof windows, and rooflights	2.2	1.4	1.4	2- Ground - Entryway_G_8
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"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = 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	3

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	>0.95

1- Gas Boiler htg

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	-	-	-	-
Standard value	0.91*	N/A	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.					

2- Split System htg & clg

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	3.91	-	-	-
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- Project DHW

	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**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
3. 1st Offices - Stairs Lift	-	-	-	-	-	-	-	-	-	-	N/A
3. 1st Offices - Toilet	-	-	0.4	-	-	-	-	-	-	-	N/A
4. 2nd Offices - Stairs Lift	-	-	-	-	-	-	-	-	-	-	N/A
4. 2nd Offices - Toilet	-	-	0.4	-	-	-	-	-	-	-	N/A
2- Ground - Entryway	-	-	-	-	-	-	-	-	-	-	N/A
2- Ground - Lift Stair Corridor	-	-	-	-	-	-	-	-	-	-	N/A
1 - Basement - Refuse	-	-	0.4	-	-	-	-	-	-	-	N/A
1 - Basement - Corridor	-	-	0.4	-	-	-	-	-	-	-	N/A

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
1 - Basement - Cycle Store	-	-	0.4	-	-	-	-	-	-	-	N/A
1 - Basement - Cycle Shower	-	-	0.4	-	-	-	-	-	-	-	N/A
1 - Basement - Stair Lift	-	-	-	-	-	-	-	-	-	-	N/A
1 - Basement - Retail Toilet	-	-	0.4	-	-	-	-	-	-	-	N/A
1 - Basement - Plant Room	-	-	0.4	-	-	-	-	-	-	-	N/A
3. 1st Offices - Office	-	-	-	1.1	-	-	-	-	-	0.71	0.65
4. 2nd Offices - Office	-	-	-	1.1	-	-	-	-	-	0.71	0.65
2- Ground - Retail	-	-	-	1.4	-	-	-	-	-	0.71	0.65
1 - Basement - Retail	-	-	-	1.4	-	-	-	-	-	0.71	0.65

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
3. 1st Offices - Stairs Lift	-	100	-	71
3. 1st Offices - Toilet	-	100	-	56
4. 2nd Offices - Stairs Lift	-	100	-	70
4. 2nd Offices - Toilet	-	100	-	55
2- Ground - Entryway	-	100	60	163
2- Ground - Lift Stair Corridor	-	100	-	84
1 - Basement - Refuse	100	-	-	13
1 - Basement - Corridor	-	100	-	39
1 - Basement - Cycle Store	100	-	-	28
1 - Basement - Cycle Shower	-	100	-	34
1 - Basement - Stair Lift	-	100	-	68
1 - Basement - Retail Toilet	-	100	60	62
1 - Basement - Plant Room	100	-	-	263
3. 1st Offices - Office	100	-	-	1257
4. 2nd Offices - Office	100	-	-	1253
2- Ground - Retail	-	100	60	1776
1 - Basement - Retail	-	100	60	879

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?
2- Ground - Entryway	NO (-47.1%)	NO
1 - Basement - Retail Toilet	N/A	N/A
3. 1st Offices - Office	NO (-49.4%)	NO
4. 2nd Offices - Office	NO (-47.7%)	NO
2- Ground - Retail	NO (-0%)	NO
1 - Basement - Retail	NO (-17%)	NO

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]	1071.6	1071.6
External area [m^2]	652.1	652.1
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	341.89	341.94
Average U-value [W/m^2K]	0.52	0.52
Alpha value* [%]	150.89	15.67

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

Building Use

% Area	Building Type
39	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
61	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: 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/m^2]

	Actual	Notional
Heating	23.03	4.9
Cooling	4.76	10.05
Auxiliary	4.79	3.7
Lighting	16.87	30.8
Hot water	1.56	1.81
Equipment*	44.67	44.67
TOTAL**	**51.01**	**51.26**

* 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/m^2]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	135.11	156.59
Primary energy* [kWh/m^2]	111.85	141.31
Total emissions [kg/m^2]	19.1	24.2

* 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] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	39.2	15.3	12.7	0	4.2	0.86	0	0.91	0
	Notional	31.3	33.6	10.6	0	4.7	0.82	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	92.3	87.2	28.7	7.4	5.1	0.89	3.28	0.91	4.39
	Notional	5.2	201.9	1.8	15.6	3.1	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 Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	3. 1st Offices - Toilet_W_10
Floor	0.2	0.13	1 - Basement - Refuse_S_3
Roof	0.15	0.13	3. 1st Offices - Toilet_R_4
Windows, roof windows, and rooflights	1.5	1.4	2- Ground - Entryway_G_8
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"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)]

$U_{i\text{-}Min}$ = 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	3

APPENDIX 4 – SBEM BRUKL GREEN & BASELINE

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

295 High Holborn

As designed

Date: Wed Aug 09 15:29:11 2017

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	24.2
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	24.2
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	15.7
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 fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the 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	0.18	0.18	3. 1st Offices - Toilet_W_10
Floor	0.25	0.13	0.13	1 - Basement - Refuse_S_3
Roof	0.25	0.13	0.13	3. 1st Offices - Toilet_R_4
Windows***, roof windows, and rooflights	2.2	1.4	1.4	2- Ground - Entryway_G_8
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	3

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	>0.95

1- Gas Boiler htg

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	-
Standard value	0.91*	N/A	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.					

2- Split System htg & clg

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.65	3.91	-	-	-
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- Project DHW

	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**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
3. 1st Offices - Stairs Lift	-	-	-	-	-	-	-	-	-	-	N/A
3. 1st Offices - Toilet	-	-	0.4	-	-	-	-	-	-	-	N/A
4. 2nd Offices - Stairs Lift	-	-	-	-	-	-	-	-	-	-	N/A
4. 2nd Offices - Toilet	-	-	0.4	-	-	-	-	-	-	-	N/A
2- Ground - Entryway	-	-	-	-	-	-	-	-	-	-	N/A
2- Ground - Lift Stair Corridor	-	-	-	-	-	-	-	-	-	-	N/A
1 - Basement - Refuse	-	-	0.4	-	-	-	-	-	-	-	N/A
1 - Basement - Corridor	-	-	0.4	-	-	-	-	-	-	-	N/A

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
1 - Basement - Cycle Store	-	-	0.4	-	-	-	-	-	-	-	N/A
1 - Basement - Cycle Shower	-	-	0.4	-	-	-	-	-	-	-	N/A
1 - Basement - Stair Lift	-	-	-	-	-	-	-	-	-	-	N/A
1 - Basement - Plant Room	-	-	0.4	-	-	-	-	-	-	-	N/A
3. 1st Offices - Office	-	-	-	1.1	-	-	-	-	-	0.71	0.65
4. 2nd Offices - Office	-	-	-	1.1	-	-	-	-	-	0.71	0.65
2- Ground - Retail	-	-	-	1.4	-	-	-	-	-	0.71	0.65
2- Ground - Riser	-	-	-	-	-	-	-	-	-	-	N/A
1 - Basement - Retail	-	-	-	1.4	-	-	-	-	-	0.71	0.65
1 - Basement - Retail Toilet	-	-	0.4	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
3. 1st Offices - Stairs Lift	-	100	-	71
3. 1st Offices - Toilet	-	100	-	56
4. 2nd Offices - Stairs Lift	-	100	-	70
4. 2nd Offices - Toilet	-	100	-	55
2- Ground - Entryway	-	100	60	163
2- Ground - Lift Stair Corridor	-	100	-	84
1 - Basement - Refuse	100	-	-	13
1 - Basement - Corridor	-	100	-	39
1 - Basement - Cycle Store	100	-	-	28
1 - Basement - Cycle Shower	-	100	-	34
1 - Basement - Stair Lift	-	100	-	68
1 - Basement - Plant Room	100	-	-	263
3. 1st Offices - Office	100	-	-	1257
4. 2nd Offices - Office	100	-	-	1253
2- Ground - Retail	-	100	60	1776
2- Ground - Riser	100	-	-	4
1 - Basement - Retail	-	100	60	879
1 - Basement - Retail Toilet	-	100	60	62

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?
2- Ground - Entryway	NO (-47.1%)	NO
3. 1st Offices - Office	NO (-49.4%)	NO
4. 2nd Offices - Office	NO (-47.7%)	NO
2- Ground - Retail	NO (-0%)	NO
2- Ground - Riser	N/A	N/A
1 - Basement - Retail	NO (-17%)	NO
1 - Basement - Retail Toilet	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]	1073.4	1073.4
External area [m^2]	657.2	657.2
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	342.81	343.27
Average U-value [W/m^2K]	0.52	0.52
Alpha value* [%]	150.53	15.64

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

Building Use

% Area	Building Type
39	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
61	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: 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/m^2]

	Actual	Notional
Heating	7.96	4.17
Cooling	4.81	10.13
Auxiliary	4.77	3.69
Lighting	16.85	30.77
Hot water	1.56	1.81
Equipment*	44.6	44.6
TOTAL**	**35.96**	**50.56**

* 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/m^2]

	Actual	Notional
Photovoltaic systems	2.34	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	135.17	156.61
Primary energy* [kWh/m^2]	99.96	141.25
Total emissions [kg/m^2]	15.7	24.2

* 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] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	39.4	13.5	12.3	0	4.2	0.89	0	0.95	0
	Notional	31.4	30.3	10.7	0	4.6	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	92.1	87.8	5.6	7.4	5.1	4.56	3.28	4.65	4.39
	Notional	5.6	202.6	0.6	15.6	3.2	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 Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	**$U_{i\text{-}Typ}$**	**$U_{i\text{-}Min}$**	**Surface where the minimum value occurs***
Wall	0.23	0.18	3. 1st Offices - Toilet_W_10
Floor	0.2	0.13	1 - Basement - Refuse_S_3
Roof	0.15	0.13	3. 1st Offices - Toilet_R_4
Windows, roof windows, and rooflights	1.5	1.4	2- Ground - Entryway_G_8
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"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)]

$U_{i\text{-}Min}$ = 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**
$m^3/(h.m^2)$ at 50 Pa	5	3

APPENDIX 5 – SAP WORKSHEETS BASELINE

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	96.8	(1a) x	2.85	(2a) =	275.88	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	275.88	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.36	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

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

DRAFT

TER WorkSheet: New dwelling design stage

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

0.39	0.38	0.37	0.34	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			3.25	x1/[1/(1.5)+ 0.04]	=	4.6			(27)
Windows Type 2			14.45	x1/[1/(1.5)+ 0.04]	=	20.45			(27)
Walls Type1	32.21	0	32.21	x 0.18	=	5.8			(29)
Walls Type2	11.69	0	11.69	x 0.18	=	2.1			(29)
Walls Type3	24.23	14.45	9.78	x 0.18	=	1.76			(29)
Walls Type4	10.55	0	10.55	x 0.18	=	1.9			(29)
Walls Type5	15.39	9.75	5.64	x 0.18	=	1.02			(29)
Total area of elements, m²			94.05						(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.82 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 4.7 (36)

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

Total fabric heat loss (33) + (36) = 51.52 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	52.4	52.13	51.87	50.64	50.41	49.34	49.34	49.14	49.75	50.41	50.88	51.36	(38)

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

(39)m=	103.92	103.65	103.39	102.16	101.93	100.86	100.86	100.66	101.27	101.93	102.4	102.88

Average = Sum(39)$_{1…12}$ /12= 102.16 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	1.07	1.07	1.07	1.06	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.06

Average = Sum(40)$_{1...12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.71 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 98.51 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	108.36	104.42	100.48	96.54	92.6	88.66	88.66	92.6	96.54	100.48	104.42	108.36	
										Total = Sum(44)$_{1...12}$ =		1182.14	(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=	160.7	140.55	145.03	126.44	121.33	104.69	97.02	111.33	112.66	131.29	143.31	155.63	
										Total = Sum(45)$_{1...12}$ =		1549.97	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.1	21.08	21.76	18.97	18.2	15.7	14.55	16.7	16.9	19.69	21.5	23.34	(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): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

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

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

(62)m=	211.63	186.55	195.96	175.73	172.25	153.98	147.94	162.25	161.94	182.22	192.6	206.55	(62)

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

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

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

Output from water heater

(64)m=	211.63	186.55	195.96	175.73	172.25	153.98	147.94	162.25	161.94	182.22	192.6	206.55	

Output from water heater (annual)$_{1...12}$ 2149.59 (64)

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

(65)m=	94.17	83.53	88.96	81.47	81.08	74.24	73	77.76	76.88	84.39	87.08	92.49	(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=	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	(66)

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

(67)m=	22.38	19.88	16.17	12.24	9.15	7.72	8.35	10.85	14.56	18.49	21.58	23	(67)

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

(68)m=	251.05	253.65	247.09	233.11	215.47	198.89	187.81	185.21	191.77	205.75	223.39	239.97	(68)

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

(69)m=	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	(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=	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	(71)

Water heating gains (Table 5)

(72)m=	126.58	124.3	119.58	113.15	108.98	103.11	98.12	104.51	106.78	113.43	120.94	124.31	(72)

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

(73)m=	466.62	464.45	449.45	425.12	400.22	376.34	360.89	367.19	379.74	404.29	432.53	453.9	(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)	
East	0.9x	3	x	3.25	x	19.64	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	3	x	3.25	x	38.42	x	0.63	x	0.7	=	114.48	(76)
East	0.9x	3	x	3.25	x	63.27	x	0.63	x	0.7	=	188.54	(76)
East	0.9x	3	x	3.25	x	92.28	x	0.63	x	0.7	=	274.97	(76)
East	0.9x	3	x	3.25	x	113.09	x	0.63	x	0.7	=	336.99	(76)

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East	0.9x	3	x	3.25	x	115.77	x	0.63	x	0.7	=	344.96	(76)
East	0.9x	3	x	3.25	x	110.22	x	0.63	x	0.7	=	328.42	(76)
East	0.9x	3	x	3.25	x	94.68	x	0.63	x	0.7	=	282.11	(76)
East	0.9x	3	x	3.25	x	73.59	x	0.63	x	0.7	=	219.28	(76)
East	0.9x	3	x	3.25	x	45.59	x	0.63	x	0.7	=	135.84	(76)
East	0.9x	3	x	3.25	x	24.49	x	0.63	x	0.7	=	72.97	(76)
East	0.9x	3	x	3.25	x	16.15	x	0.63	x	0.7	=	48.13	(76)
South	0.9x	0.77	x	14.45	x	46.75	x	0.63	x	0.7	=	206.46	(78)
South	0.9x	0.77	x	14.45	x	76.57	x	0.63	x	0.7	=	338.13	(78)
South	0.9x	0.77	x	14.45	x	97.53	x	0.63	x	0.7	=	430.72	(78)
South	0.9x	0.77	x	14.45	x	110.23	x	0.63	x	0.7	=	486.81	(78)
South	0.9x	0.77	x	14.45	x	114.87	x	0.63	x	0.7	=	507.28	(78)
South	0.9x	0.77	x	14.45	x	110.55	x	0.63	x	0.7	=	488.19	(78)
South	0.9x	0.77	x	14.45	x	108.01	x	0.63	x	0.7	=	476.99	(78)
South	0.9x	0.77	x	14.45	x	104.89	x	0.63	x	0.7	=	463.23	(78)
South	0.9x	0.77	x	14.45	x	101.89	x	0.63	x	0.7	=	449.94	(78)
South	0.9x	0.77	x	14.45	x	82.59	x	0.63	x	0.7	=	364.71	(78)
South	0.9x	0.77	x	14.45	x	55.42	x	0.63	x	0.7	=	244.73	(78)
South	0.9x	0.77	x	14.45	x	40.4	x	0.63	x	0.7	=	178.4	(78)

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

(83)m=	264.98	452.61	619.26	761.78	844.27	833.16	805.41	745.33	669.21	500.55	317.7	226.53	(83)

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

(84)m=	731.61	917.07	1068.71	1186.9	1244.49	1209.5	1166.31	1112.52	1048.95	904.84	750.23	680.43	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.71	0.53	0.38	0.41	0.64	0.9	0.98	1	(86)

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

(87)m=	20.01	20.24	20.52	20.79	20.94	20.99	21	21	20.97	20.76	20.32	19.96	(87)

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

(88)m=	20.02	20.02	20.03	20.04	20.04	20.05	20.05	20.05	20.04	20.04	20.04	20.03	(88)

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

(89)m=	0.99	0.98	0.93	0.83	0.65	0.45	0.3	0.33	0.56	0.87	0.98	0.99	(89)

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

(90)m=	18.71	19.05	19.45	19.81	19.98	20.04	20.05	20.05	20.03	19.78	19.18	18.66	(90)

fLA = Living area ÷ (4) = | 0.41 | (91)

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

(92)m=	19.25	19.54	19.89	20.21	20.38	20.43	20.44	20.44	20.42	20.19	19.65	19.19	(92)

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

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(93)m=	19.25	19.54	19.89	20.21	20.38	20.43	20.44	20.44	20.42	20.19	19.65	19.19	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.97	0.93	0.83	0.67	0.48	0.33	0.36	0.59	0.87	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	724.45	891.16	992.63	987.4	838.78	582.2	386.55	405.54	621.79	790.96	732.37	675.66		(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=	1553.22	1517.78	1384.12	1155.54	884.43	588.23	387.19	406.61	639.57	977.03	1285.31	1542.67		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	616.6	421.09	291.27	121.06	33.96	0	0	0	0	138.43	398.11	645.05		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				2665.58	(98)
Space heating requirement in kWh/m²/year													27.54	(99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	616.6	421.09	291.27	121.06	33.96	0	0	0	0	138.43	398.11	645.05		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	659.46	450.36	311.52	129.48	36.32	0	0	0	0	148.06	425.79	689.89		
									Total (kWh/year) =Sum(211)$_{1...5,10...12}$=				2850.89	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10...12}$=				0	(215)

Water heating

Output from water heater (calculated above)														
	211.63	186.55	195.96	175.73	172.25	153.98	147.94	162.25	161.94	182.22	192.6	206.55		
Efficiency of water heater													79.8	(216)
(217)m=	87.5	86.92	85.87	83.84	81.38	79.8	79.8	79.8	79.8	84.09	86.71	87.65		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	241.85	214.61	228.21	209.59	211.65	192.96	185.39	203.32	202.93	216.69	222.12	235.66		
									Total = Sum(219a)$_{1...12}$ =				2564.97	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2850.89

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Water heating fuel used			2564.97	
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			395.26	(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	=	615.79	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	554.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1169.83	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	205.14	(268)
Total CO2, kg/year		sum of (265)…(271) =		1413.89	(272)

TER = 14.61 (273)

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User Details:			
Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.1	(1a) x	2.85	(2a) =	214.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.1	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	214.03	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		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
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

0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.57	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	
Windows			18.77	x1/[1/(1.5)+ 0.04]		=	26.56			(27)
Walls Type1	23.94	0	23.94	x	0.18	=	4.31			(29)
Walls Type2	28.78	0	28.78	x	0.18	=	5.18			(29)
Walls Type3	21.66	18.77	2.89	x	0.18	=	0.52			(29)
Walls Type4	10.83	0	10.83	x	0.18	=	1.95			(29)
Total area of elements, m²			85.22							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.52 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 4.26 (36)

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

Total fabric heat loss (33) + (36) = 42.78 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.56	40.36	40.16	39.22	39.05	38.23	38.23	38.08	38.54	39.05	39.4	39.77	(38)

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

(39)m=	83.35	83.14	82.94	82.01	81.83	81.01	81.01	80.86	81.33	81.83	82.18	82.56	

Average = $Sum(39)_{1…12}$ /12= 82 (39)

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

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

Average = Sum(40)$_{1…12}$ /12= 1.09 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.33 (43)

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

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

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

(44)m=	99.36	95.75	92.14	88.52	84.91	81.3	81.3	84.91	88.52	92.14	95.75	99.36

Total = Sum(44)$_{1…12}$ = 1083.95 (44)

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

(45)m=	147.35	128.87	132.99	115.94	111.25	96	88.96	102.08	103.3	120.38	131.41	142.7

Total = Sum(45)$_{1…12}$ = 1421.23 (45)

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

(46)m=	22.1	19.33	19.95	17.39	16.69	14.4	13.34	15.31	15.49	18.06	19.71	21.41	(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): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

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

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

(62)m=	198.28	174.87	183.91	165.22	162.17	145.28	139.88	153.01	152.58	171.31	180.69	193.63	(62)

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

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

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

Output from water heater

(64)m=	198.28	174.87	183.91	165.22	162.17	145.28	139.88	153.01	152.58	171.31	180.69	193.63	

Output from water heater (annual)$_{1\ldots12}$ 2020.84 (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=	89.73	79.65	84.96	77.98	77.73	71.35	70.32	74.68	73.77	80.77	83.12	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=	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	(66)

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

(67)m=	18.62	16.54	13.45	10.18	7.61	6.43	6.94	9.03	12.12	15.38	17.96	19.14	(67)

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

(68)m=	208.9	211.06	205.6	193.97	179.29	165.5	156.28	154.11	159.57	171.2	185.88	199.68	(68)

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

(69)m=	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	(71)

Water heating gains (Table 5)

(72)m=	120.61	118.52	114.19	108.3	104.48	99.09	94.51	100.38	102.46	108.56	115.44	118.53	(72)

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

(73)m=	409.58	407.58	394.7	373.91	352.83	332.47	319.19	324.97	335.6	356.6	380.73	398.8	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	18.77	x	10.63	x	0.63	x	0.7	=	61	(74)
North	0.9x	0.77	x	18.77	x	20.32	x	0.63	x	0.7	=	116.57	(74)
North	0.9x	0.77	x	18.77	x	34.53	x	0.63	x	0.7	=	198.08	(74)
North	0.9x	0.77	x	18.77	x	55.46	x	0.63	x	0.7	=	318.16	(74)
North	0.9x	0.77	x	18.77	x	74.72	x	0.63	x	0.7	=	428.6	(74)

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North	0.9x	0.77	x	18.77	x	79.99	x	0.63	x	0.7	=	458.82	(74)
North	0.9x	0.77	x	18.77	x	74.68	x	0.63	x	0.7	=	428.37	(74)
North	0.9x	0.77	x	18.77	x	59.25	x	0.63	x	0.7	=	339.86	(74)
North	0.9x	0.77	x	18.77	x	41.52	x	0.63	x	0.7	=	238.15	(74)
North	0.9x	0.77	x	18.77	x	24.19	x	0.63	x	0.7	=	138.76	(74)
North	0.9x	0.77	x	18.77	x	13.12	x	0.63	x	0.7	=	75.25	(74)
North	0.9x	0.77	x	18.77	x	8.86	x	0.63	x	0.7	=	50.85	(74)

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

(83)m=	61	116.57	198.08	318.16	428.6	458.82	428.37	339.86	238.15	138.76	75.25	50.85	(83)

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

(84)m=	470.58	524.15	592.77	692.07	781.43	791.29	747.56	664.83	573.76	495.36	455.98	449.65	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.63	0.47	0.55	0.83	0.97	1	1	(86)

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

(87)m=	19.84	19.97	20.22	20.58	20.86	20.97	21	20.99	20.89	20.53	20.13	19.82	(87)

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

(88)m=	19.99	20	20	20.01	20.01	20.02	20.02	20.02	20.01	20.01	20.01	20	(88)

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

(89)m=	1	0.99	0.98	0.93	0.78	0.54	0.37	0.44	0.76	0.96	0.99	1	(89)

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

(90)m=	18.44	18.64	19.01	19.51	19.87	20	20.02	20.02	19.93	19.47	18.88	18.42	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.11	19.27	19.58	20.02	20.34	20.46	20.48	20.48	20.39	19.97	19.47	19.08	(92)

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

(93)m=	19.11	19.27	19.58	20.02	20.34	20.46	20.48	20.48	20.39	19.97	19.47	19.08	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.8	0.58	0.42	0.49	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	468.58	520.01	580.84	644.15	621.35	461.67	312.5	325.64	452.42	476.44	452.16	448.14	(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=	1233.98	1194.8	1085.03	911.65	706.97	474.95	314.37	329.73	511.26	766.96	1016.87	1228.53	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	569.45	453.46	375.12	192.6	63.7	0	0	0	0	216.14	406.59	580.61	(98)

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2857.68	(98)
Space heating requirement in kWh/m²/year	38.05	(99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	569.45	453.46	375.12	192.6	63.7	0	0	0	0	216.14	406.59	580.61		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	609.04	484.99	401.19	205.99	68.13	0	0	0	0	231.17	434.85	620.97		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3056.34	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	198.28	174.87	183.91	165.22	162.17	145.28	139.88	153.01	152.58	171.31	180.69	193.63		
Efficiency of water heater													79.8	(216)
(217)m=	87.47	87.24	86.68	85.22	82.55	79.8	79.8	79.8	79.8	85.43	86.91	87.56		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	226.68	200.44	212.18	193.87	196.45	182.06	175.29	191.74	191.2	200.52	207.9	221.13		
Total = Sum(219a)$_{1...12}$ =													2399.45	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3056.34	
Water heating fuel used		2399.45	
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		328.89	(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	=	660.17	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	518.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1178.45	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	170.7	(268)
Total CO2, kg/year		sum of (265)…(271) =		1388.07	(272)
TER =				18.48	(273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.7

Property Address: 9

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	134.6	(1a) x	2.85	(2a) =	383.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	134.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	383.61	(5)

2. Ventilation rate:

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

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.1	(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)	0.35	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			3.07	x1/[1/(1.4)+ 0.04]		=	4.07			(27)
Windows Type 2			2.91	x1/[1/(1.4)+ 0.04]		=	3.86			(27)
Windows Type 3			9.74	x1/[1/(1.5)+ 0.04]		=	13.78			(27)
Windows Type 4			2.56	x1/[1/(1.5)+ 0.04]		=	3.62			(27)
Windows Type 5			12.3	x1/[1/(1.5)+ 0.04]		=	17.41			(27)
Walls Type1	41.5	9.05	32.45	x	0.18	=	5.84			(29)
Walls Type2	21.4	0	21.4	x	0.18	=	3.85			(29)
Walls Type3	16.1	12.3	3.8	x	0.18	=	0.68			(29)
Walls Type4	22.2	12.3	9.9	x	0.18	=	1.78			(29)
Walls Type5	14.82	0	14.82	x	0.18	=	2.67			(29)
Walls Type6	4.2	0	4.2	x	0.18	=	0.76			(29)
Walls Type7	15.4	0	15.4	x	0.18	=	2.77			(29)
Total area of elements, m²			135.62							(31)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	65.16	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K	6.78	(36)

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

Total fabric heat loss (33) + (36) = 71.95 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	72.63	72.26	71.91	70.24	69.93	68.48	68.48	68.21	69.04	69.93	70.56	71.22	(38)

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

(39)m=	144.57	144.21	143.85	142.19	141.87	140.42	140.42	140.15	140.98	141.87	142.5	143.17	

Average = Sum(39)$_{1…12}$ /12= 142.18 (39)

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

(40)m=	1.07	1.07	1.07	1.06	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.06	

Average = Sum(40)$_{1…12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.91 (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) + 36 103.22 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	113.54	109.41	105.28	101.15	97.02	92.9	92.9	97.02	101.15	105.28	109.41	113.54	

Total = Sum(44)$_{1…12}$ = 1238.61 (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=	168.38	147.26	151.96	132.48	127.12	109.7	101.65	116.64	118.04	137.56	150.16	163.06	

Total = Sum(45)$_{1…12}$ = 1624.02 (45)

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

(46)m=	25.26	22.09	22.79	19.87	19.07	16.45	15.25	17.5	17.71	20.63	22.52	24.46	(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): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

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

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

(62)m=	219.3	193.26	202.89	181.77	178.05	158.98	152.58	167.57	167.32	188.49	199.44	213.99	(62)

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

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

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

Output from water heater

(64)m=	219.3	193.26	202.89	181.77	178.05	158.98	152.58	167.57	167.32	188.49	199.44	213.99	

Output from water heater (annual)$_{1...12}$ 2223.63 (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=	96.73	85.76	91.27	83.48	83.01	75.9	74.54	79.53	78.67	86.48	89.35	94.96	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	(66)

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

(67)m=	27.03	24.01	19.52	14.78	11.05	9.33	10.08	13.1	17.58	22.33	26.06	27.78	(67)

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

(68)m=	303.18	306.33	298.4	281.52	260.22	240.19	226.82	223.67	231.6	248.48	269.78	289.81	(68)

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

(69)m=	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	(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=	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	(71)

Water heating gains (Table 5)

(72)m=	130.01	127.62	122.67	115.94	111.57	105.42	100.19	106.89	109.27	116.24	124.1	127.63	(72)

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

(73)m=	529.81	527.55	510.19	481.84	452.43	424.53	406.67	413.25	428.04	456.63	489.54	514.81	(73)

6. Solar gains:

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

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	12.3	x	10.63	x	0.63	x	0.7	=	39.97	(74)
North	0.9x	0.77	x	12.3	x	20.32	x	0.63	x	0.7	=	76.39	(74)
North	0.9x	0.77	x	12.3	x	34.53	x	0.63	x	0.7	=	129.8	(74)
North	0.9x	0.77	x	12.3	x	55.46	x	0.63	x	0.7	=	208.49	(74)
North	0.9x	0.77	x	12.3	x	74.72	x	0.63	x	0.7	=	280.86	(74)
North	0.9x	0.77	x	12.3	x	79.99	x	0.63	x	0.7	=	300.67	(74)
North	0.9x	0.77	x	12.3	x	74.68	x	0.63	x	0.7	=	280.71	(74)
North	0.9x	0.77	x	12.3	x	59.25	x	0.63	x	0.7	=	222.71	(74)
North	0.9x	0.77	x	12.3	x	41.52	x	0.63	x	0.7	=	156.06	(74)
North	0.9x	0.77	x	12.3	x	24.19	x	0.63	x	0.7	=	90.93	(74)
North	0.9x	0.77	x	12.3	x	13.12	x	0.63	x	0.7	=	49.31	(74)
North	0.9x	0.77	x	12.3	x	8.86	x	0.63	x	0.7	=	33.32	(74)
East	0.9x	2	x	3.07	x	19.64	x	0.63	x	0.7	=	36.85	(76)
East	0.9x	1	x	2.91	x	19.64	x	0.63	x	0.7	=	17.47	(76)
East	0.9x	2	x	3.07	x	38.42	x	0.63	x	0.7	=	72.09	(76)
East	0.9x	1	x	2.91	x	38.42	x	0.63	x	0.7	=	34.17	(76)
East	0.9x	2	x	3.07	x	63.27	x	0.63	x	0.7	=	118.73	(76)
East	0.9x	1	x	2.91	x	63.27	x	0.63	x	0.7	=	56.27	(76)
East	0.9x	2	x	3.07	x	92.28	x	0.63	x	0.7	=	173.16	(76)
East	0.9x	1	x	2.91	x	92.28	x	0.63	x	0.7	=	82.07	(76)
East	0.9x	2	x	3.07	x	113.09	x	0.63	x	0.7	=	212.21	(76)
East	0.9x	1	x	2.91	x	113.09	x	0.63	x	0.7	=	100.58	(76)
East	0.9x	2	x	3.07	x	115.77	x	0.63	x	0.7	=	217.24	(76)
East	0.9x	1	x	2.91	x	115.77	x	0.63	x	0.7	=	102.96	(76)
East	0.9x	2	x	3.07	x	110.22	x	0.63	x	0.7	=	206.82	(76)
East	0.9x	1	x	2.91	x	110.22	x	0.63	x	0.7	=	98.02	(76)
East	0.9x	2	x	3.07	x	94.68	x	0.63	x	0.7	=	177.66	(76)
East	0.9x	1	x	2.91	x	94.68	x	0.63	x	0.7	=	84.2	(76)
East	0.9x	2	x	3.07	x	73.59	x	0.63	x	0.7	=	138.09	(76)
East	0.9x	1	x	2.91	x	73.59	x	0.63	x	0.7	=	65.45	(76)
East	0.9x	2	x	3.07	x	45.59	x	0.63	x	0.7	=	85.55	(76)
East	0.9x	1	x	2.91	x	45.59	x	0.63	x	0.7	=	40.54	(76)
East	0.9x	2	x	3.07	x	24.49	x	0.63	x	0.7	=	45.95	(76)
East	0.9x	1	x	2.91	x	24.49	x	0.63	x	0.7	=	21.78	(76)
East	0.9x	2	x	3.07	x	16.15	x	0.63	x	0.7	=	30.31	(76)
East	0.9x	1	x	2.91	x	16.15	x	0.63	x	0.7	=	14.36	(76)
South	0.9x	0.77	x	9.74	x	46.75	x	0.63	x	0.7	=	139.17	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.63	x	0.7	=	36.58	(78)
South	0.9x	0.77	x	9.74	x	76.57	x	0.63	x	0.7	=	227.92	(78)

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South	0.9x	0.77	x	2.56	x	76.57	x	0.63	x	0.7	=	59.9	(78)
South	0.9x	0.77	x	9.74	x	97.53	x	0.63	x	0.7	=	290.33	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.63	x	0.7	=	76.31	(78)
South	0.9x	0.77	x	9.74	x	110.23	x	0.63	x	0.7	=	328.13	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.63	x	0.7	=	86.24	(78)
South	0.9x	0.77	x	9.74	x	114.87	x	0.63	x	0.7	=	341.93	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.63	x	0.7	=	89.87	(78)
South	0.9x	0.77	x	9.74	x	110.55	x	0.63	x	0.7	=	329.06	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.63	x	0.7	=	86.49	(78)
South	0.9x	0.77	x	9.74	x	108.01	x	0.63	x	0.7	=	321.52	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.63	x	0.7	=	84.51	(78)
South	0.9x	0.77	x	9.74	x	104.89	x	0.63	x	0.7	=	312.24	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.63	x	0.7	=	82.07	(78)
South	0.9x	0.77	x	9.74	x	101.89	x	0.63	x	0.7	=	303.28	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.63	x	0.7	=	79.71	(78)
South	0.9x	0.77	x	9.74	x	82.59	x	0.63	x	0.7	=	245.83	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.63	x	0.7	=	64.61	(78)
South	0.9x	0.77	x	9.74	x	55.42	x	0.63	x	0.7	=	164.96	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.63	x	0.7	=	43.36	(78)
South	0.9x	0.77	x	9.74	x	40.4	x	0.63	x	0.7	=	120.25	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.63	x	0.7	=	31.61	(78)

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

(83)m=	270.04	470.47	671.43	878.1	1025.46	1036.42	991.57	878.87	742.59	527.46	325.36	229.85	(83)

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

(84)m=	799.85	998.02	1181.62	1359.93	1477.88	1460.95	1398.25	1292.12	1170.63	984.09	814.89	744.66	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.79	0.6	0.44	0.49	0.76	0.96	1	1	(86)

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

(87)m=	19.86	20.06	20.34	20.67	20.89	20.98	21	20.99	20.94	20.62	20.17	19.82	(87)

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

(88)m=	20.02	20.02	20.03	20.04	20.04	20.05	20.05	20.05	20.04	20.04	20.03	20.03	(88)

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

(89)m=	1	0.99	0.97	0.9	0.74	0.52	0.35	0.39	0.68	0.94	0.99	1	(89)

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

(90)m=	18.49	18.79	19.2	19.66	19.94	20.04	20.05	20.05	20	19.61	18.96	18.45	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.13	19.38	19.74	20.14	20.39	20.48	20.49	20.49	20.44	20.09	19.53	19.09	(92)

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

(93)m=	19.13	19.38	19.74	20.14	20.39	20.48	20.49	20.49	20.44	20.09	19.53	19.09	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.9	0.76	0.55	0.39	0.44	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	797.18	987.69	1144.58	1227.57	1120.67	809.13	544.61	569.66	834.28	927.52	808.05	742.92	(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=	2144.5	2088.86	1903.94	1597.59	1232.69	825.68	546.63	573.5	893.76	1345.7	1771.07	2132.29	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1002.41	739.99	564.96	266.42	83.35	0	0	0	0	311.12	693.37	1033.69	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4695.3 (98)

Space heating requirement in kWh/m²/year 34.88 (99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	1002.41	739.99	564.96	266.42	83.35	0	0	0	0	311.12	693.37	1033.69		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1072.09	791.43	604.24	284.94	89.14	0	0	0	0	332.75	741.57	1105.55		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													5021.71	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	219.3	193.26	202.89	181.77	178.05	158.98	152.58	167.57	167.32	188.49	199.44	213.99		
Efficiency of water heater													79.8	(216)
(217)m=	88.37	88.05	87.4	85.83	82.93	79.8	79.8	79.8	79.8	86.14	87.87	88.47		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	248.16	219.48	232.13	211.77	214.71	199.22	191.2	209.99	209.68	218.81	226.98	241.89		
Total = Sum(219a)$_{1...12}$ =													2624	(219)

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Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			5021.71	
Water heating fuel used			2624	
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			477.34	(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	=	1084.69	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	566.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1651.47	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	247.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1938.14	(272)
TER =				14.4	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.7

Property Address: 5F

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	96.8	(1a) x	2.85	(2a) =	275.88	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	275.88	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.36	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

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

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

0.39	0.38	0.37	0.34	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			3.25	x1/[1/(1.4)+ 0.04]		=	4.31			(27)
Windows Type 2			14.45	x1/[1/(1.5)+ 0.04]		=	20.45			(27)
Floor			96.8	x	0.13	=	12.584			(28)
Walls Type1	32.21	9.75	22.46	x	0.18	=	4.04			(29)
Walls Type2	11.69	0	11.69	x	0.18	=	2.1			(29)
Walls Type3	24.23	14.45	9.78	x	0.18	=	1.76			(29)
Walls Type4	10.55	0	10.55	x	0.18	=	1.9			(29)
Walls Type5	15.39	0	15.39	x	0.18	=	2.77			(29)
Total area of elements, m²			190.85							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 58.53 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.54 (36)

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

Total fabric heat loss (33) + (36) = 68.07 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	52.4	52.13	51.87	50.64	50.41	49.34	49.34	49.14	49.75	50.41	50.88	51.36	(38)

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

(39)m=	120.47	120.21	119.95	118.72	118.49	117.41	117.41	117.22	117.83	118.49	118.95	119.44	

Average = Sum(39)$_{1…12}$ /12= 118.71 (39)

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

(40)m=	1.24	1.24	1.24	1.23	1.22	1.21	1.21	1.21	1.22	1.22	1.23	1.23

Average = Sum(40)$_{1\ldots12}$ /12= 1.23 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.71 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 98.51 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	108.36	104.42	100.48	96.54	92.6	88.66	88.66	92.6	96.54	100.48	104.42	108.36	
										Total = Sum(44)$_{1\ldots12}$ =		1182.14	(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=	160.7	140.55	145.03	126.44	121.33	104.69	97.02	111.33	112.66	131.29	143.31	155.63	
										Total = Sum(45)$_{1\ldots12}$ =		1549.97	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.1	21.08	21.76	18.97	18.2	15.7	14.55	16.7	16.9	19.69	21.5	23.34	(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): — 1.65 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.89 (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) — 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

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

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

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

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

(62)m=	211.63	186.55	195.96	175.73	172.25	153.98	147.94	162.25	161.94	182.22	192.6	206.55	(62)

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

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

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

Output from water heater

(64)m=	211.63	186.55	195.96	175.73	172.25	153.98	147.94	162.25	161.94	182.22	192.6	206.55	

Output from water heater (annual)$_{1...12}$ 2149.59 (64)

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

(65)m=	94.17	83.53	88.96	81.47	81.08	74.24	73	77.76	76.88	84.39	87.08	92.49	(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=	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	22.38	19.88	16.17	12.24	9.15	7.72	8.35	10.85	14.56	18.49	21.58	23	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	251.05	253.65	247.09	233.11	215.47	198.89	187.81	185.21	191.77	205.75	223.39	239.97	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	(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=	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	(71)
Water heating gains (Table 5)													
(72)m=	126.58	124.3	119.58	113.15	108.98	103.11	98.12	104.51	106.78	113.43	120.94	124.31	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	466.62	464.45	449.45	425.12	400.22	376.34	360.89	367.19	379.74	404.29	432.53	453.9	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	3	x	3.25	x	19.64	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	3	x	3.25	x	38.42	x	0.63	x	0.7	=	114.48	(76)
East	0.9x	3	x	3.25	x	63.27	x	0.63	x	0.7	=	188.54	(76)
East	0.9x	3	x	3.25	x	92.28	x	0.63	x	0.7	=	274.97	(76)
East	0.9x	3	x	3.25	x	113.09	x	0.63	x	0.7	=	336.99	(76)

East	0.9x	3	x	3.25	x	115.77	x	0.63	x	0.7	=	344.96	(76)
East	0.9x	3	x	3.25	x	110.22	x	0.63	x	0.7	=	328.42	(76)
East	0.9x	3	x	3.25	x	94.68	x	0.63	x	0.7	=	282.11	(76)
East	0.9x	3	x	3.25	x	73.59	x	0.63	x	0.7	=	219.28	(76)
East	0.9x	3	x	3.25	x	45.59	x	0.63	x	0.7	=	135.84	(76)
East	0.9x	3	x	3.25	x	24.49	x	0.63	x	0.7	=	72.97	(76)
East	0.9x	3	x	3.25	x	16.15	x	0.63	x	0.7	=	48.13	(76)
South	0.9x	0.77	x	14.45	x	46.75	x	0.63	x	0.7	=	206.46	(78)
South	0.9x	0.77	x	14.45	x	76.57	x	0.63	x	0.7	=	338.13	(78)
South	0.9x	0.77	x	14.45	x	97.53	x	0.63	x	0.7	=	430.72	(78)
South	0.9x	0.77	x	14.45	x	110.23	x	0.63	x	0.7	=	486.81	(78)
South	0.9x	0.77	x	14.45	x	114.87	x	0.63	x	0.7	=	507.28	(78)
South	0.9x	0.77	x	14.45	x	110.55	x	0.63	x	0.7	=	488.19	(78)
South	0.9x	0.77	x	14.45	x	108.01	x	0.63	x	0.7	=	476.99	(78)
South	0.9x	0.77	x	14.45	x	104.89	x	0.63	x	0.7	=	463.23	(78)
South	0.9x	0.77	x	14.45	x	101.89	x	0.63	x	0.7	=	449.94	(78)
South	0.9x	0.77	x	14.45	x	82.59	x	0.63	x	0.7	=	364.71	(78)
South	0.9x	0.77	x	14.45	x	55.42	x	0.63	x	0.7	=	244.73	(78)
South	0.9x	0.77	x	14.45	x	40.4	x	0.63	x	0.7	=	178.4	(78)

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

(83)m=	264.98	452.61	619.26	761.78	844.27	833.16	805.41	745.33	669.21	500.55	317.7	226.53	(83)

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

(84)m=	731.61	917.07	1068.71	1186.9	1244.49	1209.5	1166.31	1112.52	1048.95	904.84	750.23	680.43	(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	0.9	0.77	0.6	0.44	0.48	0.71	0.93	0.99	1	(86)

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

(87)m=	19.78	20.01	20.32	20.64	20.87	20.97	20.99	20.99	20.93	20.62	20.13	19.73	(87)

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

(88)m=	19.88	19.89	19.89	19.9	19.9	19.91	19.91	19.91	19.91	19.9	19.9	19.89	(88)

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

(89)m=	0.99	0.98	0.95	0.86	0.71	0.5	0.33	0.37	0.62	0.9	0.98	0.99	(89)

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

(90)m=	18.28	18.62	19.06	19.51	19.78	19.89	19.91	19.91	19.86	19.49	18.8	18.22	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	18.89	19.2	19.58	19.97	20.23	20.34	20.35	20.35	20.3	19.96	19.34	18.84	(92)

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

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(93)m=	18.89	19.2	19.58	19.97	20.23	20.34	20.35	20.35	20.3	19.96	19.34	18.84	(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	0.87	0.73	0.54	0.38	0.41	0.65	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	724.75	894.49	1006.47	1028.1	910.16	655.02	438.31	459.46	686.15	813.78	734.49	675.72	(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=	1758.04	1718.47	1568.36	1314.55	1010.33	673.41	440.84	463.44	730.64	1108.86	1456.41	1748.47	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	768.77	553.71	418.05	206.25	74.52	0	0	0	0	219.54	519.78	798.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3558.74 (98)

Space heating requirement in kWh/m²/year 36.76 (99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	768.77	553.71	418.05	206.25	74.52	0	0	0	0	219.54	519.78	798.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	822.21	592.21	447.11	220.59	79.7	0	0	0	0	234.8	555.92	853.61	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3806.14 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	211.63	186.55	195.96	175.73	172.25	153.98	147.94	162.25	161.94	182.22	192.6	206.55

Efficiency of water heater 79.8 (216)

(217)m=	87.95	87.54	86.79	85.24	82.75	79.8	79.8	79.8	79.8	85.31	87.33	88.07	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	240.61	213.09	225.8	206.15	208.15	192.96	185.39	203.32	202.93	213.59	220.53	234.53

Total = Sum(219a)$_{1...12}$ = 2547.04 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3806.14

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Water heating fuel used			2547.04	
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			395.26	(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	=	822.13	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	550.16	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1372.29	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	205.14	(268)
Total CO2, kg/year			sum of (265)…(271) =		1616.35	(272)

TER =	16.7	(273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.7

Property Address: 6F

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.1	(1a) x	2.85	(2a) =	214.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.1	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	214.03	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

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

Number of sides sheltered		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
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

0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.57	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	
Windows			18.77	x1/[1/(1.5)+ 0.04]		=	26.56			(27)
Floor			75.1	x	0.13	=	9.763			(28)
Walls Type1	23.94	0	23.94	x	0.18	=	4.31			(29)
Walls Type2	28.78	0	28.78	x	0.18	=	5.18			(29)
Walls Type3	21.66	18.77	2.89	x	0.18	=	0.52			(29)
Walls Type4	10.83	0	10.83	x	0.18	=	1.95			(29)
Total area of elements, m²			160.31							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 48.28 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.02 (36)

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

Total fabric heat loss (33) + (36) = 56.3 (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	
(38)m=	40.56	40.36	40.16	39.22	39.05	38.23	38.23	38.08	38.54	39.05	39.4	39.77	(38)

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

(39)m=	96.87	96.66	96.46	95.52	95.35	94.53	94.53	94.38	94.84	95.35	95.7	96.07	

Average = Sum(39)$_{1…12}$ /12= 95.52 (39)

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

(40)m=	1.29	1.29	1.28	1.27	1.27	1.26	1.26	1.26	1.26	1.27	1.27	1.28	

Average = Sum(40)$_{1…12}$ /12= 1.27 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.33 (43)

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

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

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

(44)m=	99.36	95.75	92.14	88.52	84.91	81.3	81.3	84.91	88.52	92.14	95.75	99.36	

Total = Sum(44)$_{1…12}$ = 1083.95 (44)

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

(45)m=	147.35	128.87	132.99	115.94	111.25	96	88.96	102.08	103.3	120.38	131.41	142.7	

Total = Sum(45)$_{1…12}$ = 1421.23 (45)

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

(46)m=	22.1	19.33	19.95	17.39	16.69	14.4	13.34	15.31	15.49	18.06	19.71	21.41	(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): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (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) 0.89 (55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

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

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

(62)m=	198.28	174.87	183.91	165.22	162.17	145.28	139.88	153.01	152.58	171.31	180.69	193.63	(62)

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

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

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

Output from water heater

(64)m=	198.28	174.87	183.91	165.22	162.17	145.28	139.88	153.01	152.58	171.31	180.69	193.63	

Output from water heater (annual)$_{1...12}$ 2020.84 (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=	89.73	79.65	84.96	77.98	77.73	71.35	70.32	74.68	73.77	80.77	83.12	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=	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.62	16.54	13.45	10.18	7.61	6.43	6.94	9.03	12.12	15.38	17.96	19.14	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	208.9	211.06	205.6	193.97	179.29	165.5	156.28	154.11	159.57	171.2	185.88	199.68	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	(71)
Water heating gains (Table 5)													
(72)m=	120.61	118.52	114.19	108.3	104.48	99.09	94.51	100.38	102.46	108.56	115.44	118.53	(72)
Total internal gains =					(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m								
(73)m=	409.58	407.58	394.7	373.91	352.83	332.47	319.19	324.97	335.6	356.6	380.73	398.8	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	18.77	x	10.63	x	0.63	x	0.7	=	61	(74)
North	0.9x	0.77	x	18.77	x	20.32	x	0.63	x	0.7	=	116.57	(74)
North	0.9x	0.77	x	18.77	x	34.53	x	0.63	x	0.7	=	198.08	(74)
North	0.9x	0.77	x	18.77	x	55.46	x	0.63	x	0.7	=	318.16	(74)
North	0.9x	0.77	x	18.77	x	74.72	x	0.63	x	0.7	=	428.6	(74)

North	0.9x	0.77	x	18.77	x	79.99	x	0.63	x	0.7	=	458.82	(74)
North	0.9x	0.77	x	18.77	x	74.68	x	0.63	x	0.7	=	428.37	(74)
North	0.9x	0.77	x	18.77	x	59.25	x	0.63	x	0.7	=	339.86	(74)
North	0.9x	0.77	x	18.77	x	41.52	x	0.63	x	0.7	=	238.15	(74)
North	0.9x	0.77	x	18.77	x	24.19	x	0.63	x	0.7	=	138.76	(74)
North	0.9x	0.77	x	18.77	x	13.12	x	0.63	x	0.7	=	75.25	(74)
North	0.9x	0.77	x	18.77	x	8.86	x	0.63	x	0.7	=	50.85	(74)

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

(83)m=	61	116.57	198.08	318.16	428.6	458.82	428.37	339.86	238.15	138.76	75.25	50.85	(83)

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

(84)m=	470.58	524.15	592.77	692.07	781.43	791.29	747.56	664.83	573.76	495.36	455.98	449.65	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.7	0.54	0.62	0.87	0.98	1	1	(86)

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

(87)m=	19.6	19.74	20.01	20.4	20.75	20.94	20.98	20.97	20.81	20.38	19.93	19.58	(87)

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

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

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

(89)m=	1	0.99	0.98	0.95	0.82	0.6	0.41	0.48	0.8	0.97	0.99	1	(89)

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

(90)m=	18	18.2	18.59	19.16	19.62	19.83	19.87	19.86	19.72	19.14	18.48	17.97	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

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

(92)m=	18.76	18.93	19.26	19.75	20.15	20.36	20.4	20.39	20.24	19.73	19.17	18.73	(92)

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

(93)m=	18.76	18.93	19.26	19.75	20.15	20.36	20.4	20.39	20.24	19.73	19.17	18.73	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.47	0.55	0.83	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	468.48	520.06	581.98	652.69	652.84	510.62	352.85	364.66	475.78	479.13	452.24	448.02	(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=	1400.32	1356.03	1231.26	1036.11	806.1	544.08	358.97	376.51	581.88	870.41	1155.05	1395.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	693.29	561.78	483.06	276.06	114.02	0	0	0	0	291.11	506.03	705.28	(98)

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3630.63	(98)
Space heating requirement in kWh/m²/year	48.34	(99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	693.29	561.78	483.06	276.06	114.02	0	0	0	0	291.11	506.03	705.28		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	741.49	600.83	516.65	295.25	121.95	0	0	0	0	311.35	541.2	754.31		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3883.03	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	198.28	174.87	183.91	165.22	162.17	145.28	139.88	153.01	152.58	171.31	180.69	193.63		
Efficiency of water heater													79.8	(216)
(217)m=	87.88	87.71	87.27	86.17	83.89	79.8	79.8	79.8	79.8	86.22	87.42	87.96		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	225.62	199.38	210.73	191.73	193.31	182.06	175.29	191.74	191.2	198.7	206.7	220.13		
Total = Sum(219a)$_{1...12}$ =													2386.6	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3883.03	
Water heating fuel used			2386.6	
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			328.89	(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	=	838.73	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	515.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1354.24	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	170.7	(268)
Total CO2, kg/year		sum of (265)…(271) =		1563.86	(272)

TER = 20.82 (273)

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User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.7

Property Address: 9R

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	134.6	(1a) x	3.05	(2a) =	410.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	134.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	410.53	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.1	(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)	0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.66		x1/[1/(1.5)+ 0.04]	=	3.76			(27)
Windows Type 2			8.43		x1/[1/(1.5)+ 0.04]	=	11.93			(27)
Windows Type 3			2.22		x1/[1/(1.5)+ 0.04]	=	3.14			(27)
Windows Type 4			10.65		x1/[1/(1.5)+ 0.04]	=	15.07			(27)
Rooflights			4.363833		x1/[1/(1.7) + 0.04]	=	7.418516			(27b)
Walls Type1	44.4	0	44.4	x	0.18	=	7.99			(29)
Walls Type2	17.2	8.43	8.77	x	0.18	=	1.58			(29)
Walls Type3	23.8	10.65	13.15	x	0.18	=	2.37			(29)
Walls Type4	15.9	0	15.9	x	0.18	=	2.86			(29)
Walls Type5	22.9	0	22.9	x	0.18	=	4.12			(29)
Walls Type6	4.5	2.22	2.28	x	0.18	=	0.41			(29)
Walls Type7	16.5	7.98	8.52	x	0.18	=	1.53			(29)
Roof	134.6	4.36	130.24	x	0.13	=	16.93			(30)
Total area of elements, m²			279.8							(31)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	86.18	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 13.99 | (36)

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

Total fabric heat loss (33) + (36) = | 100.17 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	77.34	76.97	76.6	74.89	74.56	73.07	73.07	72.79	73.65	74.56	75.21	75.89	(38)

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

(39)m=	177.51	177.13	176.77	175.05	174.73	173.24	173.24	172.96	173.81	174.73	175.38	176.06

Average = $Sum(39)_{1...12}$ /12= | 175.05 | (39)

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

(40)m=	1.32	1.32	1.31	1.3	1.3	1.29	1.29	1.28	1.29	1.3	1.3	1.31

Average = $Sum(40)_{1...12}$ /12= | 1.3 | (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 | 2.91 | (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 | 103.22 | (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	113.54	109.41	105.28	101.15	97.02	92.9	92.9	97.02	101.15	105.28	109.41	113.54

Total = $Sum(44)_{1...12}$ = | 1238.61 | (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=	168.38	147.26	151.96	132.48	127.12	109.7	101.65	116.64	118.04	137.56	150.16	163.06

Total = $Sum(45)_{1...12}$ = | 1624.02 | (45)

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

(46)m=	25.26	22.09	22.79	19.87	19.07	16.45	15.25	17.5	17.71	20.63	22.52	24.46	(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): | 1.65 | (48)

Temperature factor from Table 2b | 0.54 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0.89 | (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.89	(55)

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(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=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

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

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

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

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

(62)m=	219.3	193.26	202.89	181.77	178.05	158.98	152.58	167.57	167.32	188.49	199.44	213.99	(62)

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

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

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

Output from water heater

(64)m=	219.3	193.26	202.89	181.77	178.05	158.98	152.58	167.57	167.32	188.49	199.44	213.99	

Output from water heater (annual)$_{1...12}$ 2223.63 (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=	96.73	85.76	91.27	83.48	83.01	75.9	74.54	79.53	78.67	86.48	89.35	94.96	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	(66)

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

(67)m=	27.03	24.01	19.52	14.78	11.05	9.33	10.08	13.1	17.58	22.33	26.06	27.78	(67)

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

(68)m=	303.18	306.33	298.4	281.52	260.22	240.19	226.82	223.67	231.6	248.48	269.78	289.81	(68)

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

(69)m=	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	(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=	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	(71)

Water heating gains (Table 5)

(72)m=	130.01	127.62	122.67	115.94	111.57	105.42	100.19	106.89	109.27	116.24	124.1	127.63	(72)

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

(73)m=	529.81	527.55	510.19	481.84	452.43	424.53	406.67	413.25	428.04	456.63	489.54	514.81	(73)

6. Solar gains:

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

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	10.65	x	10.63	x	0.63	x	0.7	=	34.61	(74)
North	0.9x	0.77	x	10.65	x	20.32	x	0.63	x	0.7	=	66.14	(74)
North	0.9x	0.77	x	10.65	x	34.53	x	0.63	x	0.7	=	112.39	(74)
North	0.9x	0.77	x	10.65	x	55.46	x	0.63	x	0.7	=	180.52	(74)
North	0.9x	0.77	x	10.65	x	74.72	x	0.63	x	0.7	=	243.18	(74)
North	0.9x	0.77	x	10.65	x	79.99	x	0.63	x	0.7	=	260.33	(74)
North	0.9x	0.77	x	10.65	x	74.68	x	0.63	x	0.7	=	243.06	(74)
North	0.9x	0.77	x	10.65	x	59.25	x	0.63	x	0.7	=	192.83	(74)
North	0.9x	0.77	x	10.65	x	41.52	x	0.63	x	0.7	=	135.13	(74)
North	0.9x	0.77	x	10.65	x	24.19	x	0.63	x	0.7	=	78.73	(74)
North	0.9x	0.77	x	10.65	x	13.12	x	0.63	x	0.7	=	42.7	(74)
North	0.9x	0.77	x	10.65	x	8.86	x	0.63	x	0.7	=	28.85	(74)
East	0.9x	3	x	2.66	x	19.64	x	0.63	x	0.7	=	47.9	(76)
East	0.9x	3	x	2.66	x	38.42	x	0.63	x	0.7	=	93.7	(76)
East	0.9x	3	x	2.66	x	63.27	x	0.63	x	0.7	=	154.31	(76)
East	0.9x	3	x	2.66	x	92.28	x	0.63	x	0.7	=	225.05	(76)
East	0.9x	3	x	2.66	x	113.09	x	0.63	x	0.7	=	275.81	(76)
East	0.9x	3	x	2.66	x	115.77	x	0.63	x	0.7	=	282.34	(76)
East	0.9x	3	x	2.66	x	110.22	x	0.63	x	0.7	=	268.8	(76)
East	0.9x	3	x	2.66	x	94.68	x	0.63	x	0.7	=	230.89	(76)
East	0.9x	3	x	2.66	x	73.59	x	0.63	x	0.7	=	179.47	(76)
East	0.9x	3	x	2.66	x	45.59	x	0.63	x	0.7	=	111.18	(76)
East	0.9x	3	x	2.66	x	24.49	x	0.63	x	0.7	=	59.72	(76)
East	0.9x	3	x	2.66	x	16.15	x	0.63	x	0.7	=	39.39	(76)
South	0.9x	0.77	x	8.43	x	46.75	x	0.63	x	0.7	=	120.45	(78)
South	0.9x	0.77	x	8.43	x	76.57	x	0.63	x	0.7	=	197.26	(78)
South	0.9x	0.77	x	8.43	x	97.53	x	0.63	x	0.7	=	251.28	(78)
South	0.9x	0.77	x	8.43	x	110.23	x	0.63	x	0.7	=	284	(78)
South	0.9x	0.77	x	8.43	x	114.87	x	0.63	x	0.7	=	295.94	(78)
South	0.9x	0.77	x	8.43	x	110.55	x	0.63	x	0.7	=	284.81	(78)
South	0.9x	0.77	x	8.43	x	108.01	x	0.63	x	0.7	=	278.27	(78)
South	0.9x	0.77	x	8.43	x	104.89	x	0.63	x	0.7	=	270.24	(78)
South	0.9x	0.77	x	8.43	x	101.89	x	0.63	x	0.7	=	262.49	(78)
South	0.9x	0.77	x	8.43	x	82.59	x	0.63	x	0.7	=	212.77	(78)
South	0.9x	0.77	x	8.43	x	55.42	x	0.63	x	0.7	=	142.77	(78)
South	0.9x	0.77	x	8.43	x	40.4	x	0.63	x	0.7	=	104.08	(78)
West	0.9x	0.77	x	2.22	x	19.64	x	0.63	x	0.7	=	13.33	(80)
West	0.9x	0.77	x	2.22	x	38.42	x	0.63	x	0.7	=	26.07	(80)
West	0.9x	0.77	x	2.22	x	63.27	x	0.63	x	0.7	=	42.93	(80)

West	0.9x	0.77	x	2.22	x	92.28	x	0.63	x	0.7	=	62.61	(80)
West	0.9x	0.77	x	2.22	x	113.09	x	0.63	x	0.7	=	76.73	(80)
West	0.9x	0.77	x	2.22	x	115.77	x	0.63	x	0.7	=	78.55	(80)
West	0.9x	0.77	x	2.22	x	110.22	x	0.63	x	0.7	=	74.78	(80)
West	0.9x	0.77	x	2.22	x	94.68	x	0.63	x	0.7	=	64.23	(80)
West	0.9x	0.77	x	2.22	x	73.59	x	0.63	x	0.7	=	49.93	(80)
West	0.9x	0.77	x	2.22	x	45.59	x	0.63	x	0.7	=	30.93	(80)
West	0.9x	0.77	x	2.22	x	24.49	x	0.63	x	0.7	=	16.61	(80)
West	0.9x	0.77	x	2.22	x	16.15	x	0.63	x	0.7	=	10.96	(80)
Rooflights	0.9x	1	x	4.36	x	26	x	0.63	x	0.7	=	45.03	(82)
Rooflights	0.9x	1	x	4.36	x	54	x	0.63	x	0.7	=	93.53	(82)
Rooflights	0.9x	1	x	4.36	x	96	x	0.63	x	0.7	=	166.27	(82)
Rooflights	0.9x	1	x	4.36	x	150	x	0.63	x	0.7	=	259.8	(82)
Rooflights	0.9x	1	x	4.36	x	192	x	0.63	x	0.7	=	332.55	(82)
Rooflights	0.9x	1	x	4.36	x	200	x	0.63	x	0.7	=	346.4	(82)
Rooflights	0.9x	1	x	4.36	x	189	x	0.63	x	0.7	=	327.35	(82)
Rooflights	0.9x	1	x	4.36	x	157	x	0.63	x	0.7	=	271.92	(82)
Rooflights	0.9x	1	x	4.36	x	115	x	0.63	x	0.7	=	199.18	(82)
Rooflights	0.9x	1	x	4.36	x	66	x	0.63	x	0.7	=	114.31	(82)
Rooflights	0.9x	1	x	4.36	x	33	x	0.63	x	0.7	=	57.16	(82)
Rooflights	0.9x	1	x	4.36	x	21	x	0.63	x	0.7	=	36.37	(82)

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

(83)m=	261.31	476.7	727.18	1011.98	1224.21	1252.43	1192.26	1030.13	826.19	547.92	318.96	219.65	(83)

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

(84)m=	791.12	1004.25	1237.37	1493.82	1676.64	1676.96	1598.93	1443.38	1254.24	1004.55	808.5	734.46	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.62	0.47	0.53	0.8	0.97	1	1	(86)

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

(87)m=	19.53	19.74	20.09	20.5	20.82	20.96	20.99	20.98	20.87	20.43	19.89	19.49	(87)

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

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

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

(89)m=	1	0.99	0.97	0.91	0.75	0.53	0.35	0.41	0.72	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=	17.88	18.19	18.69	19.28	19.67	19.83	19.85	19.85	19.75	19.19	18.42	17.83	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

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

(92)m=	18.65	18.92	19.34	19.86	20.21	20.36	20.38	20.38	20.27	19.77	19.11	18.61	(92)

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

(93)m=	18.65	18.92	19.34	19.86	20.21	20.36	20.38	20.38	20.27	19.77	19.11	18.61	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.77	0.57	0.41	0.47	0.75	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	788.33	994.18	1199.94	1353.01	1287.45	958.1	649.16	676.34	942.8	956.53	802.1	732.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2547.52	2483.77	2270.37	1917.79	1486.89	997.31	655.63	688.46	1073.18	1602.25	2106.13	2536.9	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1308.84	1001	796.4	406.64	148.39	0	0	0	0	480.41	938.9	1342.42	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6423 (98)

Space heating requirement in kWh/m²/year 47.72 (99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	1308.84	1001	796.4	406.64	148.39	0	0	0	0	480.41	938.9	1342.42		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1399.83	1070.59	851.76	434.91	158.7	0	0	0	0	513.81	1004.17	1435.74		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													6869.52	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	219.3	193.26	202.89	181.77	178.05	158.98	152.58	167.57	167.32	188.49	199.44	213.99		
Efficiency of water heater													79.8	(216)
(217)m=	88.79	88.58	88.1	86.9	84.33	79.8	79.8	79.8	79.8	87.21	88.42	88.86		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	246.99	218.18	230.29	209.17	211.13	199.22	191.2	209.99	209.68	216.14	225.56	240.81		
Total = Sum(219a)$_{1...12}$ =													2608.34	(219)

TER WorkSheet: New dwelling design stage

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			6869.52	
Water heating fuel used			2608.34	
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			477.34	(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	=	1483.82	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	563.4	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2047.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	247.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		2333.88	(272)

TER = 17.34 (273)

APPENDIX 6 – SAP WORKSHEETS LEAN

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.7

Property Address: 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	96.8	(1a) x	2.85	(2a) =	275.88	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	275.88	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.35	(23c)

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

(24a)m=	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	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=	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	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			5.13	x1/[1/(1.4)+ 0.04]		=	6.8			(27)
Windows Type 2			22.8	x1/[1/(1.4)+ 0.04]		=	30.23			(27)
Walls Type1	32.21	0	32.21	x	0.18	=	5.8			(29)
Walls Type2	11.69	0	11.69	x	0.18	=	2.1			(29)
Walls Type3	24.23	22.8	1.43	x	1.4	=	2			(29)
Walls Type4	10.55	0	10.55	x	0.16	=	1.65			(29)
Walls Type5	15.39	15.39	0	x	1.4	=	0			(29)
Total area of elements, m²			94.05							(31)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	62.18	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		14.11	(36)

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

Total fabric heat loss	(33) + (36) =	76.29	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.11	24.82	24.53	23.08	22.79	21.34	21.34	21.05	21.92	22.79	23.37	23.95	(38)

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

(39)m=	101.4	101.11	100.82	99.37	99.08	97.62	97.62	97.33	98.21	99.08	99.66	100.24	

Average = Sum(39)$_{1…12}$ /12= 99.29 (39)

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

(40)m=	1.05	1.04	1.04	1.03	1.02	1.01	1.01	1.01	1.01	1.02	1.03	1.04	
										Average = Sum(40)$_{1…12}$ /12=		1.03	(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	2.71	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)		
if TFA £ 13.9, N = 1		
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	98.51	(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	108.36	104.42	100.48	96.54	92.6	88.66	88.66	92.6	96.54	100.48	104.42	108.36	
										Total = Sum(44)$_{1…12}$ =		1182.14	(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=	160.7	140.55	145.03	126.44	121.33	104.69	97.02	111.33	112.66	131.29	143.31	155.63	
										Total = Sum(45)$_{1…12}$ =		1549.97	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.1	21.08	21.76	18.97	18.2	15.7	14.55	16.7	16.9	19.69	21.5	23.34	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		200	(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):		2.24	(48)
Temperature factor from Table 2b		0.6	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	1.34	(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)		1.34	(55)
Water storage loss calculated for each month	((56)m = (55) × (41)m		

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3	0	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m		
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)		

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

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

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

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

(62)m=	225.63	199.19	209.96	189.28	186.25	167.53	161.94	176.25	175.49	196.22	206.14	220.55	(62)

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

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

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

Output from water heater

(64)m=	225.63	199.19	209.96	189.28	186.25	167.53	161.94	176.25	175.49	196.22	206.14	220.55	

Output from water heater (annual)$_{1\ldots12}$ 2314.43 (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=	105.37	93.65	100.16	92.31	92.28	85.08	84.2	88.96	87.72	95.59	97.92	103.69	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	55.95	49.7	40.42	30.6	22.87	19.31	20.86	27.12	36.4	46.22	53.95	57.51	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	374.7	378.59	368.79	347.93	321.6	296.85	280.32	276.43	286.23	307.09	333.42	358.17	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	(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=	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	(71)
Water heating gains (Table 5)													
(72)m=	141.63	139.36	134.63	128.21	124.03	118.16	113.17	119.57	121.84	128.49	136	139.37	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	680.4	675.75	651.95	614.85	576.62	542.44	522.47	531.23	552.58	589.91	631.47	663.15	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	3	x	5.13	x	19.64	x	0.63	x	1	=	131.97	(76)
East	0.9x	3	x	5.13	x	38.42	x	0.63	x	1	=	258.15	(76)
East	0.9x	3	x	5.13	x	63.27	x	0.63	x	1	=	425.14	(76)
East	0.9x	3	x	5.13	x	92.28	x	0.63	x	1	=	620.04	(76)
East	0.9x	3	x	5.13	x	113.09	x	0.63	x	1	=	759.88	(76)

East	0.9x	3	x	5.13	x	115.77	x	0.63	x	1	=	777.88	(76)
East	0.9x	3	x	5.13	x	110.22	x	0.63	x	1	=	740.57	(76)
East	0.9x	3	x	5.13	x	94.68	x	0.63	x	1	=	636.14	(76)
East	0.9x	3	x	5.13	x	73.59	x	0.63	x	1	=	494.46	(76)
East	0.9x	3	x	5.13	x	45.59	x	0.63	x	1	=	306.32	(76)
East	0.9x	3	x	5.13	x	24.49	x	0.63	x	1	=	164.55	(76)
East	0.9x	3	x	5.13	x	16.15	x	0.63	x	1	=	108.52	(76)
South	0.9x	0.77	x	22.8	x	46.75	x	0.63	x	1	=	465.38	(78)
South	0.9x	0.77	x	22.8	x	76.57	x	0.63	x	1	=	762.18	(78)
South	0.9x	0.77	x	22.8	x	97.53	x	0.63	x	1	=	970.88	(78)
South	0.9x	0.77	x	22.8	x	110.23	x	0.63	x	1	=	1097.3	(78)
South	0.9x	0.77	x	22.8	x	114.87	x	0.63	x	1	=	1143.46	(78)
South	0.9x	0.77	x	22.8	x	110.55	x	0.63	x	1	=	1100.42	(78)
South	0.9x	0.77	x	22.8	x	108.01	x	0.63	x	1	=	1075.18	(78)
South	0.9x	0.77	x	22.8	x	104.89	x	0.63	x	1	=	1044.15	(78)
South	0.9x	0.77	x	22.8	x	101.89	x	0.63	x	1	=	1014.2	(78)
South	0.9x	0.77	x	22.8	x	82.59	x	0.63	x	1	=	822.08	(78)
South	0.9x	0.77	x	22.8	x	55.42	x	0.63	x	1	=	551.64	(78)
South	0.9x	0.77	x	22.8	x	40.4	x	0.63	x	1	=	402.13	(78)

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

(83)m=	597.35	1020.33	1396.02	1717.34	1903.34	1878.3	1815.75	1680.29	1508.65	1128.4	716.18	510.65	(83)

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

(84)m=	1277.74	1696.08	2047.96	2332.19	2479.96	2420.73	2338.21	2211.51	2061.23	1718.31	1347.65	1173.81	(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=	0.94	0.83	0.68	0.51	0.37	0.26	0.18	0.2	0.33	0.58	0.86	0.95	(86)

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

(87)m=	20.51	20.78	20.93	20.98	21	21	21	21	21	20.97	20.77	20.44	(87)

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

(88)m=	20.04	20.05	20.05	20.06	20.06	20.08	20.08	20.08	20.07	20.06	20.06	20.05	(88)

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

(89)m=	0.92	0.8	0.64	0.47	0.33	0.22	0.15	0.16	0.28	0.54	0.83	0.94	(89)

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

(90)m=	19.44	19.79	19.97	20.05	20.06	20.08	20.08	20.08	20.07	20.04	19.8	19.35	(90)

fLA = Living area ÷ (4) = | 0.41 | (91)

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

(92)m=	19.88	20.2	20.36	20.43	20.45	20.46	20.46	20.46	20.45	20.43	20.2	19.8	(92)

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

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(93)m=	19.88	20.2	20.36	20.43	20.45	20.46	20.46	20.46	20.45	20.43	20.2	19.8	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.92	0.8	0.65	0.49	0.35	0.24	0.16	0.18	0.3	0.56	0.83	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1173.71	1362.05	1337.05	1134.22	864.88	571.54	376.43	394.91	623.28	954.7	1121.74	1101.56	(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=	1579.54	1546.48	1397.64	1145.95	866.58	571.68	376.45	394.93	623.84	973.45	1305.63	1563.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	301.94	123.94	45.08	8.45	1.26	0	0	0	0	13.95	132.4	343.8	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 970.81 (98)

Space heating requirement in kWh/m²/year 10.03 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	917.67	722.42	739.74	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	1	1	1	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	916.32	722.05	739.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	2737.85	2644.77	2495.2	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1311.5	1430.5	1306.48	0	0	0	0	

Total = Sum(104)$_{6..8}$ = 4048.48 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.73 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6..8}$ = 0 (106)

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

(107)m=	0	0	0	0	0	240.83	262.68	239.9	0	0	0	0

Total = Sum(107)$_{6..8}$ = 743.41 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 7.68 (108)

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)

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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 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		970.81	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1019.35	(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		2314.43	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2430.15	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	34.5	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	156	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		235.6	(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) =	235.6	(331)
Energy for lighting (calculated in Appendix L)		395.26	(332)

10b. Fuel costs – Community heating scheme

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating from CHP	(307a)	x	4.24	x 0.01 =	43.22	(340a)
Water heating from CHP	(310a)	x	4.24	x 0.01 =	103.04	(342a)
			Fuel Price			
Space cooling (community cooling system)	(315)		13.19	x 0.01 =	20.58	(348)
Pumps and fans	(331)		13.19	x 0.01 =	31.08	(349)
Energy for lighting	(332)		13.19	x 0.01 =	52.13	(350)
Additional standing charges (Table 12)					120	(351)
Total energy cost	= (340a)…(342e) + (345)…(354) =				370.05	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12)	0.42	(356)

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Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0] =	1.1	(357)
SAP rating (section12)		84.71	(358)

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					91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x			0	=	818.78	(367)
Electrical energy for heat distribution	[(313) x			0.52	=	17.9	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	836.69	(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) =					836.69	(376)
CO2 associated with space cooling	(315) x			0.52	=	80.96	(377)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	122.28	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	205.14	(379)
Total CO2, kg/year	sum of (376)…(382) =					1245.06	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.86	(384)
EI rating (section 14)						88.23	(385)

13b. Primary Energy – Community heating scheme

		Energy kWh/year		Primary factor		P.Energy kWh/year	
Energy 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					91	(367a)
Energy associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x			0	=	4624.61	(367)
Electrical energy for heat distribution	[(313) x				=	105.9	(372)
Total Energy associated with community systems	(363)…(366) + (368)...(372)				=	4730.51	(373)
if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)						4730.51	(373)
Energy associated with space heating (secondary)	(309) x			0	=	0	(374)
Energy associated with water from immersion heater or instantaneous heater	(312) x			1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =					4730.51	(376)
Energy associated with space cooling	(315) x			3.07	=	478.91	(377)
Energy associated with electricity for pumps and fans within dwelling	(331)) x			3.07	=	723.3	(378)
Energy associated with electricity for lighting	(332))) x			3.07	=	1213.44	(379)
Total Primary Energy, kWh/year	sum of (376)…(382) =					7146.16	(383)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.7

Property Address: 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.1	(1a) x	2.85	(2a) =	214.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.1	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		214.03	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		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
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) =	73.1	(23c)

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

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

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			19.95	x1/[1/(1.4)+ 0.04]		=	26.45			(27)
Walls Type1	23.94	0	23.94	x	0.16	=	3.75			(29)
Walls Type2	28.78	0	28.78	x	0.16	=	4.51			(29)
Walls Type3	21.66	19.95	1.71	x	1.4	=	2.39			(29)
Walls Type4	10.83	0	10.83	x	0.16	=	1.7			(29)
Total area of elements, m²			85.22							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	38.81	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		12.78	(36)
if details of thermal bridging are not known (36) = 0.15 x (31)			
Total fabric heat loss	(33) + (36) =	51.59	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.97	19.76	19.56	18.53	18.33	17.3	17.3	17.1	17.71	18.33	18.74	19.15	(38)

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

(39)m=	71.56	71.36	71.15	70.13	69.92	68.89	68.89	68.69	69.3	69.92	70.33	70.74	

Average = $Sum(39)_{1\ldots12}$ /12= 70.07 (39)

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

(40)m=	0.95	0.95	0.95	0.93	0.93	0.92	0.92	0.91	0.92	0.93	0.94	0.94

Average = Sum(40)$_{1...12}$ /12= 0.93 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.33 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.36	95.75	92.14	88.52	84.91	81.3	81.3	84.91	88.52	92.14	95.75	99.36	

Total = Sum(44)$_{1...12}$ = 1083.95 (44)

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

(45)m=	147.35	128.87	132.99	115.94	111.25	96	88.96	102.08	103.3	120.38	131.41	142.7

Total = Sum(45)$_{1...12}$ = 1421.23 (45)

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

(46)m=	22.1	19.33	19.95	17.39	16.69	14.4	13.34	15.31	15.49	18.06	19.71	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

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

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

(62)m=	212.28	187.52	197.91	178.77	176.17	158.83	153.88	167.01	166.13	185.31	194.24	207.63	(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=	212.28	187.52	197.91	178.77	176.17	158.83	153.88	167.01	166.13	185.31	194.24	207.63	

Output from water heater (annual)$_{1...12}$ 2185.68 (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=	100.94	89.77	96.16	88.82	88.93	82.19	81.52	85.88	84.61	91.97	93.96	99.39	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	46.56	41.35	33.63	25.46	19.03	16.07	17.36	22.57	30.29	38.46	44.89	47.85	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	311.79	315.02	306.87	289.51	267.6	247.01	233.25	230.02	238.17	255.53	277.44	298.03	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	(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=	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	(71)
Water heating gains (Table 5)													
(72)m=	135.67	133.58	129.25	123.36	119.53	114.15	109.57	115.43	117.52	123.61	130.5	133.59	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	592.82	588.76	568.55	537.14	504.97	476.03	458.99	466.83	484.79	516.41	551.63	578.28	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	19.95	x	10.63	x	0.63	x	1	=	92.62	(74)
North	0.9x	0.77	x	19.95	x	20.32	x	0.63	x	1	=	176.99	(74)
North	0.9x	0.77	x	19.95	x	34.53	x	0.63	x	1	=	300.76	(74)
North	0.9x	0.77	x	19.95	x	55.46	x	0.63	x	1	=	483.09	(74)
North	0.9x	0.77	x	19.95	x	74.72	x	0.63	x	1	=	650.77	(74)

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North	0.9x	0.77	x	19.95	x	79.99	x	0.63	x	1	=	696.67	(74)
North	0.9x	0.77	x	19.95	x	74.68	x	0.63	x	1	=	650.43	(74)
North	0.9x	0.77	x	19.95	x	59.25	x	0.63	x	1	=	516.03	(74)
North	0.9x	0.77	x	19.95	x	41.52	x	0.63	x	1	=	361.61	(74)
North	0.9x	0.77	x	19.95	x	24.19	x	0.63	x	1	=	210.69	(74)
North	0.9x	0.77	x	19.95	x	13.12	x	0.63	x	1	=	114.25	(74)
North	0.9x	0.77	x	19.95	x	8.86	x	0.63	x	1	=	77.21	(74)

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

(83)m=	92.62	176.99	300.76	483.09	650.77	696.67	650.43	516.03	361.61	210.69	114.25	77.21	(83)

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

(84)m=	685.44	765.76	869.31	1020.23	1155.75	1172.7	1109.42	982.86	846.39	727.1	665.89	655.49	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.92	0.77	0.55	0.38	0.27	0.32	0.56	0.86	0.97	0.99	(86)

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

(87)m=	20.32	20.47	20.7	20.91	20.99	21	21	21	20.99	20.86	20.56	20.3	(87)

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

(88)m=	20.12	20.13	20.13	20.14	20.14	20.15	20.15	20.16	20.15	20.14	20.14	20.13	(88)

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

(89)m=	0.98	0.96	0.9	0.73	0.51	0.33	0.22	0.26	0.49	0.82	0.95	0.98	(89)

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

(90)m=	19.25	19.46	19.77	20.05	20.13	20.15	20.15	20.15	20.14	20	19.6	19.21	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

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

(92)m=	19.76	19.94	20.21	20.46	20.54	20.55	20.55	20.56	20.54	20.41	20.06	19.73	(92)

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

(93)m=	19.76	19.94	20.21	20.46	20.54	20.55	20.55	20.56	20.54	20.41	20.06	19.73	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.9	0.74	0.53	0.35	0.25	0.29	0.52	0.83	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	669.03	732.21	781.59	757.64	610.98	409.7	272.39	285.32	442.08	603.85	634.56	642.65	(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=	1106.13	1072.95	975.27	810.66	617.9	410.17	272.43	285.43	446.64	685.97	911.28	1098.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	325.21	228.98	144.1	38.18	5.15	0	0	0	0	61.1	199.24	339.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1340.98 (98)
Space heating requirement in kWh/m²/year	17.86 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	647.6	509.82	522.03	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	1	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	642.57	508.29	518.56	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1290.32	1219.24	1069.98	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	466.38	528.94	410.26	0	0	0	0	
Total = Sum(104)$_{6...8}$ =												1405.58	(104)
Cooled fraction — f C = cooled area ÷ (4) =												0.91	(105)
Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = Sum(104)$_{6...8}$ =												0	(106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	106.66	120.97	93.82	0	0	0	0	
Total = Sum(107)$_{6...8}$ =												321.45	(107)
Space cooling requirement in kWh/m²/year — (107) ÷ (4) =												4.28	(108)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1340.98	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1408.03	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2185.68	
If DHW from community scheme:			

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Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2294.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.03	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	67.45	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		204.72	(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) =	204.72	(331)
Energy for lighting (calculated in Appendix L)		328.89	(332)

10b. Fuel costs – Community heating scheme

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating from CHP	(307a) x	4.24	x 0.01 =	59.7	(340a)
Water heating from CHP	(310a) x	4.24	x 0.01 =	97.31	(342a)
		Fuel Price			
Space cooling (community cooling system)	(315)	13.19	x 0.01 =	8.9	(348)
Pumps and fans	(331)	13.19	x 0.01 =	27	(349)
Energy for lighting	(332)	13.19	x 0.01 =	43.38	(350)
Additional standing charges (Table 12)				120	(351)
Total energy cost	= (340a)…(342e) + (345)…(354) =			356.29	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12)		0.42	(356)
Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0] =	1.25	(357)
SAP rating (section12)		82.62	(358)

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				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	878.95	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.22	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	898.17	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				898.17	(376)
CO2 associated with space cooling	(315) x		0.52	=	35.01	(377)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	106.25	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.7	(379)
Total CO2, kg/year	sum of (376)…(382) =			1210.12	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.11	(384)
EI rating (section 14)				86.5	(385)

13b. Primary Energy – Community heating scheme

		Energy kWh/year		**Primary factor**	**P.Energy kWh/year**	
Energy 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				91	(367a)
Energy associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	4964.45	(367)
Electrical energy for heat distribution	[(313) x			=	113.68	(372)
Total Energy associated with community systems	(363)…(366) + (368)...(372)			=	5078.14	(373)
if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)					5078.14	(373)
Energy associated with space heating (secondary)	(309) x		0	=	0	(374)
Energy associated with water from immersion heater or instantaneous heater	(312) x		1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =				5078.14	(376)
Energy associated with space cooling	(315) x		3.07	=	207.08	(377)
Energy associated with electricity for pumps and fans within dwelling	(331)) x		3.07	=	628.49	(378)
Energy associated with electricity for lighting	(332))) x		3.07	=	1009.7	(379)
Total Primary Energy, kWh/year	sum of (376)…(382) =				6923.41	(383)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: 9

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	134.6	(1a) x	2.85	(2a) =	383.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	134.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	383.61	(5)

2. Ventilation rate:

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.25 (23c)

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

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

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

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

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			5.13	x1/[1/(1.4)+ 0.04]		=	6.8			(27)
Windows Type 2			4.85	x1/[1/(1.4)+ 0.04]		=	6.43			(27)
Windows Type 3			16.25	x1/[1/(1.4)+ 0.04]		=	21.54			(27)
Windows Type 4			4.28	x1/[1/(1.4)+ 0.04]		=	5.67			(27)
Windows Type 5			20.52	x1/[1/(1.4)+ 0.04]		=	27.2			(27)
Walls Type1	41.5	0	41.5	x	0.18	=	7.47			(29)
Walls Type2	21.4	0	21.4	x	0.16	=	3.36			(29)
Walls Type3	16.1	20.53	-4.43	x	1.4	=	-6.2			(29)
Walls Type4	22.2	20.52	1.68	x	1.4	=	2.35			(29)
Walls Type5	14.82	0	14.82	x	0.16	=	2.32			(29)
Walls Type6	4.2	0	4.2	x	1.4	=	5.88			(29)
Walls Type7	15.4	15.11	0.29	x	1.4	=	0.41			(29)
Total area of elements, m²			135.62							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 90.04 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 20.34 (36) *if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 110.38 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.14	37.74	37.34	35.32	34.92	32.9	32.9	32.49	33.7	34.92	35.72	36.53	(38)

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

(39)m=	148.53	148.12	147.72	145.7	145.3	143.28	143.28	142.88	144.09	145.3	146.11	146.91	

Average = $Sum(39)_{1...12}$ /12= 145.6 (39)

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

(40)m=	1.1	1.1	1.1	1.08	1.08	1.06	1.06	1.06	1.07	1.08	1.09	1.09	

Average = $Sum(40)_{1...12}$ /12= 1.08 (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 2.91 (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) + 36 103.22 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	113.54	109.41	105.28	101.15	97.02	92.9	92.9	97.02	101.15	105.28	109.41	113.54	

Total = $Sum(44)_{1...12}$ = 1238.61 (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=	168.38	147.26	151.96	132.48	127.12	109.7	101.65	116.64	118.04	137.56	150.16	163.06	

Total = $Sum(45)_{1...12}$ = 1624.02 (45)

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

(46)m=	25.26	22.09	22.79	19.87	19.07	16.45	15.25	17.5	17.71	20.63	22.52	24.46	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

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

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

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

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

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

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

(62)m=	233.3	205.91	216.89	195.32	192.05	172.53	166.58	181.57	180.87	202.49	212.99	227.99	(62)

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

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

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

Output from water heater

(64)m=	233.3	205.91	216.89	195.32	192.05	172.53	166.58	181.57	180.87	202.49	212.99	227.99	

Output from water heater (annual)$_{1\ldots12}$ | 2388.47 | (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=	107.93	95.88	102.47	94.32	94.21	86.74	85.74	90.73	89.51	97.68	100.19	106.16	(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=	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	(66)

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

(67)m=	67.57	60.02	48.81	36.95	27.62	23.32	25.2	32.75	43.96	55.82	65.15	69.45	(67)

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

(68)m=	452.51	457.21	445.38	420.18	388.39	358.5	338.53	333.84	345.67	370.86	402.66	432.55	(68)

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

(69)m=	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	(71)

Water heating gains (Table 5)

(72)m=	145.06	142.68	137.73	131	126.63	120.47	115.24	121.94	124.32	131.29	139.16	142.69	(72)

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

(73)m=	778.61	773.37	745.37	701.59	656.09	615.75	592.43	602	627.42	671.43	720.43	758.15	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	20.52	x	10.63	x	0.63	x	1	=	95.26	(74)
North	0.9x	0.77	x	20.52	x	20.32	x	0.63	x	1	=	182.05	(74)
North	0.9x	0.77	x	20.52	x	34.53	x	0.63	x	1	=	309.35	(74)
North	0.9x	0.77	x	20.52	x	55.46	x	0.63	x	1	=	496.9	(74)
North	0.9x	0.77	x	20.52	x	74.72	x	0.63	x	1	=	669.36	(74)
North	0.9x	0.77	x	20.52	x	79.99	x	0.63	x	1	=	716.57	(74)
North	0.9x	0.77	x	20.52	x	74.68	x	0.63	x	1	=	669.01	(74)
North	0.9x	0.77	x	20.52	x	59.25	x	0.63	x	1	=	530.78	(74)
North	0.9x	0.77	x	20.52	x	41.52	x	0.63	x	1	=	371.94	(74)
North	0.9x	0.77	x	20.52	x	24.19	x	0.63	x	1	=	216.71	(74)
North	0.9x	0.77	x	20.52	x	13.12	x	0.63	x	1	=	117.52	(74)
North	0.9x	0.77	x	20.52	x	8.86	x	0.63	x	1	=	79.42	(74)
East	0.9x	2	x	5.13	x	19.64	x	0.63	x	1	=	87.98	(76)
East	0.9x	1	x	4.85	x	19.64	x	0.63	x	1	=	41.59	(76)
East	0.9x	2	x	5.13	x	38.42	x	0.63	x	1	=	172.1	(76)
East	0.9x	1	x	4.85	x	38.42	x	0.63	x	1	=	81.35	(76)
East	0.9x	2	x	5.13	x	63.27	x	0.63	x	1	=	283.43	(76)
East	0.9x	1	x	4.85	x	63.27	x	0.63	x	1	=	133.98	(76)
East	0.9x	2	x	5.13	x	92.28	x	0.63	x	1	=	413.36	(76)
East	0.9x	1	x	4.85	x	92.28	x	0.63	x	1	=	195.4	(76)
East	0.9x	2	x	5.13	x	113.09	x	0.63	x	1	=	506.59	(76)
East	0.9x	1	x	4.85	x	113.09	x	0.63	x	1	=	239.47	(76)
East	0.9x	2	x	5.13	x	115.77	x	0.63	x	1	=	518.58	(76)
East	0.9x	1	x	4.85	x	115.77	x	0.63	x	1	=	245.14	(76)
East	0.9x	2	x	5.13	x	110.22	x	0.63	x	1	=	493.71	(76)
East	0.9x	1	x	4.85	x	110.22	x	0.63	x	1	=	233.38	(76)
East	0.9x	2	x	5.13	x	94.68	x	0.63	x	1	=	424.09	(76)
East	0.9x	1	x	4.85	x	94.68	x	0.63	x	1	=	200.47	(76)
East	0.9x	2	x	5.13	x	73.59	x	0.63	x	1	=	329.64	(76)
East	0.9x	1	x	4.85	x	73.59	x	0.63	x	1	=	155.82	(76)
East	0.9x	2	x	5.13	x	45.59	x	0.63	x	1	=	204.21	(76)
East	0.9x	1	x	4.85	x	45.59	x	0.63	x	1	=	96.53	(76)
East	0.9x	2	x	5.13	x	24.49	x	0.63	x	1	=	109.7	(76)
East	0.9x	1	x	4.85	x	24.49	x	0.63	x	1	=	51.85	(76)
East	0.9x	2	x	5.13	x	16.15	x	0.63	x	1	=	72.35	(76)
East	0.9x	1	x	4.85	x	16.15	x	0.63	x	1	=	34.2	(76)
South	0.9x	0.77	x	16.25	x	46.75	x	0.63	x	1	=	331.69	(78)
South	0.9x	0.77	x	4.28	x	46.75	x	0.63	x	1	=	87.36	(78)
South	0.9x	0.77	x	16.25	x	76.57	x	0.63	x	1	=	543.22	(78)

South	0.9x	0.77	x	4.28	x	76.57	x	0.63	x	1	=	143.08	(78)
South	0.9x	0.77	x	16.25	x	97.53	x	0.63	x	1	=	691.96	(78)
South	0.9x	0.77	x	4.28	x	97.53	x	0.63	x	1	=	182.25	(78)
South	0.9x	0.77	x	16.25	x	110.23	x	0.63	x	1	=	782.07	(78)
South	0.9x	0.77	x	4.28	x	110.23	x	0.63	x	1	=	205.98	(78)
South	0.9x	0.77	x	16.25	x	114.87	x	0.63	x	1	=	814.96	(78)
South	0.9x	0.77	x	4.28	x	114.87	x	0.63	x	1	=	214.65	(78)
South	0.9x	0.77	x	16.25	x	110.55	x	0.63	x	1	=	784.29	(78)
South	0.9x	0.77	x	4.28	x	110.55	x	0.63	x	1	=	206.57	(78)
South	0.9x	0.77	x	16.25	x	108.01	x	0.63	x	1	=	766.3	(78)
South	0.9x	0.77	x	4.28	x	108.01	x	0.63	x	1	=	201.83	(78)
South	0.9x	0.77	x	16.25	x	104.89	x	0.63	x	1	=	744.18	(78)
South	0.9x	0.77	x	4.28	x	104.89	x	0.63	x	1	=	196.01	(78)
South	0.9x	0.77	x	16.25	x	101.89	x	0.63	x	1	=	722.84	(78)
South	0.9x	0.77	x	4.28	x	101.89	x	0.63	x	1	=	190.38	(78)
South	0.9x	0.77	x	16.25	x	82.59	x	0.63	x	1	=	585.91	(78)
South	0.9x	0.77	x	4.28	x	82.59	x	0.63	x	1	=	154.32	(78)
South	0.9x	0.77	x	16.25	x	55.42	x	0.63	x	1	=	393.16	(78)
South	0.9x	0.77	x	4.28	x	55.42	x	0.63	x	1	=	103.55	(78)
South	0.9x	0.77	x	16.25	x	40.4	x	0.63	x	1	=	286.61	(78)
South	0.9x	0.77	x	4.28	x	40.4	x	0.63	x	1	=	75.49	(78)

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

(83)m=	643.87	1121.8	1600.97	2093.71	2445.04	2471.16	2364.24	2095.53	1770.62	1257.69	775.78	548.06	(83)

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

(84)m=	1422.48	1895.17	2346.34	2795.3	3101.13	3086.91	2956.68	2697.53	2398.04	1929.12	1496.21	1306.21	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.92	0.8	0.61	0.43	0.3	0.21	0.24	0.41	0.72	0.94	0.98	(86)

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

(87)m=	20.23	20.55	20.81	20.96	20.99	21	21	21	21	20.92	20.56	20.16	(87)

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

(88)m=	20	20	20	20.02	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01	(88)

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

(89)m=	0.97	0.9	0.76	0.57	0.39	0.25	0.17	0.19	0.36	0.67	0.92	0.98	(89)

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

(90)m=	19.01	19.45	19.79	19.97	20.01	20.03	20.03	20.03	20.02	19.94	19.49	18.93	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

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(92)m=	19.59	19.97	20.27	20.44	20.47	20.48	20.49	20.49	20.48	20.4	19.99	19.51	(92)

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

(93)m=	19.59	19.97	20.27	20.44	20.47	20.48	20.49	20.49	20.48	20.4	19.99	19.51	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.9	0.77	0.58	0.41	0.27	0.19	0.22	0.38	0.69	0.92	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1372.94	1703.74	1815.98	1633.09	1267.87	842.61	556.64	583.76	915.81	1336.15	1376.23	1273.37	(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=	2270.39	2231.63	2034.43	1680.81	1274.71	843.2	556.7	583.89	919.26	1424.04	1883.14	2249.1	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	667.7	354.75	162.53	34.36	5.09	0	0	0	0	65.39	364.98	725.94	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2380.73 (98)

Space heating requirement in kWh/m²/year 17.69 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1346.86	1060.29	1085.88	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	1	1	1	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1341.86	1058.76	1083.13	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	3504.12	3355.83	3051.32	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1556.83	1709.02	1464.33	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 4730.18 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.91 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

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

(107)m=	0	0	0	0	0	352.77	387.26	331.81	0	0	0	0

Total = Sum(107)$_{6...8}$ = 1071.85 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 7.96 (108)

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		**kWh/year**	
Annual space heating requirement		2380.73	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2499.77	(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		2388.47	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2507.9	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.08	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	224.92	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		432.44	(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) =	432.44	(331)
Energy for lighting (calculated in Appendix L)		477.34	(332)

10b. Fuel costs – Community heating scheme

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating from CHP	(307a) x	4.24	x 0.01 =	105.99	(340a)
Water heating from CHP	(310a) x	4.24	x 0.01 =	106.33	(342a)
		Fuel Price			
Space cooling (community cooling system)	(315)	13.19	x 0.01 =	29.67	(348)
Pumps and fans	(331)	13.19	x 0.01 =	57.04	(349)
Energy for lighting	(332)	13.19	x 0.01 =	62.96	(350)
Additional standing charges (Table 12)				120	(351)
Total energy cost	= (340a)…(342e) + (345)…(354) =			481.99	(355)

11b. SAP rating - Community heating scheme

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Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0] =			1.13	(357)
SAP rating (section12)				84.28	(358)

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				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	1188.63	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	25.99	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1214.62	(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) =				1214.62	(376)
CO2 associated with space cooling	(315) x		0.52	=	116.73	(377)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	224.43	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	247.74	(379)
Total CO2, kg/year	sum of (376)…(382) =				1803.53	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.4	(384)
EI rating (section 14)					86.54	(385)

13b. Primary Energy – Community heating scheme

		Energy kWh/year	Primary factor		P.Energy kWh/year	
Energy 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				91	(367a)
Energy associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	6713.57	(367)
Electrical energy for heat distribution	[(313) x			=	153.74	(372)
Total Energy associated with community systems	(363)…(366) + (368)...(372)			=	6867.31	(373)
if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)					6867.31	(373)
Energy associated with space heating (secondary)	(309) x		0	=	0	(374)
Energy associated with water from immersion heater or instantaneous heater	(312) x		1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =				6867.31	(376)
Energy associated with space cooling	(315) x		3.07	=	690.5	(377)
Energy associated with electricity for pumps and fans within dwelling	(331)) x		3.07	=	1327.58	(378)
Energy associated with electricity for lighting	(332))) x		3.07	=	1465.44	(379)
Total Primary Energy, kWh/year	sum of (376)…(382) =				10350.82	(383)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: 5F

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	96.8	(1a) x	2.85	(2a) =	275.88	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.8	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		275.88	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

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

DRAFT

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.35	(23c)

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

(24a)m=	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	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=	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	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			5.13	x1/[1/(1.4)+ 0.04]		=	6.8			(27)
Windows Type 2			22.8	x1/[1/(1.4)+ 0.04]		=	30.23			(27)
Floor			96.8	x	0.065	=	6.292			(28)
Walls Type1	32.21	0	32.21	x	0.18	=	5.8			(29)
Walls Type2	11.69	0	11.69	x	0.18	=	2.1			(29)
Walls Type3	24.23	22.8	1.43	x	1.4	=	2			(29)
Walls Type4	10.55	0	10.55	x	0.16	=	1.65			(29)
Walls Type5	15.39	15.39	0	x	1.4	=	0			(29)
Total area of elements, m²			190.85							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	68.47	(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		28.63	(36)

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

Total fabric heat loss	(33) + (36) =	97.1	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.11	24.82	24.53	23.08	22.79	21.34	21.34	21.05	21.92	22.79	23.37	23.95	(38)

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

(39)m=	122.21	121.92	121.63	120.18	119.89	118.44	118.44	118.15	119.02	119.89	120.47	121.05	

Average = Sum(39)$_{1…12}$ /12= 120.11 (39)

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

(40)m=	1.26	1.26	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.24	1.25

Average = Sum(40)$_{1...12}$ /12= 1.24 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.71 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 98.51 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	108.36	104.42	100.48	96.54	92.6	88.66	88.66	92.6	96.54	100.48	104.42	108.36	
										Total = Sum(44)$_{1...12}$ =		1182.14	(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=	160.7	140.55	145.03	126.44	121.33	104.69	97.02	111.33	112.66	131.29	143.31	155.63	
										Total = Sum(45)$_{1...12}$ =		1549.97	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.1	21.08	21.76	18.97	18.2	15.7	14.55	16.7	16.9	19.69	21.5	23.34	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

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

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

(62)m=	225.63	199.19	209.96	189.28	186.25	167.53	161.94	176.25	175.49	196.22	206.14	220.55	(62)

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

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

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

Output from water heater

(64)m=	225.63	199.19	209.96	189.28	186.25	167.53	161.94	176.25	175.49	196.22	206.14	220.55	

Output from water heater (annual)$_{1...12}$ 2314.43 (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=	105.37	93.65	100.16	92.31	92.28	85.08	84.2	88.96	87.72	95.59	97.92	103.69	(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=	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	162.47	(66)

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

(67)m=	55.95	49.7	40.42	30.6	22.87	19.31	20.86	27.12	36.4	46.22	53.95	57.51	(67)

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

(68)m=	374.7	378.59	368.79	347.93	321.6	296.85	280.32	276.43	286.23	307.09	333.42	358.17	(68)

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

(69)m=	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	53.96	(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=	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	(71)

Water heating gains (Table 5)

(72)m=	141.63	139.36	134.63	128.21	124.03	118.16	113.17	119.57	121.84	128.49	136	139.37	(72)

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

(73)m=	680.4	675.75	651.95	614.85	576.62	542.44	522.47	531.23	552.58	589.91	631.47	663.15	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	3	x	5.13	x	19.64	x	0.63	x	1	=	131.97	(76)
East	0.9x	3	x	5.13	x	38.42	x	0.63	x	1	=	258.15	(76)
East	0.9x	3	x	5.13	x	63.27	x	0.63	x	1	=	425.14	(76)
East	0.9x	3	x	5.13	x	92.28	x	0.63	x	1	=	620.04	(76)
East	0.9x	3	x	5.13	x	113.09	x	0.63	x	1	=	759.88	(76)

East	0.9x	3	x	5.13	x	115.77	x	0.63	x	1	=	777.88	(76)
East	0.9x	3	x	5.13	x	110.22	x	0.63	x	1	=	740.57	(76)
East	0.9x	3	x	5.13	x	94.68	x	0.63	x	1	=	636.14	(76)
East	0.9x	3	x	5.13	x	73.59	x	0.63	x	1	=	494.46	(76)
East	0.9x	3	x	5.13	x	45.59	x	0.63	x	1	=	306.32	(76)
East	0.9x	3	x	5.13	x	24.49	x	0.63	x	1	=	164.55	(76)
East	0.9x	3	x	5.13	x	16.15	x	0.63	x	1	=	108.52	(76)
South	0.9x	0.77	x	22.8	x	46.75	x	0.63	x	1	=	465.38	(78)
South	0.9x	0.77	x	22.8	x	76.57	x	0.63	x	1	=	762.18	(78)
South	0.9x	0.77	x	22.8	x	97.53	x	0.63	x	1	=	970.88	(78)
South	0.9x	0.77	x	22.8	x	110.23	x	0.63	x	1	=	1097.3	(78)
South	0.9x	0.77	x	22.8	x	114.87	x	0.63	x	1	=	1143.46	(78)
South	0.9x	0.77	x	22.8	x	110.55	x	0.63	x	1	=	1100.42	(78)
South	0.9x	0.77	x	22.8	x	108.01	x	0.63	x	1	=	1075.18	(78)
South	0.9x	0.77	x	22.8	x	104.89	x	0.63	x	1	=	1044.15	(78)
South	0.9x	0.77	x	22.8	x	101.89	x	0.63	x	1	=	1014.2	(78)
South	0.9x	0.77	x	22.8	x	82.59	x	0.63	x	1	=	822.08	(78)
South	0.9x	0.77	x	22.8	x	55.42	x	0.63	x	1	=	551.64	(78)
South	0.9x	0.77	x	22.8	x	40.4	x	0.63	x	1	=	402.13	(78)

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

(83)m=	597.35	1020.33	1396.02	1717.34	1903.34	1878.3	1815.75	1680.29	1508.65	1128.4	716.18	510.65	(83)

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

(84)m=	1277.74	1696.08	2047.96	2332.19	2479.96	2420.73	2338.21	2211.51	2061.23	1718.31	1347.65	1173.81	(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	0.88	0.76	0.6	0.44	0.31	0.22	0.25	0.4	0.67	0.9	0.97	(86)

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

(87)m=	20.22	20.55	20.8	20.94	20.99	21	21	21	20.99	20.92	20.56	20.14	(87)

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

(88)m=	19.87	19.87	19.88	19.89	19.89	19.9	19.9	19.9	19.9	19.89	19.88	19.88	(88)

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

(89)m=	0.94	0.85	0.72	0.55	0.39	0.26	0.17	0.19	0.33	0.62	0.88	0.96	(89)

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

(90)m=	18.9	19.34	19.66	19.83	19.88	19.9	19.9	19.9	19.89	19.81	19.38	18.8	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	19.44	19.84	20.13	20.29	20.33	20.35	20.35	20.35	20.35	20.27	19.87	19.35	(92)

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

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(93)m=	19.44	19.84	20.13	20.29	20.33	20.35	20.35	20.35	20.35	20.27	19.87	19.35	(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	0.85	0.73	0.57	0.41	0.28	0.19	0.21	0.36	0.64	0.87	0.95	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1197.7	1444.81	1489.73	1320.74	1025.49	680.06	444.34	466.95	739.65	1093.68	1179.07	1117.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1850.43	1821.46	1657.38	1368.43	1035.16	681.2	444.47	467.17	743.35	1158.83	1537.96	1834.14	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	485.63	253.11	124.73	34.34	7.2	0	0	0	0	48.48	258.4	533.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1745	(98)
Space heating requirement in kWh/m²/year	18.03	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1113.31	876.43	897.92	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	1	1	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1104.34	873.46	893.62	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	2737.85	2644.77	2495.2	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1176.13	1317.86	1191.58	0	0	0	0	

	Total = Sum(104)$_{6...8}$ =	3685.56	(104)
Cooled fraction	f C = cooled area ÷ (4) =	0.73	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ =	0	(106)

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

(107)m=	0	0	0	0	0	215.97	241.99	218.8	0	0	0	0

	Total = Sum(107)$_{6...8}$ =	676.76	(107)
Space cooling requirement in kWh/m²/year	(107) ÷ (4) =	6.99	(108)

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)

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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 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		1745	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1832.25	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2314.43	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2430.15	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.62	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	142.01	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		235.6	(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) =	235.6	(331)
Energy for lighting (calculated in Appendix L)		395.26	(332)

10b. Fuel costs – Community heating scheme

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating from CHP	(307a) x	4.24	x 0.01 =	77.69	(340a)
Water heating from CHP	(310a) x	4.24	x 0.01 =	103.04	(342a)
		Fuel Price			
Space cooling (community cooling system)	(315)	13.19	x 0.01 =	18.73	(348)
Pumps and fans	(331)	13.19	x 0.01 =	31.08	(349)
Energy for lighting	(332)	13.19	x 0.01 =	52.13	(350)
Additional standing charges (Table 12)				120	(351)
Total energy cost	= (340a)…(342e) + (345)…(354) =			402.67	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12)	0.42	(356)

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Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0] =			1.19	(357)
SAP rating (section12)				83.36	(358)

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					91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x			0	=	1011.73	(367)
Electrical energy for heat distribution	[(313) x			0.52	=	22.12	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)				=	1033.86	(373)
CO2 associated with space heating (secondary)	(309) x			0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x			0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =					1033.86	(376)
CO2 associated with space cooling	(315) x			0.52	=	73.7	(377)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x			0.52	=	122.28	(378)
CO2 associated with electricity for lighting	(332))) x			0.52	=	205.14	(379)
Total CO2, kg/year	sum of (376)…(382) =					1434.98	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					14.82	(384)
EI rating (section 14)						86.44	(385)

13b. Primary Energy – Community heating scheme

		Energy kWh/year		Primary factor		P.Energy kWh/year	
Energy 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					91	(367a)
Energy associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x			0	=	5714.43	(367)
Electrical energy for heat distribution	[(313) x				=	130.86	(372)
Total Energy associated with community systems	(363)…(366) + (368)...(372)				=	5845.28	(373)
if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)						5845.28	(373)
Energy associated with space heating (secondary)	(309) x			0	=	0	(374)
Energy associated with water from immersion heater or instantaneous heater	(312) x			1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =					5845.28	(376)
Energy associated with space cooling	(315) x			3.07	=	435.98	(377)
Energy associated with electricity for pumps and fans within dwelling	(331)) x			3.07	=	723.3	(378)
Energy associated with electricity for lighting	(332))) x			3.07	=	1213.44	(379)
Total Primary Energy, kWh/year	sum of (376)…(382) =					8218	(383)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: 6F

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.1	(1a) x	2.85	(2a) =	214.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.1	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	214.03	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		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

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) = 73.1 (23c)

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

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

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

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

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			19.95	x1/[1/(1.4)+ 0.04]		=	26.45			(27)
Floor			75.1	x	0.065	=	4.8815			(28)
Walls Type1	23.94	0	23.94	x	0.16	=	3.75			(29)
Walls Type2	28.78	0	28.78	x	0.16	=	4.51			(29)
Walls Type3	21.66	19.95	1.71	x	1.4	=	2.39			(29)
Walls Type4	10.83	0	10.83	x	0.16	=	1.7			(29)
Total area of elements, m²			160.31							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.69 (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 24.05 (36)

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

Total fabric heat loss (33) + (36) = 67.74 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.97	19.76	19.56	18.53	18.33	17.3	17.3	17.1	17.71	18.33	18.74	19.15	(38)

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

(39)m=	87.71	87.5	87.3	86.27	86.07	85.04	85.04	84.84	85.45	86.07	86.48	86.89	

Average = Sum(39)$_{1…12}$ /12= 86.22 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(40)m=	1.17	1.17	1.16	1.15	1.15	1.13	1.13	1.13	1.14	1.15	1.15	1.16

Average = Sum(40)$_{1\ldots12}$ /12= 1.15 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.36 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 90.33 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	99.36	95.75	92.14	88.52	84.91	81.3	81.3	84.91	88.52	92.14	95.75	99.36

Total = Sum(44)$_{1\ldots12}$ = 1083.95 (44)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(45)m=	147.35	128.87	132.99	115.94	111.25	96	88.96	102.08	103.3	120.38	131.41	142.7

Total = Sum(45)$_{1\ldots12}$ = 1421.23 (45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	22.1	19.33	19.95	17.39	16.69	14.4	13.34	15.31	15.49	18.06	19.71	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 200 (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): — 2.24 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 1.34 (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) — 1.34 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(56)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	212.28	187.52	197.91	178.77	176.17	158.83	153.88	167.01	166.13	185.31	194.24	207.63	(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=	212.28	187.52	197.91	178.77	176.17	158.83	153.88	167.01	166.13	185.31	194.24	207.63	

Output from water heater (annual)$_{1...12}$ 2185.68 (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=	100.94	89.77	96.16	88.82	88.93	82.19	81.52	85.88	84.61	91.97	93.96	99.39	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	141.8	(66)

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

(67)m=	46.56	41.35	33.63	25.46	19.03	16.07	17.36	22.57	30.29	38.46	44.89	47.85	(67)

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

(68)m=	311.79	315.02	306.87	289.51	267.6	247.01	233.25	230.02	238.17	255.53	277.44	298.03	(68)

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

(69)m=	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	51.54	(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=	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	(71)

Water heating gains (Table 5)

(72)m=	135.67	133.58	129.25	123.36	119.53	114.15	109.57	115.43	117.52	123.61	130.5	133.59	(72)

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

(73)m=	592.82	588.76	568.55	537.14	504.97	476.03	458.99	466.83	484.79	516.41	551.63	578.28	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	19.95	x	10.63	x	0.63	x	1	=	92.62	(74)
North	0.9x	0.77	x	19.95	x	20.32	x	0.63	x	1	=	176.99	(74)
North	0.9x	0.77	x	19.95	x	34.53	x	0.63	x	1	=	300.76	(74)
North	0.9x	0.77	x	19.95	x	55.46	x	0.63	x	1	=	483.09	(74)
North	0.9x	0.77	x	19.95	x	74.72	x	0.63	x	1	=	650.77	(74)

North	0.9x	0.77	x	19.95	x	79.99	x	0.63	x	1	=	696.67	(74)
North	0.9x	0.77	x	19.95	x	74.68	x	0.63	x	1	=	650.43	(74)
North	0.9x	0.77	x	19.95	x	59.25	x	0.63	x	1	=	516.03	(74)
North	0.9x	0.77	x	19.95	x	41.52	x	0.63	x	1	=	361.61	(74)
North	0.9x	0.77	x	19.95	x	24.19	x	0.63	x	1	=	210.69	(74)
North	0.9x	0.77	x	19.95	x	13.12	x	0.63	x	1	=	114.25	(74)
North	0.9x	0.77	x	19.95	x	8.86	x	0.63	x	1	=	77.21	(74)

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

(83)m=	92.62	176.99	300.76	483.09	650.77	696.67	650.43	516.03	361.61	210.69	114.25	77.21	(83)

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

(84)m=	685.44	765.76	869.31	1020.23	1155.75	1172.7	1109.42	982.86	846.39	727.1	665.89	655.49	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.84	0.66	0.46	0.34	0.39	0.66	0.91	0.98	0.99	(86)

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

(87)m=	20.02	20.18	20.45	20.77	20.95	20.99	21	21	20.96	20.71	20.31	19.99	(87)

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

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

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

(89)m=	0.98	0.97	0.93	0.81	0.59	0.39	0.26	0.31	0.57	0.87	0.97	0.99	(89)

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

(90)m=	18.67	18.9	19.28	19.72	19.92	19.97	19.97	19.98	19.94	19.65	19.1	18.63	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.31	19.51	19.83	20.22	20.4	20.45	20.46	20.46	20.42	20.15	19.68	19.28	(92)

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

(93)m=	19.31	19.51	19.83	20.22	20.4	20.45	20.46	20.46	20.42	20.15	19.68	19.28	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.82	0.62	0.42	0.3	0.35	0.61	0.88	0.97	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	672.3	740.55	807.08	831.79	717.22	494.22	327.77	343.36	518.93	640.68	642.68	645.06	(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=	1316.5	1278.02	1164.08	976.34	749.21	497.9	328.24	344.43	540.45	822.05	1087.47	1309.86	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	479.28	361.18	265.61	104.07	23.8	0	0	0	0	134.94	320.25	494.61	(98)

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2183.75	(98)
Space heating requirement in kWh/m²/year		29.08	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	799.38	629.3	644.75	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.96	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	771.25	618.59	624.46	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1290.32	1219.24	1069.98	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	373.73	446.88	331.47	0	0	0	0	

	Total = Sum(104)$_{6...8}$ =	1152.09	(104)
Cooled fraction	f C = cooled area ÷ (4) =	0.91	(105)

Intermittency factor (Table 10b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

	Total = Sum(104)$_{6...8}$ =	0	(106)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(107)m=	0	0	0	0	0	85.47	102.2	75.81	0	0	0	0

	Total = Sum(107)$_{6...8}$ =	263.48	(107)
Space cooling requirement in kWh/m²/year	(107) ÷ (4) =	3.51	(108)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2183.75	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2292.94	(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	2185.68	

If DHW from community scheme:

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Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2294.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.88	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	55.29	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		204.72	(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) =	204.72	(331)
Energy for lighting (calculated in Appendix L)		328.89	(332)

10b. Fuel costs – Community heating scheme

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating from CHP	(307a) x	4.24	x 0.01 =	97.22	(340a)
Water heating from CHP	(310a) x	4.24	x 0.01 =	97.31	(342a)
		Fuel Price			
Space cooling (community cooling system)	(315)	13.19	x 0.01 =	7.29	(348)
Pumps and fans	(331)	13.19	x 0.01 =	27	(349)
Energy for lighting	(332)	13.19	x 0.01 =	43.38	(350)
Additional standing charges (Table 12)				120	(351)
Total energy cost	= (340a)…(342e) + (345)…(354) =			392.2	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12)		0.42	(356)
Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0] =	1.37	(357)
SAP rating (section12)		80.87	(358)

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				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	1089	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.81	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1112.81	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1112.81	(376)
CO2 associated with space cooling	(315) x		0.52	=	28.69	(377)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	106.25	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.7	(379)
Total CO2, kg/year	sum of (376)…(382) =			1418.45	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.89	(384)
EI rating (section 14)				84.17	(385)

13b. Primary Energy – Community heating scheme

		Energy kWh/year	Primary factor		P.Energy kWh/year	
Energy 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				91	(367a)
Energy associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	6150.81	(367)
Electrical energy for heat distribution	[(313) x			=	140.85	(372)
Total Energy associated with community systems	(363)…(366) + (368)...(372)			=	6291.66	(373)
if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)					6291.66	(373)
Energy associated with space heating (secondary)	(309) x		0	=	0	(374)
Energy associated with water from immersion heater or instantaneous heater	(312) x		1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =				6291.66	(376)
Energy associated with space cooling	(315) x		3.07	=	169.74	(377)
Energy associated with electricity for pumps and fans within dwelling	(331)) x		3.07	=	628.49	(378)
Energy associated with electricity for lighting	(332))) x		3.07	=	1009.7	(379)
Total Primary Energy, kWh/year	sum of (376)…(382) =				8099.59	(383)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.7

Property Address: 9R

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	134.6	(1a) x	3.05	(2a) =	410.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	134.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	410.53	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.25 (23c)

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

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

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

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

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			5.49	x1/[1/(1.4)+ 0.04]		=	7.28			(27)
Windows Type 2			17.39	x1/[1/(1.4)+ 0.04]		=	23.05			(27)
Windows Type 3			4.58	x1/[1/(1.4)+ 0.04]		=	6.07			(27)
Windows Type 4			21.96	x1/[1/(1.4)+ 0.04]		=	29.11			(27)
Rooflights			9	x1/[1/(1.4) + 0.04]		=	12.6			(27b)
Walls Type1	44.4	0	44.4	x	0.18	=	7.99			(29)
Walls Type2	17.2	17.39	-0.19	x	1.4	=	-0.27			(29)
Walls Type3	23.8	21.96	1.84	x	1.4	=	2.58			(29)
Walls Type4	15.9	0	15.9	x	0.16	=	2.49			(29)
Walls Type5	22.9	0	22.9	x	0.18	=	4.12			(29)
Walls Type6	4.5	4.58	-0.08	x	1.4	=	-0.11			(29)
Walls Type7	16.5	16.47	0.03	x	1.4	=	0.04			(29)
Roof	134.6	9	125.6	x	0.12	=	15.07			(30)
Total area of elements, m²			279.8							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 123.93 (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 | 41.97 | (36)

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

Total fabric heat loss (33) + (36) = | 165.9 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.82	40.39	39.96	37.8	37.37	35.21	35.21	34.77	36.07	37.37	38.23	39.09	(38)

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

(39)m=	206.72	206.29	205.85	203.69	203.26	201.1	201.1	200.67	201.97	203.26	204.13	204.99	

Average = $Sum(39)_{1…12}$ /12= | 203.59 | (39)

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

(40)m=	1.54	1.53	1.53	1.51	1.51	1.49	1.49	1.49	1.5	1.51	1.52	1.52

Average = $Sum(40)_{1…12}$ /12= | 1.51 | (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.91 | (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 | 103.22 | (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	113.54	109.41	105.28	101.15	97.02	92.9	92.9	97.02	101.15	105.28	109.41	113.54

Total = $Sum(44)_{1…12}$ = | 1238.61 | (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=	168.38	147.26	151.96	132.48	127.12	109.7	101.65	116.64	118.04	137.56	150.16	163.06

Total = $Sum(45)_{1…12}$ = | 1624.02 | (45)

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

(46)m=	25.26	22.09	22.79	19.87	19.07	16.45	15.25	17.5	17.71	20.63	22.52	24.46	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 200 | (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): | 2.24 | (48)

Temperature factor from Table 2b | 0.6 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 1.34 | (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.34	(55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

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

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

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

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

(62)m=	233.3	205.91	216.89	195.32	192.05	172.53	166.58	181.57	180.87	202.49	212.99	227.99	(62)

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

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

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

Output from water heater

(64)m=	233.3	205.91	216.89	195.32	192.05	172.53	166.58	181.57	180.87	202.49	212.99	227.99	

Output from water heater (annual)$_{1…12}$ — 2388.47 (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=	107.93	95.88	102.47	94.32	94.21	86.74	85.74	90.73	89.51	97.68	100.19	106.16	(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=	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	174.36	(66)

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

(67)m=	67.57	60.02	48.81	36.95	27.62	23.32	25.2	32.75	43.96	55.82	65.15	69.45	(67)

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

(68)m=	452.51	457.21	445.38	420.18	388.39	358.5	338.53	333.84	345.67	370.86	402.66	432.55	(68)

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

(69)m=	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	55.34	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	(71)

Water heating gains (Table 5)

(72)m=	145.06	142.68	137.73	131	126.63	120.47	115.24	121.94	124.32	131.29	139.16	142.69	(72)

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

(73)m=	778.61	773.37	745.37	701.59	656.09	615.75	592.43	602	627.42	671.43	720.43	758.15	(73)

6. Solar gains:

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

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	21.96	x	10.63	x	0.63	x	1	=	132.4	(74)
North	0.9x	1	x	21.96	x	20.32	x	0.63	x	1	=	253.02	(74)
North	0.9x	1	x	21.96	x	34.53	x	0.63	x	1	=	429.95	(74)
North	0.9x	1	x	21.96	x	55.46	x	0.63	x	1	=	690.61	(74)
North	0.9x	1	x	21.96	x	74.72	x	0.63	x	1	=	930.31	(74)
North	0.9x	1	x	21.96	x	79.99	x	0.63	x	1	=	995.92	(74)
North	0.9x	1	x	21.96	x	74.68	x	0.63	x	1	=	929.82	(74)
North	0.9x	1	x	21.96	x	59.25	x	0.63	x	1	=	737.69	(74)
North	0.9x	1	x	21.96	x	41.52	x	0.63	x	1	=	516.94	(74)
North	0.9x	1	x	21.96	x	24.19	x	0.63	x	1	=	301.19	(74)
North	0.9x	1	x	21.96	x	13.12	x	0.63	x	1	=	163.33	(74)
North	0.9x	1	x	21.96	x	8.86	x	0.63	x	1	=	110.37	(74)
East	0.9x	3	x	5.49	x	19.64	x	0.63	x	1	=	183.41	(76)
East	0.9x	3	x	5.49	x	38.42	x	0.63	x	1	=	358.79	(76)
East	0.9x	3	x	5.49	x	63.27	x	0.63	x	1	=	590.88	(76)
East	0.9x	3	x	5.49	x	92.28	x	0.63	x	1	=	861.76	(76)
East	0.9x	3	x	5.49	x	113.09	x	0.63	x	1	=	1056.12	(76)
East	0.9x	3	x	5.49	x	115.77	x	0.63	x	1	=	1081.12	(76)
East	0.9x	3	x	5.49	x	110.22	x	0.63	x	1	=	1029.27	(76)
East	0.9x	3	x	5.49	x	94.68	x	0.63	x	1	=	884.13	(76)
East	0.9x	3	x	5.49	x	73.59	x	0.63	x	1	=	687.21	(76)
East	0.9x	3	x	5.49	x	45.59	x	0.63	x	1	=	425.73	(76)
East	0.9x	3	x	5.49	x	24.49	x	0.63	x	1	=	228.69	(76)
East	0.9x	3	x	5.49	x	16.15	x	0.63	x	1	=	150.83	(76)
South	0.9x	1	x	17.39	x	46.75	x	0.63	x	1	=	460.98	(78)
South	0.9x	1	x	17.39	x	76.57	x	0.63	x	1	=	754.97	(78)
South	0.9x	1	x	17.39	x	97.53	x	0.63	x	1	=	961.7	(78)
South	0.9x	1	x	17.39	x	110.23	x	0.63	x	1	=	1086.93	(78)
South	0.9x	1	x	17.39	x	114.87	x	0.63	x	1	=	1132.64	(78)
South	0.9x	1	x	17.39	x	110.55	x	0.63	x	1	=	1090.02	(78)
South	0.9x	1	x	17.39	x	108.01	x	0.63	x	1	=	1065.01	(78)
South	0.9x	1	x	17.39	x	104.89	x	0.63	x	1	=	1034.27	(78)
South	0.9x	1	x	17.39	x	101.89	x	0.63	x	1	=	1004.61	(78)
South	0.9x	1	x	17.39	x	82.59	x	0.63	x	1	=	814.3	(78)
South	0.9x	1	x	17.39	x	55.42	x	0.63	x	1	=	546.42	(78)
South	0.9x	1	x	17.39	x	40.4	x	0.63	x	1	=	398.33	(78)
West	0.9x	1	x	4.58	x	19.64	x	0.63	x	1	=	51	(80)
West	0.9x	1	x	4.58	x	38.42	x	0.63	x	1	=	99.77	(80)
West	0.9x	1	x	4.58	x	63.27	x	0.63	x	1	=	164.31	(80)

West	0.9x	1	x	4.58	x	92.28	x	0.63	x	1	=	239.64	(80)
West	0.9x	1	x	4.58	x	113.09	x	0.63	x	1	=	293.69	(80)
West	0.9x	1	x	4.58	x	115.77	x	0.63	x	1	=	300.64	(80)
West	0.9x	1	x	4.58	x	110.22	x	0.63	x	1	=	286.22	(80)
West	0.9x	1	x	4.58	x	94.68	x	0.63	x	1	=	245.86	(80)
West	0.9x	1	x	4.58	x	73.59	x	0.63	x	1	=	191.1	(80)
West	0.9x	1	x	4.58	x	45.59	x	0.63	x	1	=	118.39	(80)
West	0.9x	1	x	4.58	x	24.49	x	0.63	x	1	=	63.59	(80)
West	0.9x	1	x	4.58	x	16.15	x	0.63	x	1	=	41.94	(80)
Rooflights	0.9x	1	x	9	x	26	x	0.63	x	1	=	132.68	(82)
Rooflights	0.9x	1	x	9	x	54	x	0.63	x	1	=	275.56	(82)
Rooflights	0.9x	1	x	9	x	96	x	0.63	x	1	=	489.89	(82)
Rooflights	0.9x	1	x	9	x	150	x	0.63	x	1	=	765.45	(82)
Rooflights	0.9x	1	x	9	x	192	x	0.63	x	1	=	979.78	(82)
Rooflights	0.9x	1	x	9	x	200	x	0.63	x	1	=	1020.6	(82)
Rooflights	0.9x	1	x	9	x	189	x	0.63	x	1	=	964.47	(82)
Rooflights	0.9x	1	x	9	x	157	x	0.63	x	1	=	801.17	(82)
Rooflights	0.9x	1	x	9	x	115	x	0.63	x	1	=	586.84	(82)
Rooflights	0.9x	1	x	9	x	66	x	0.63	x	1	=	336.8	(82)
Rooflights	0.9x	1	x	9	x	33	x	0.63	x	1	=	168.4	(82)
Rooflights	0.9x	1	x	9	x	21	x	0.63	x	1	=	107.16	(82)

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

(83)m=	960.47	1742.12	2636.72	3644.38	4392.53	4488.3	4274.79	3703.13	2986.7	1996.42	1170.44	808.64	(83)

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

(84)m=	1739.08	2515.48	3382.09	4345.97	5048.62	5104.05	4867.23	4305.12	3614.12	2667.85	1890.87	1566.79	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.89	0.75	0.54	0.37	0.25	0.18	0.21	0.38	0.7	0.93	0.98	(86)

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

(87)m=	19.85	20.3	20.7	20.93	20.99	21	21	21	20.99	20.84	20.29	19.75	(87)

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

(88)m=	19.66	19.66	19.67	19.68	19.68	19.69	19.69	19.69	19.69	19.68	19.68	19.67	(88)

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

(89)m=	0.96	0.87	0.7	0.49	0.32	0.2	0.13	0.15	0.31	0.64	0.9	0.97	(89)

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

(90)m=	18.22	18.84	19.35	19.61	19.67	19.69	19.69	19.69	19.68	19.54	18.85	18.09	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

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(92)m=	18.98	19.53	19.99	20.23	20.29	20.3	20.31	20.31	20.29	20.15	19.53	18.87	(92)

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

(93)m=	18.98	19.53	19.99	20.23	20.29	20.3	20.31	20.31	20.29	20.15	19.53	18.87	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.95	0.87	0.72	0.51	0.34	0.22	0.15	0.18	0.34	0.66	0.9	0.96	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1654.51	2179.29	2419.31	2221.11	1730.22	1145.24	744.97	783.41	1240.36	1759.48	1701.65	1510.8	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	3035.23	3017.46	2776.19	2307.46	1745.51	1147.2	745.26	784	1251.14	1940.67	2536.65	3007.06	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1027.26	563.25	265.52	62.18	11.37	0	0	0	0	134.8	601.2	1113.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3778.79 (98)

Space heating requirement in kWh/m²/year 28.07 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1890.38	1488.17	1525.11	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1869.94	1480.12	1511.13	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	5104.05	4867.23	4305.12	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	2328.56	2520.01	2078.73	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 6927.3 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.91 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

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

(107)m=	0	0	0	0	0	527.65	571.03	471.03	0	0	0	0

Total = Sum(107)$_{6...8}$ = 1569.71 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 11.66 (108)

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		**kWh/year**	
Annual space heating requirement		3778.79	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3967.73	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2388.47	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2507.9	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	64.76	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	329.39	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		462.78	(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) =	462.78	(331)
Energy for lighting (calculated in Appendix L)		477.34	(332)

10b. Fuel costs – Community heating scheme

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating from CHP	(307a) x	4.24	x 0.01 =	168.23	(340a)
Water heating from CHP	(310a) x	4.24	x 0.01 =	106.33	(342a)
		Fuel Price			
Space cooling (community cooling system)	(315)	13.19	x 0.01 =	43.45	(348)
Pumps and fans	(331)	13.19	x 0.01 =	61.04	(349)
Energy for lighting	(332)	13.19	x 0.01 =	62.96	(350)
Additional standing charges (Table 12)				120	(351)
Total energy cost	= (340a)…(342e) + (345)…(354) =			562.02	(355)

11b. SAP rating - Community heating scheme

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Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0] =			1.31	(357)
SAP rating (section12)				81.67	(358)

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				91	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	1537.07	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	33.61	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1570.68	(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) =				1570.68	(376)
CO2 associated with space cooling	(315) x		0.52	=	170.95	(377)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	240.18	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	247.74	(379)
Total CO2, kg/year	sum of (376)…(382) =				2229.56	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.56	(384)
EI rating (section 14)					83.37	(385)

13b. Primary Energy – Community heating scheme

		Energy kWh/year	Primary factor		P.Energy kWh/year	
Energy 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				91	(367a)
Energy associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	8681.61	(367)
Electrical energy for heat distribution	[(313) x			=	198.8	(372)
Total Energy associated with community systems	(363)…(366) + (368)...(372)			=	8880.41	(373)
if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)					8880.41	(373)
Energy associated with space heating (secondary)	(309) x		0	=	0	(374)
Energy associated with water from immersion heater or instantaneous heater	(312) x		1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =				8880.41	(376)
Energy associated with space cooling	(315) x		3.07	=	1011.23	(377)
Energy associated with electricity for pumps and fans within dwelling	(331)) x		3.07	=	1420.74	(378)
Energy associated with electricity for lighting	(332))) x		3.07	=	1465.44	(379)
Total Primary Energy, kWh/year	sum of (376)…(382) =				12777.82	(383)

APPENDIX 7 – SAP WORKSHEETS GREEN

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: 5

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	96.8	(1a) x	2.85	(2a) =	275.88	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	275.88	(5)

2. Ventilation rate:

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.35 (23c)

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

(24a)m=	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	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=	0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	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			5.13	x1/[1/(1.4)+ 0.04]		=	6.8			(27)
Windows Type 2			22.8	x1/[1/(1.4)+ 0.04]		=	30.23			(27)
Walls Type1	32.21	0	32.21	x	0.18	=	5.8			(29)
Walls Type2	11.69	0	11.69	x	0.18	=	2.1			(29)
Walls Type3	24.23	22.8	1.43	x	1.4	=	2			(29)
Walls Type4	10.55	0	10.55	x	0.16	=	1.65			(29)
Walls Type5	15.39	15.39	0	x	1.4	=	0			(29)
Total area of elements, m²			94.05							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 62.18 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 14.11 (36)

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

Total fabric heat loss (33) + (36) = 76.29 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.11	24.82	24.53	23.08	22.79	21.34	21.34	21.05	21.92	22.79	23.37	23.95	(38)

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

(39)m=	101.4	101.11	100.82	99.37	99.08	97.62	97.62	97.33	98.21	99.08	99.66	100.24	

Average = Sum(39)$_{1…12}$ /12= 99.29 (39)

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

(40)m=	1.05	1.04	1.04	1.03	1.02	1.01	1.01	1.01	1.01	1.02	1.03	1.04

Average = Sum(40)$_{1…12}$ /12= 1.03 (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 2.71 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 98.51 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	108.36	104.42	100.48	96.54	92.6	88.66	88.66	92.6	96.54	100.48	104.42	108.36

Total = Sum(44)$_{1…12}$ = 1182.14 (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=	160.7	140.55	145.03	126.44	121.33	104.69	97.02	111.33	112.66	131.29	143.31	155.63

Total = Sum(45)$_{1…12}$ = 1549.97 (45)

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

(46)m=	24.1	21.08	21.76	18.97	18.2	15.7	14.55	16.7	16.9	19.69	21.5	23.34	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

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

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

(62)m=	225.63	199.19	209.96	189.28	186.25	167.53	161.94	176.25	175.49	196.22	206.14	220.55	(62)

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

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

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

Output from water heater

(64)m=	225.63	199.19	209.96	189.28	186.25	167.53	161.94	176.25	175.49	196.22	206.14	220.55	

Output from water heater (annual)$_{1...12}$ 2314.43 (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=	105.37	93.65	100.16	92.31	92.28	85.08	84.2	88.96	87.72	95.59	97.92	103.69	(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=	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	(66)

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

(67)m=	22.38	19.88	16.17	12.24	9.15	7.72	8.35	10.85	14.56	18.49	21.58	23	(67)

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

(68)m=	251.05	253.65	247.09	233.11	215.47	198.89	187.81	185.21	191.77	205.75	223.39	239.97	(68)

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

(69)m=	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	(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=	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	(71)

Water heating gains (Table 5)

(72)m=	141.63	139.36	134.63	128.21	124.03	118.16	113.17	119.57	121.84	128.49	136	139.37	(72)

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

(73)m=	478.68	476.51	461.5	437.18	412.27	388.39	372.95	379.24	391.79	416.34	444.58	465.96	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	3	x	5.13	x	19.64	x	0.63	x	1	=	131.97	(76)
East	0.9x	3	x	5.13	x	38.42	x	0.63	x	1	=	258.15	(76)
East	0.9x	3	x	5.13	x	63.27	x	0.63	x	1	=	425.14	(76)
East	0.9x	3	x	5.13	x	92.28	x	0.63	x	1	=	620.04	(76)
East	0.9x	3	x	5.13	x	113.09	x	0.63	x	1	=	759.88	(76)

East	0.9x	3	x	5.13	x	115.77	x	0.63	x	1	=	777.88	(76)
East	0.9x	3	x	5.13	x	110.22	x	0.63	x	1	=	740.57	(76)
East	0.9x	3	x	5.13	x	94.68	x	0.63	x	1	=	636.14	(76)
East	0.9x	3	x	5.13	x	73.59	x	0.63	x	1	=	494.46	(76)
East	0.9x	3	x	5.13	x	45.59	x	0.63	x	1	=	306.32	(76)
East	0.9x	3	x	5.13	x	24.49	x	0.63	x	1	=	164.55	(76)
East	0.9x	3	x	5.13	x	16.15	x	0.63	x	1	=	108.52	(76)
South	0.9x	0.77	x	22.8	x	46.75	x	0.63	x	1	=	465.38	(78)
South	0.9x	0.77	x	22.8	x	76.57	x	0.63	x	1	=	762.18	(78)
South	0.9x	0.77	x	22.8	x	97.53	x	0.63	x	1	=	970.88	(78)
South	0.9x	0.77	x	22.8	x	110.23	x	0.63	x	1	=	1097.3	(78)
South	0.9x	0.77	x	22.8	x	114.87	x	0.63	x	1	=	1143.46	(78)
South	0.9x	0.77	x	22.8	x	110.55	x	0.63	x	1	=	1100.42	(78)
South	0.9x	0.77	x	22.8	x	108.01	x	0.63	x	1	=	1075.18	(78)
South	0.9x	0.77	x	22.8	x	104.89	x	0.63	x	1	=	1044.15	(78)
South	0.9x	0.77	x	22.8	x	101.89	x	0.63	x	1	=	1014.2	(78)
South	0.9x	0.77	x	22.8	x	82.59	x	0.63	x	1	=	822.08	(78)
South	0.9x	0.77	x	22.8	x	55.42	x	0.63	x	1	=	551.64	(78)
South	0.9x	0.77	x	22.8	x	40.4	x	0.63	x	1	=	402.13	(78)

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

(83)m=	597.35	1020.33	1396.02	1717.34	1903.34	1878.3	1815.75	1680.29	1508.65	1128.4	716.18	510.65	(83)

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

(84)m=	1076.03	1496.83	1857.52	2154.52	2315.61	2266.69	2188.7	2059.53	1900.44	1544.74	1160.76	976.61	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.88	0.73	0.55	0.4	0.28	0.2	0.22	0.36	0.64	0.91	0.98	(86)

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

(87)m=	20.35	20.69	20.89	20.98	21	21	21	21	21	20.96	20.67	20.28	(87)

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

(88)m=	20.04	20.05	20.05	20.06	20.06	20.08	20.08	20.08	20.07	20.06	20.06	20.05	(88)

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

(89)m=	0.96	0.85	0.69	0.51	0.36	0.24	0.16	0.17	0.31	0.59	0.89	0.97	(89)

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

(90)m=	19.23	19.68	19.93	20.04	20.06	20.08	20.08	20.08	20.07	20.03	19.68	19.13	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	19.69	20.09	20.33	20.43	20.45	20.46	20.46	20.46	20.45	20.41	20.09	19.6	(92)

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

(93)m=	19.69	20.09	20.33	20.43	20.45	20.46	20.46	20.46	20.45	20.41	20.09	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=	0.95	0.86	0.7	0.52	0.37	0.25	0.17	0.19	0.33	0.61	0.89	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1026.96	1280.26	1307.69	1128.55	864.11	571.48	376.43	394.9	622.95	942.77	1030.99	945.7	(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=	1560.47	1536.31	1394.21	1145.32	866.49	571.67	376.44	394.93	623.8	972.11	1294.35	1543.55	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	396.93	172.06	64.37	12.08	1.77	0	0	0	0	21.83	189.62	444.8	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1303.47 (98)

Space heating requirement in kWh/m²/year 13.47 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	917.67	722.42	739.74	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	1	1	1	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	916.32	722.05	739.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	2737.85	2644.77	2495.2	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	1311.5	1430.5	1306.48	0	0	0	0

Total = Sum(104)$_{6...8}$ = 4048.48 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.73 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

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

(107)m=	0	0	0	0	0	240.83	262.68	239.9	0	0	0	0

Total = Sum(107)$_{6...8}$ = 743.41 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 7.68 (108)

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)

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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 heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1303.47	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1368.65	(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		2314.43	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2430.15	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	37.99	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	156	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		235.6	(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) =	235.6	(331)
Energy for lighting (calculated in Appendix L)		395.26	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-259.09	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	**Emission factor kg CO2/kWh**		**Emissions kg CO2/year**	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				132	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	621.62	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.72	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	641.34	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				641.34	(376)
CO2 associated with space cooling	(315) x		0.52	=	80.96	(377)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	122.28	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	205.14	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-134.47	(380)
Total CO2, kg/year	sum of (376)…(382) =			915.25	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			9.46	(384)
EI rating (section 14)				91.35	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.7

Property Address: 6

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	75.1	(1a)	x	2.85	(2a)	=	214.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.1	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	214.03	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		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
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) = 73.1 (23c)

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

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

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

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

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

(25)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			19.95	x1/[1/(1.4)+ 0.04]		=	26.45			(27)
Walls Type1	23.94	0	23.94	x	0.16	=	3.75			(29)
Walls Type2	28.78	0	28.78	x	0.18	=	5.18			(29)
Walls Type3	21.66	19.95	1.71	x	1.4	=	2.39			(29)
Walls Type4	10.83	0	10.83	x	0.16	=	1.7			(29)
Total area of elements, m²			85.22							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.48 (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 12.78 (36)

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

Total fabric heat loss (33) + (36) = 52.26 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.97	19.76	19.56	18.53	18.33	17.3	17.3	17.1	17.71	18.33	18.74	19.15	(38)

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

(39)m=	72.23	72.02	71.82	70.79	70.59	69.56	69.56	69.36	69.97	70.59	71	71.41	

Average = $Sum(39)_{1…12}$ /12= 70.74 (39)

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

(40)m=	0.96	0.96	0.96	0.94	0.94	0.93	0.93	0.92	0.93	0.94	0.95	0.95

Average = Sum(40)$_{1…12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.33 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.36	95.75	92.14	88.52	84.91	81.3	81.3	84.91	88.52	92.14	95.75	99.36	
											Total = Sum(44)$_{1…12}$ =	1083.95	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	147.35	128.87	132.99	115.94	111.25	96	88.96	102.08	103.3	120.38	131.41	142.7	
											Total = Sum(45)$_{1…12}$ =	1421.23	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.1	19.33	19.95	17.39	16.69	14.4	13.34	15.31	15.49	18.06	19.71	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

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

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

(62)m=	212.28	187.52	197.91	178.77	176.17	158.83	153.88	167.01	166.13	185.31	194.24	207.63	(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=	212.28	187.52	197.91	178.77	176.17	158.83	153.88	167.01	166.13	185.31	194.24	207.63	

Output from water heater (annual)$_{1...12}$ 2185.68 (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=	100.94	89.77	96.16	88.82	88.93	82.19	81.52	85.88	84.61	91.97	93.96	99.39	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	(66)

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

(67)m=	18.62	16.54	13.45	10.18	7.61	6.43	6.94	9.03	12.12	15.38	17.96	19.14	(67)

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

(68)m=	208.9	211.06	205.6	193.97	179.29	165.5	156.28	154.11	159.57	171.2	185.88	199.68	(68)

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

(69)m=	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	(71)

Water heating gains (Table 5)

(72)m=	135.67	133.58	129.25	123.36	119.53	114.15	109.57	115.43	117.52	123.61	130.5	133.59	(72)

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

(73)m=	421.64	419.63	406.75	385.96	364.89	344.52	331.24	337.02	347.66	368.65	392.79	410.86	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	19.95	x	10.63	x	0.63	x	1	=	92.62	(74)
North	0.9x	0.77	x	19.95	x	20.32	x	0.63	x	1	=	176.99	(74)
North	0.9x	0.77	x	19.95	x	34.53	x	0.63	x	1	=	300.76	(74)
North	0.9x	0.77	x	19.95	x	55.46	x	0.63	x	1	=	483.09	(74)
North	0.9x	0.77	x	19.95	x	74.72	x	0.63	x	1	=	650.77	(74)

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North	0.9x	0.77	x	19.95	x	79.99	x	0.63	x	1	=	696.67	(74)
North	0.9x	0.77	x	19.95	x	74.68	x	0.63	x	1	=	650.43	(74)
North	0.9x	0.77	x	19.95	x	59.25	x	0.63	x	1	=	516.03	(74)
North	0.9x	0.77	x	19.95	x	41.52	x	0.63	x	1	=	361.61	(74)
North	0.9x	0.77	x	19.95	x	24.19	x	0.63	x	1	=	210.69	(74)
North	0.9x	0.77	x	19.95	x	13.12	x	0.63	x	1	=	114.25	(74)
North	0.9x	0.77	x	19.95	x	8.86	x	0.63	x	1	=	77.21	(74)

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

(83)m=	92.62	176.99	300.76	483.09	650.77	696.67	650.43	516.03	361.61	210.69	114.25	77.21	(83)

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

(84)m=	514.25	596.63	707.51	869.06	1015.66	1041.19	981.67	853.06	709.26	579.34	507.04	488.07	(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	0.96	0.85	0.63	0.43	0.31	0.37	0.66	0.94	0.99	1	(86)

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

(87)m=	20.1	20.26	20.53	20.85	20.98	21	21	21	20.98	20.75	20.37	20.07	(87)

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

(88)m=	20.12	20.12	20.12	20.13	20.13	20.15	20.15	20.15	20.14	20.13	20.13	20.12	(88)

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

(89)m=	0.99	0.99	0.95	0.81	0.58	0.37	0.25	0.3	0.58	0.91	0.99	1	(89)

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

(90)m=	18.92	19.15	19.54	19.97	20.11	20.14	20.15	20.15	20.13	19.86	19.32	18.89	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.48	19.68	20.01	20.38	20.52	20.55	20.55	20.55	20.53	20.28	19.82	19.45	(92)

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

(93)m=	19.48	19.68	20.01	20.38	20.52	20.55	20.55	20.55	20.53	20.28	19.82	19.45	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.83	0.6	0.4	0.28	0.34	0.62	0.92	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	510.88	587.47	673.31	717.19	609	412.82	274.69	287.63	438.55	530.68	499.5	485.63	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1096.39	1064.51	970.48	812.89	622.74	413.8	274.78	287.91	449.89	683.33	902.98	1088.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	435.62	320.57	221.09	68.91	10.22	0	0	0	0	113.57	290.5	448.89	(98)

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1909.37	(98)
Space heating requirement in kWh/m²/year	25.42	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	653.87	514.75	527.1	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	1	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	648.35	513.06	523.29	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1290.32	1219.24	1069.98	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	462.22	525.4	406.74	0	0	0	0	

	Total = Sum(104)$_{6...8}$ =	1394.36	(104)
Cooled fraction	f C = cooled area ÷ (4) =	0.91	(105)

Intermittency factor (Table 10b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

	Total = Sum(104)$_{6...8}$ =	0	(106)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(107)m=	0	0	0	0	0	105.71	120.16	93.02	0	0	0	0

	Total = Sum(107)$_{6...8}$ =	318.88	(107)
Space cooling requirement in kWh/m²/year	(107) ÷ (4) =	4.25	(108)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1909.37	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2004.84	(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	2185.68	

If DHW from community scheme:

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Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2294.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	66.91	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		204.72	(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) =	204.72	(331)
Energy for lighting (calculated in Appendix L)		328.89	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-207.27	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				132	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	703.6	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.32	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	725.92	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				725.92	(376)
CO2 associated with space cooling	(315) x		0.52	=	34.73	(377)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	106.25	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	170.7	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-107.57	(380)
Total CO2, kg/year	sum of (376)…(382) =				930.02	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				12.38	(384)
EI rating (section 14)					89.62	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.7

Property Address: 9

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	134.6	(1a) x	2.85	(2a) =	383.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	134.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	383.61	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	72.25	(23c)

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

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

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

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

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			5.13	x1/[1/(1.2)+ 0.04]		=	5.87			(27)
Windows Type 2			4.85	x1/[1/(1.2)+ 0.04]		=	5.55			(27)
Windows Type 3			16.25	x1/[1/(1.2)+ 0.04]		=	18.61			(27)
Windows Type 4			4.28	x1/[1/(1.2)+ 0.04]		=	4.9			(27)
Windows Type 5			20.52	x1/[1/(1.2)+ 0.04]		=	23.5			(27)
Walls Type1	41.5	15.11	26.39	x	0.18	=	4.75			(29)
Walls Type2	21.4	0	21.4	x	0.16	=	3.36			(29)
Walls Type3	16.1	20.53	-4.43	x	1.4	=	-6.2			(29)
Walls Type4	22.2	20.52	1.68	x	1.4	=	2.35			(29)
Walls Type5	14.82	0	14.82	x	0.16	=	2.32			(29)
Walls Type6	4.2	0	4.2	x	1.4	=	5.88			(29)
Walls Type7	15.4	0	15.4	x	1.4	=	21.56			(29)
Total area of elements, m²			135.62							(31)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	98.33	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K	20.34	(36)

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

Total fabric heat loss (33) + (36) = 118.67 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.14	37.74	37.34	35.32	34.92	32.9	32.9	32.49	33.7	34.92	35.72	36.53	(38)

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

(39)m=	156.81	156.41	156.01	153.99	153.59	151.57	151.57	151.16	152.37	153.59	154.39	155.2	

Average = Sum(39)$_{1…12}$ /12= 153.89 (39)

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

(40)m=	1.17	1.16	1.16	1.14	1.14	1.13	1.13	1.12	1.13	1.14	1.15	1.15

Average = Sum(40)$_{1…12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.91 (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) + 36 103.22 (43)

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

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

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

(44)m=	113.54	109.41	105.28	101.15	97.02	92.9	92.9	97.02	101.15	105.28	109.41	113.54

Total = Sum(44)$_{1…12}$ = 1238.61 (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=	168.38	147.26	151.96	132.48	127.12	109.7	101.65	116.64	118.04	137.56	150.16	163.06

Total = Sum(45)$_{1…12}$ = 1624.02 (45)

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

(46)m=	25.26	22.09	22.79	19.87	19.07	16.45	15.25	17.5	17.71	20.63	22.52	24.46	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

DER WorkSheet: New dwelling design stage

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

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

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

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

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

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

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

(62)m=	233.3	205.91	216.89	195.32	192.05	172.53	166.58	181.57	180.87	202.49	212.99	227.99	(62)

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

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

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

Output from water heater

(64)m=	233.3	205.91	216.89	195.32	192.05	172.53	166.58	181.57	180.87	202.49	212.99	227.99	

Output from water heater (annual)$_{1...12}$ | 2388.47 | (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=	107.93	95.88	102.47	94.32	94.21	86.74	85.74	90.73	89.51	97.68	100.19	106.16	(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=	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	(66)

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

(67)m=	27.03	24.01	19.52	14.78	11.05	9.33	10.08	13.1	17.58	22.33	26.06	27.78	(67)

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

(68)m=	303.18	306.33	298.4	281.52	260.22	240.19	226.82	223.67	231.6	248.48	269.78	289.81	(68)

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

(69)m=	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	(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=	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	(71)

Water heating gains (Table 5)

(72)m=	145.06	142.68	137.73	131	126.63	120.47	115.24	121.94	124.32	131.29	139.16	142.69	(72)

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

(73)m=	541.86	539.6	522.24	493.89	464.48	436.58	418.73	425.31	440.1	468.69	501.59	526.86	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	20.52	x	10.63	x	0.63	x	0.9	=	85.74	(74)
North	0.9x	0.77	x	20.52	x	20.32	x	0.63	x	0.9	=	163.85	(74)
North	0.9x	0.77	x	20.52	x	34.53	x	0.63	x	0.9	=	278.42	(74)
North	0.9x	0.77	x	20.52	x	55.46	x	0.63	x	0.9	=	447.21	(74)
North	0.9x	0.77	x	20.52	x	74.72	x	0.63	x	0.9	=	602.43	(74)
North	0.9x	0.77	x	20.52	x	79.99	x	0.63	x	0.9	=	644.92	(74)
North	0.9x	0.77	x	20.52	x	74.68	x	0.63	x	0.9	=	602.11	(74)
North	0.9x	0.77	x	20.52	x	59.25	x	0.63	x	0.9	=	477.7	(74)
North	0.9x	0.77	x	20.52	x	41.52	x	0.63	x	0.9	=	334.75	(74)
North	0.9x	0.77	x	20.52	x	24.19	x	0.63	x	0.9	=	195.04	(74)
North	0.9x	0.77	x	20.52	x	13.12	x	0.63	x	0.9	=	105.77	(74)
North	0.9x	0.77	x	20.52	x	8.86	x	0.63	x	0.9	=	71.47	(74)
East	0.9x	2	x	5.13	x	19.64	x	0.63	x	0.9	=	79.18	(76)
East	0.9x	1	x	4.85	x	19.64	x	0.63	x	0.9	=	37.43	(76)
East	0.9x	2	x	5.13	x	38.42	x	0.63	x	0.9	=	154.89	(76)
East	0.9x	1	x	4.85	x	38.42	x	0.63	x	0.9	=	73.22	(76)
East	0.9x	2	x	5.13	x	63.27	x	0.63	x	0.9	=	255.08	(76)
East	0.9x	1	x	4.85	x	63.27	x	0.63	x	0.9	=	120.58	(76)
East	0.9x	2	x	5.13	x	92.28	x	0.63	x	0.9	=	372.02	(76)
East	0.9x	1	x	4.85	x	92.28	x	0.63	x	0.9	=	175.86	(76)
East	0.9x	2	x	5.13	x	113.09	x	0.63	x	0.9	=	455.93	(76)
East	0.9x	1	x	4.85	x	113.09	x	0.63	x	0.9	=	215.52	(76)
East	0.9x	2	x	5.13	x	115.77	x	0.63	x	0.9	=	466.73	(76)
East	0.9x	1	x	4.85	x	115.77	x	0.63	x	0.9	=	220.63	(76)
East	0.9x	2	x	5.13	x	110.22	x	0.63	x	0.9	=	444.34	(76)
East	0.9x	1	x	4.85	x	110.22	x	0.63	x	0.9	=	210.04	(76)
East	0.9x	2	x	5.13	x	94.68	x	0.63	x	0.9	=	381.68	(76)
East	0.9x	1	x	4.85	x	94.68	x	0.63	x	0.9	=	180.43	(76)
East	0.9x	2	x	5.13	x	73.59	x	0.63	x	0.9	=	296.67	(76)
East	0.9x	1	x	4.85	x	73.59	x	0.63	x	0.9	=	140.24	(76)
East	0.9x	2	x	5.13	x	45.59	x	0.63	x	0.9	=	183.79	(76)
East	0.9x	1	x	4.85	x	45.59	x	0.63	x	0.9	=	86.88	(76)
East	0.9x	2	x	5.13	x	24.49	x	0.63	x	0.9	=	98.73	(76)
East	0.9x	1	x	4.85	x	24.49	x	0.63	x	0.9	=	46.67	(76)
East	0.9x	2	x	5.13	x	16.15	x	0.63	x	0.9	=	65.11	(76)
East	0.9x	1	x	4.85	x	16.15	x	0.63	x	0.9	=	30.78	(76)
South	0.9x	0.77	x	16.25	x	46.75	x	0.63	x	0.9	=	298.52	(78)
South	0.9x	0.77	x	4.28	x	46.75	x	0.63	x	0.9	=	78.63	(78)
South	0.9x	0.77	x	16.25	x	76.57	x	0.63	x	0.9	=	488.9	(78)

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South	0.9x	0.77	x	4.28	x	76.57	x	0.63	x	0.9	=	128.77	(78)
South	0.9x	0.77	x	16.25	x	97.53	x	0.63	x	0.9	=	622.77	(78)
South	0.9x	0.77	x	4.28	x	97.53	x	0.63	x	0.9	=	164.03	(78)
South	0.9x	0.77	x	16.25	x	110.23	x	0.63	x	0.9	=	703.86	(78)
South	0.9x	0.77	x	4.28	x	110.23	x	0.63	x	0.9	=	185.39	(78)
South	0.9x	0.77	x	16.25	x	114.87	x	0.63	x	0.9	=	733.47	(78)
South	0.9x	0.77	x	4.28	x	114.87	x	0.63	x	0.9	=	193.18	(78)
South	0.9x	0.77	x	16.25	x	110.55	x	0.63	x	0.9	=	705.86	(78)
South	0.9x	0.77	x	4.28	x	110.55	x	0.63	x	0.9	=	185.91	(78)
South	0.9x	0.77	x	16.25	x	108.01	x	0.63	x	0.9	=	689.67	(78)
South	0.9x	0.77	x	4.28	x	108.01	x	0.63	x	0.9	=	181.65	(78)
South	0.9x	0.77	x	16.25	x	104.89	x	0.63	x	0.9	=	669.77	(78)
South	0.9x	0.77	x	4.28	x	104.89	x	0.63	x	0.9	=	176.41	(78)
South	0.9x	0.77	x	16.25	x	101.89	x	0.63	x	0.9	=	650.55	(78)
South	0.9x	0.77	x	4.28	x	101.89	x	0.63	x	0.9	=	171.35	(78)
South	0.9x	0.77	x	16.25	x	82.59	x	0.63	x	0.9	=	527.32	(78)
South	0.9x	0.77	x	4.28	x	82.59	x	0.63	x	0.9	=	138.89	(78)
South	0.9x	0.77	x	16.25	x	55.42	x	0.63	x	0.9	=	353.85	(78)
South	0.9x	0.77	x	4.28	x	55.42	x	0.63	x	0.9	=	93.2	(78)
South	0.9x	0.77	x	16.25	x	40.4	x	0.63	x	0.9	=	257.95	(78)
South	0.9x	0.77	x	4.28	x	40.4	x	0.63	x	0.9	=	67.94	(78)

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

(83)m=	579.49	1009.62	1440.87	1884.34	2200.53	2224.04	2127.82	1885.98	1593.56	1131.92	698.21	493.25	(83)

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

(84)m=	1121.35	1549.22	1963.12	2378.23	2665.01	2660.63	2546.55	2311.28	2033.65	1600.6	1199.8	1020.12	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.96	0.89	0.72	0.53	0.36	0.26	0.3	0.51	0.83	0.98	0.99	(86)

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

(87)m=	19.95	20.29	20.64	20.89	20.98	21	21	21	20.99	20.82	20.32	19.89	(87)

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

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

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

(89)m=	0.99	0.95	0.86	0.67	0.47	0.31	0.2	0.23	0.44	0.79	0.97	0.99	(89)

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

(90)m=	18.58	19.06	19.53	19.86	19.95	19.98	19.98	19.98	19.97	19.78	19.12	18.49	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

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

(92)m=	19.22	19.63	20.05	20.34	20.43	20.46	20.46	20.46	20.45	20.27	19.68	19.15	(92)

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

(93)m=	19.22	19.63	20.05	20.34	20.43	20.46	20.46	20.46	20.45	20.27	19.68	19.15	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.95	0.86	0.69	0.5	0.33	0.23	0.27	0.47	0.8	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1106.12	1471.89	1693.1	1642.16	1320.42	885.54	584.58	613.15	955.31	1283.9	1156.94	1010.77	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2340.05	2304.55	2114.09	1762.35	1341.44	887.7	584.82	613.66	966.97	1485.07	1942.59	2320.1	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	918.04	559.55	313.21	86.54	15.64	0	0	0	0	149.67	565.67	974.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3582.47 (98)

Space heating requirement in kWh/m²/year 26.62 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1424.73	1121.6	1148.85	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	1	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1412.27	1117.51	1141.82	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	3215.28	3079.49	2806.39	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	1298.17	1459.72	1238.43	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 3996.32 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.91 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

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

(107)m=	0	0	0	0	0	294.16	330.77	280.63	0	0	0	0

Total = Sum(107)$_{6...8}$ = 905.56 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 6.73 (108)

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 heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3582.47	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3761.6	(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		2388.47	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2507.9	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	62.69	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	190.02	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		432.44	(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) =	432.44	(331)
Energy for lighting (calculated in Appendix L)		477.34	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-362.72	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				132	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	1025.92	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	32.54	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1058.46	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1058.46	(376)

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CO2 associated with space cooling	(315) x	0.52	=	98.62	(377)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	224.43	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	247.74	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-188.25	(380)
Total CO2, kg/year	sum of (376)…(382) =			1441	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			10.71	(384)
EI rating (section 14)				89.25	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.7

Property Address: 5F

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	96.8	(1a)	x	2.85	(2a)	=	275.88	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.8	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			275.88	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.25 (23c)

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

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

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

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

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

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

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

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

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			5.13	x1/[1/(1.4)+ 0.04]		=	6.8			(27)
Windows Type 2			22.8	x1/[1/(1.4)+ 0.04]		=	30.23			(27)
Floor			96.8	x	0.065	=	6.292			(28)
Walls Type1	32.21	15.39	16.82	x	0.18	=	3.03			(29)
Walls Type2	11.69	0	11.69	x	0.18	=	2.1			(29)
Walls Type3	24.23	22.8	1.43	x	1.4	=	2			(29)
Walls Type4	10.55	0	10.55	x	0.16	=	1.65			(29)
Walls Type5	15.39	0	15.39	x	1.4	=	21.55			(29)
Total area of elements, m²			190.85							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 87.25 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 28.63 (36)

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

Total fabric heat loss (33) + (36) = 115.88 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.43	27.14	26.85	25.4	25.11	23.66	23.66	23.37	24.24	25.11	25.69	26.27	(38)

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

(39)m=	143.31	143.02	142.73	141.28	140.99	139.53	139.53	139.24	140.11	140.99	141.57	142.15	

Average = Sum(39)$_{1…12}$ /12= 141.2 (39)

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

(40)m=	1.48	1.48	1.47	1.46	1.46	1.44	1.44	1.44	1.45	1.46	1.46	1.47

Average = Sum(40)$_{1...12}$ /12= 1.46 (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 2.71 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 98.51 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	108.36	104.42	100.48	96.54	92.6	88.66	88.66	92.6	96.54	100.48	104.42	108.36	
										Total = Sum(44)$_{1...12}$ =		1182.14	(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=	160.7	140.55	145.03	126.44	121.33	104.69	97.02	111.33	112.66	131.29	143.31	155.63	
										Total = Sum(45)$_{1...12}$ =		1549.97	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.1	21.08	21.76	18.97	18.2	15.7	14.55	16.7	16.9	19.69	21.5	23.34	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

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

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

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

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	225.63	199.19	209.96	189.28	186.25	167.53	161.94	176.25	175.49	196.22	206.14	220.55	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	225.63	199.19	209.96	189.28	186.25	167.53	161.94	176.25	175.49	196.22	206.14	220.55	

Output from water heater (annual)$_{1...12}$ 2314.43 (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=	105.37	93.65	100.16	92.31	92.28	85.08	84.2	88.96	87.72	95.59	97.92	103.69	(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=	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	135.39	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.38	19.88	16.17	12.24	9.15	7.72	8.35	10.85	14.56	18.49	21.58	23	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	251.05	253.65	247.09	233.11	215.47	198.89	187.81	185.21	191.77	205.75	223.39	239.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	(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=	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	-108.31	(71)

Water heating gains (Table 5)

(72)m=	141.63	139.36	134.63	128.21	124.03	118.16	113.17	119.57	121.84	128.49	136	139.37	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	478.68	476.51	461.5	437.18	412.27	388.39	372.95	379.24	391.79	416.34	444.58	465.96	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	3	x	5.13	x	19.64	x	0.63	x	0.1	=	13.2	(76)
East	0.9x	3	x	5.13	x	38.42	x	0.63	x	0.1	=	25.82	(76)
East	0.9x	3	x	5.13	x	63.27	x	0.63	x	0.1	=	42.51	(76)
East	0.9x	3	x	5.13	x	92.28	x	0.63	x	0.1	=	62	(76)
East	0.9x	3	x	5.13	x	113.09	x	0.63	x	0.1	=	75.99	(76)

East	0.9x	3	x	5.13	x	115.77	x	0.63	x	0.1	=	77.79	(76)
East	0.9x	3	x	5.13	x	110.22	x	0.63	x	0.1	=	74.06	(76)
East	0.9x	3	x	5.13	x	94.68	x	0.63	x	0.1	=	63.61	(76)
East	0.9x	3	x	5.13	x	73.59	x	0.63	x	0.1	=	49.45	(76)
East	0.9x	3	x	5.13	x	45.59	x	0.63	x	0.1	=	30.63	(76)
East	0.9x	3	x	5.13	x	24.49	x	0.63	x	0.1	=	16.45	(76)
East	0.9x	3	x	5.13	x	16.15	x	0.63	x	0.1	=	10.85	(76)
South	0.9x	0.77	x	22.8	x	46.75	x	0.63	x	1	=	465.38	(78)
South	0.9x	0.77	x	22.8	x	76.57	x	0.63	x	1	=	762.18	(78)
South	0.9x	0.77	x	22.8	x	97.53	x	0.63	x	1	=	970.88	(78)
South	0.9x	0.77	x	22.8	x	110.23	x	0.63	x	1	=	1097.3	(78)
South	0.9x	0.77	x	22.8	x	114.87	x	0.63	x	1	=	1143.46	(78)
South	0.9x	0.77	x	22.8	x	110.55	x	0.63	x	1	=	1100.42	(78)
South	0.9x	0.77	x	22.8	x	108.01	x	0.63	x	1	=	1075.18	(78)
South	0.9x	0.77	x	22.8	x	104.89	x	0.63	x	1	=	1044.15	(78)
South	0.9x	0.77	x	22.8	x	101.89	x	0.63	x	1	=	1014.2	(78)
South	0.9x	0.77	x	22.8	x	82.59	x	0.63	x	1	=	822.08	(78)
South	0.9x	0.77	x	22.8	x	55.42	x	0.63	x	1	=	551.64	(78)
South	0.9x	0.77	x	22.8	x	40.4	x	0.63	x	1	=	402.13	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	478.58	787.99	1013.39	1159.31	1219.44	1178.21	1149.23	1107.76	1063.64	852.71	568.09	412.98	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	957.26	1264.5	1474.89	1596.48	1631.72	1566.6	1522.18	1487	1455.43	1269.05	1012.67	878.94	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.96	0.91	0.83	0.71	0.55	0.4	0.42	0.62	0.86	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.67	20	20.34	20.65	20.86	20.96	20.99	20.99	20.94	20.66	20.09	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.7	19.7	19.71	19.72	19.72	19.73	19.73	19.73	19.73	19.72	19.72	19.71	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.95	0.89	0.79	0.64	0.45	0.29	0.31	0.52	0.81	0.96	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18	18.47	18.94	19.36	19.6	19.71	19.73	19.73	19.69	19.38	18.62	17.91	(90)

fLA = Living area ÷ (4) = 0.41 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.69	19.1	19.51	19.89	20.12	20.23	20.25	20.25	20.2	19.9	19.22	18.61	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.69	19.1	19.51	19.89	20.12	20.23	20.25	20.25	20.2	19.9	19.22	18.61	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.94	0.89	0.8	0.66	0.49	0.33	0.36	0.56	0.82	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	935.23	1190.73	1306.53	1269.53	1080.98	763.23	505.76	531.25	814.72	1040.57	963.34	863.8	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2062.21	2031.21	1857.55	1552.43	1186.96	785.18	509.13	535.9	855.07	1311.56	1716.42	2048.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	838.48	564.8	409.96	203.68	78.84	0	0	0	0	201.62	542.22	881.38	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3720.98 (98)

Space heating requirement in kWh/m²/year 38.44 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1311.62	1032.55	1058.26	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.93	0.96	0.96	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1214.78	992.56	1010.95	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1919.56	1865.73	1826.01	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	507.44	649.64	606.41	0	0	0	0

Total = Sum(104)$_{6...8}$ = 1763.49 (104)

Cooled fraction — f C = cooled area ÷ (4) = 0.73 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	93.18	119.29	111.35	0	0	0	0

Total = Sum(107)$_{6...8}$ = 323.82 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 3.35 (108)

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)

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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 heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3720.98	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3907.03	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2314.43	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2430.15	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	63.37	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	67.95	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		310.99	(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) =	310.99	(331)
Energy for lighting (calculated in Appendix L)		395.26	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-259.09	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				132	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	1036.99	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	32.89	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1069.88	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1069.88	(376)
CO2 associated with space cooling	(315) x		0.52	=	35.27	(377)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	161.41	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	205.14	(379)
Energy saving/generation technologies (333) to (334) as applicable					
Item 1		0.52	x 0.01 =	-134.47	(380)
Total CO2, kg/year	sum of (376)…(382) =			1337.23	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.81	(384)
EI rating (section 14)				87.36	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.7

Property Address: 6F

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	75.1	(1a)	x	2.85	(2a)	=	214.03	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.1	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	214.03	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		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
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) = 73.1 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows			19.95	x1/[1/(1.4)+ 0.04]		=	26.45			(27)
Floor			75.1	x	0.065	=	4.8815			(28)
Walls Type1	23.94	0	23.94	x	0.16	=	3.75			(29)
Walls Type2	28.78	0	28.78	x	0.16	=	4.51			(29)
Walls Type3	21.66	19.95	1.71	x	1.4	=	2.39			(29)
Walls Type4	10.83	0	10.83	x	0.16	=	1.7			(29)
Total area of elements, m²			160.31							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.69 (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 24.05 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 67.74 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.97	19.76	19.56	18.53	18.33	17.3	17.3	17.1	17.71	18.33	18.74	19.15	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	87.71	87.5	87.3	86.27	86.07	85.04	85.04	84.84	85.45	86.07	86.48	86.89	

Average = Sum(39)$_{1…12}$ /12= 86.22 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.16	1.15	1.15	1.13	1.13	1.13	1.14	1.15	1.15	1.16

Average = Sum(40)1…12 /12= 1.15 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.36 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.33 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.36	95.75	92.14	88.52	84.91	81.3	81.3	84.91	88.52	92.14	95.75	99.36

Total = Sum(44)1…12 = 1083.95 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	147.35	128.87	132.99	115.94	111.25	96	88.96	102.08	103.3	120.38	131.41	142.7

Total = Sum(45)1…12 = 1421.23 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.1	19.33	19.95	17.39	16.69	14.4	13.34	15.31	15.49	18.06	19.71	21.41	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (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): 2.24 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.34 (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) 1.34 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	212.28	187.52	197.91	178.77	176.17	158.83	153.88	167.01	166.13	185.31	194.24	207.63	(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=	212.28	187.52	197.91	178.77	176.17	158.83	153.88	167.01	166.13	185.31	194.24	207.63	

Output from water heater (annual)$_{1...12}$ 2185.68 (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=	100.94	89.77	96.16	88.82	88.93	82.19	81.52	85.88	84.61	91.97	93.96	99.39	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	118.17	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.62	16.54	13.45	10.18	7.61	6.43	6.94	9.03	12.12	15.38	17.96	19.14	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	208.9	211.06	205.6	193.97	179.29	165.5	156.28	154.11	159.57	171.2	185.88	199.68	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	34.82	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	-94.53	(71)
Water heating gains (Table 5)													
(72)m=	135.67	133.58	129.25	123.36	119.53	114.15	109.57	115.43	117.52	123.61	130.5	133.59	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	421.64	419.63	406.75	385.96	364.89	344.52	331.24	337.02	347.66	368.65	392.79	410.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	19.95	x	10.63	x	0.63	x	1	=	92.62	(74)
North	0.9x	0.77	x	19.95	x	20.32	x	0.63	x	1	=	176.99	(74)
North	0.9x	0.77	x	19.95	x	34.53	x	0.63	x	1	=	300.76	(74)
North	0.9x	0.77	x	19.95	x	55.46	x	0.63	x	1	=	483.09	(74)
North	0.9x	0.77	x	19.95	x	74.72	x	0.63	x	1	=	650.77	(74)

North	0.9x	0.77	x	19.95	x	79.99	x	0.63	x	1	=	696.67	(74)
North	0.9x	0.77	x	19.95	x	74.68	x	0.63	x	1	=	650.43	(74)
North	0.9x	0.77	x	19.95	x	59.25	x	0.63	x	1	=	516.03	(74)
North	0.9x	0.77	x	19.95	x	41.52	x	0.63	x	1	=	361.61	(74)
North	0.9x	0.77	x	19.95	x	24.19	x	0.63	x	1	=	210.69	(74)
North	0.9x	0.77	x	19.95	x	13.12	x	0.63	x	1	=	114.25	(74)
North	0.9x	0.77	x	19.95	x	8.86	x	0.63	x	1	=	77.21	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	92.62	176.99	300.76	483.09	650.77	696.67	650.43	516.03	361.61	210.69	114.25	77.21	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	514.25	596.63	707.51	869.06	1015.66	1041.19	981.67	853.06	709.26	579.34	507.04	488.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.72	0.51	0.38	0.45	0.75	0.96	0.99	1	(86)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													
(87)m=	19.81	19.98	20.28	20.67	20.92	20.99	21	21	20.93	20.57	20.13	19.78	(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)													
(88)m=	19.95	19.95	19.95	19.96	19.96	19.97	19.97	19.98	19.97	19.96	19.96	19.95	(88)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)													
(89)m=	1	0.99	0.97	0.87	0.66	0.44	0.29	0.35	0.67	0.94	0.99	1	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m=	18.37	18.62	19.05	19.6	19.89	19.97	19.97	19.97	19.92	19.48	18.84	18.34	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.06	19.27	19.64	20.11	20.38	20.45	20.46	20.46	20.4	20	19.45	19.02	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m=	19.06	19.27	19.64	20.11	20.38	20.45	20.46	20.46	20.4	20	19.45	19.02	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.88	0.69	0.47	0.33	0.4	0.7	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	511.07	588.84	681.64	760.7	697.03	491.44	327.36	342.28	498.64	544.09	500.64	485.7	(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=	1294.28	1257.05	1146.73	966.95	746.76	497.57	328.19	344.3	538	809.03	1068.03	1288.1	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	582.71	449.04	346.03	148.5	36.99	0	0	0	0	197.12	408.52	596.99	(98)

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2765.91	(98)
Space heating requirement in kWh/m²/year	36.83	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	799.38	629.3	644.75	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.96	0.98	0.97	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	771.25	618.59	624.46	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1290.32	1219.24	1069.98	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	373.73	446.88	331.47	0	0	0	0	

	Total = Sum(104)$_{6...8}$ =	1152.09	(104)
Cooled fraction	f C = cooled area ÷ (4) =	0.91	(105)

Intermittency factor (Table 10b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ =	0	(106)

Space cooling requirement for month = (104)m × (105) × (106)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(107)m=	0	0	0	0	0	85.47	102.2	75.81	0	0	0	0

	Total = Sum(107)$_{6...8}$ =	263.48	(107)
Space cooling requirement in kWh/m²/year	(107) ÷ (4) =	3.51	(108)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2765.91	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2904.21	(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	2185.68	

If DHW from community scheme:

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Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2294.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	51.99	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	55.29	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		204.72	(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) =	204.72	(331)
Energy for lighting (calculated in Appendix L)		328.89	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-207.27	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				132	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	850.77	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.98	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	877.76	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				877.76	(376)
CO2 associated with space cooling	(315) x		0.52	=	28.69	(377)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	106.25	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	170.7	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-107.57	(380)
Total CO2, kg/year	sum of (376)…(382) =				1075.82	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.33	(384)
EI rating (section 14)					88	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.7

Property Address: 9R

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	134.6	(1a) x	3.05	(2a) =	410.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	134.6	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	410.53	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 72.25 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.3	0.3	0.29	0.28	0.28	0.26	0.26	0.26	0.27	0.28	0.28	0.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			5.49	x1/[1/(1.4)+ 0.04]		=	7.28			(27)
Windows Type 2			17.39	x1/[1/(1.4)+ 0.04]		=	23.05			(27)
Windows Type 3			4.58	x1/[1/(1.4)+ 0.04]		=	6.07			(27)
Windows Type 4			21.96	x1/[1/(1.4)+ 0.04]		=	29.11			(27)
Rooflights			9	x1/[1/(1.4) + 0.04]		=	12.6			(27b)
Walls Type1	44.4	0	44.4	x	0.18	=	7.99			(29)
Walls Type2	17.2	17.39	-0.19	x	1.4	=	-0.27			(29)
Walls Type3	23.8	21.96	1.84	x	1.4	=	2.58			(29)
Walls Type4	15.9	0	15.9	x	0.16	=	2.49			(29)
Walls Type5	22.9	0	22.9	x	0.18	=	4.12			(29)
Walls Type6	4.5	4.58	-0.08	x	1.4	=	-0.11			(29)
Walls Type7	16.5	16.47	0.03	x	1.4	=	0.04			(29)
Roof	134.6	9	125.6	x	0.12	=	15.07			(30)
Total area of elements, m²			279.8							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 123.93 (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	41.97	(36)
if details of thermal bridging are not known (36) = 0.15 x (31)		
Total fabric heat loss (33) + (36) =	165.9	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.82	40.39	39.96	37.8	37.37	35.21	35.21	34.77	36.07	37.37	38.23	39.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	206.72	206.29	205.85	203.69	203.26	201.1	201.1	200.67	201.97	203.26	204.13	204.99	

Average = Sum(39)$_{1...12}$ /12= 203.59 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.54	1.53	1.53	1.51	1.51	1.49	1.49	1.49	1.5	1.51	1.52	1.52

Average = Sum(40)$_{1...12}$ /12= 1.51 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.91 (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) + 36 103.22 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	113.54	109.41	105.28	101.15	97.02	92.9	92.9	97.02	101.15	105.28	109.41	113.54

Total = Sum(44)$_{1...12}$ = 1238.61 (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=	168.38	147.26	151.96	132.48	127.12	109.7	101.65	116.64	118.04	137.56	150.16	163.06

Total = Sum(45)$_{1...12}$ = 1624.02 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.26	22.09	22.79	19.87	19.07	16.45	15.25	17.5	17.71	20.63	22.52	24.46	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	200	(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):	2.24	(48)
Temperature factor from Table 2b	0.6	(49)
Energy lost from water storage, kWh/year (48) x (49) =	1.34	(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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.34	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(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=	41.66	37.63	41.66	40.32	41.66	40.32	41.66	41.66	40.32	41.66	40.32	41.66	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	233.3	205.91	216.89	195.32	192.05	172.53	166.58	181.57	180.87	202.49	212.99	227.99	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	233.3	205.91	216.89	195.32	192.05	172.53	166.58	181.57	180.87	202.49	212.99	227.99	

Output from water heater (annual)$_{1...12}$ — 2388.47 (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=	107.93	95.88	102.47	94.32	94.21	86.74	85.74	90.73	89.51	97.68	100.19	106.16	(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=	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	145.3	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	27.03	24.01	19.52	14.78	11.05	9.33	10.08	13.1	17.58	22.33	26.06	27.78	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	303.18	306.33	298.4	281.52	260.22	240.19	226.82	223.67	231.6	248.48	269.78	289.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	37.53	(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=	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	-116.24	(71)

Water heating gains (Table 5)

(72)m=	145.06	142.68	137.73	131	126.63	120.47	115.24	121.94	124.32	131.29	139.16	142.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	541.86	539.6	522.24	493.89	464.48	436.58	418.73	425.31	440.1	468.69	501.59	526.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	21.96	x	10.63	x	0.63	x	1	=	101.95	(74)
North	0.9x	0.77	x	21.96	x	20.32	x	0.63	x	1	=	194.83	(74)
North	0.9x	0.77	x	21.96	x	34.53	x	0.63	x	1	=	331.06	(74)
North	0.9x	0.77	x	21.96	x	55.46	x	0.63	x	1	=	531.77	(74)
North	0.9x	0.77	x	21.96	x	74.72	x	0.63	x	1	=	716.34	(74)
North	0.9x	0.77	x	21.96	x	79.99	x	0.63	x	1	=	766.86	(74)
North	0.9x	0.77	x	21.96	x	74.68	x	0.63	x	1	=	715.96	(74)
North	0.9x	0.77	x	21.96	x	59.25	x	0.63	x	1	=	568.03	(74)
North	0.9x	0.77	x	21.96	x	41.52	x	0.63	x	1	=	398.04	(74)
North	0.9x	0.77	x	21.96	x	24.19	x	0.63	x	1	=	231.92	(74)
North	0.9x	0.77	x	21.96	x	13.12	x	0.63	x	1	=	125.77	(74)
North	0.9x	0.77	x	21.96	x	8.86	x	0.63	x	1	=	84.99	(74)
East	0.9x	3	x	5.49	x	19.64	x	0.63	x	1	=	141.23	(76)
East	0.9x	3	x	5.49	x	38.42	x	0.63	x	1	=	276.27	(76)
East	0.9x	3	x	5.49	x	63.27	x	0.63	x	1	=	454.97	(76)
East	0.9x	3	x	5.49	x	92.28	x	0.63	x	1	=	663.55	(76)
East	0.9x	3	x	5.49	x	113.09	x	0.63	x	1	=	813.21	(76)
East	0.9x	3	x	5.49	x	115.77	x	0.63	x	1	=	832.46	(76)
East	0.9x	3	x	5.49	x	110.22	x	0.63	x	1	=	792.54	(76)
East	0.9x	3	x	5.49	x	94.68	x	0.63	x	1	=	680.78	(76)
East	0.9x	3	x	5.49	x	73.59	x	0.63	x	1	=	529.15	(76)
East	0.9x	3	x	5.49	x	45.59	x	0.63	x	1	=	327.82	(76)
East	0.9x	3	x	5.49	x	24.49	x	0.63	x	1	=	176.09	(76)
East	0.9x	3	x	5.49	x	16.15	x	0.63	x	1	=	116.14	(76)
South	0.9x	0.77	x	17.39	x	46.75	x	0.63	x	1	=	354.96	(78)
South	0.9x	0.77	x	17.39	x	76.57	x	0.63	x	1	=	581.33	(78)
South	0.9x	0.77	x	17.39	x	97.53	x	0.63	x	1	=	740.51	(78)
South	0.9x	0.77	x	17.39	x	110.23	x	0.63	x	1	=	836.93	(78)
South	0.9x	0.77	x	17.39	x	114.87	x	0.63	x	1	=	872.14	(78)
South	0.9x	0.77	x	17.39	x	110.55	x	0.63	x	1	=	839.31	(78)
South	0.9x	0.77	x	17.39	x	108.01	x	0.63	x	1	=	820.06	(78)
South	0.9x	0.77	x	17.39	x	104.89	x	0.63	x	1	=	796.39	(78)
South	0.9x	0.77	x	17.39	x	101.89	x	0.63	x	1	=	773.55	(78)
South	0.9x	0.77	x	17.39	x	82.59	x	0.63	x	1	=	627.01	(78)
South	0.9x	0.77	x	17.39	x	55.42	x	0.63	x	1	=	420.74	(78)
South	0.9x	0.77	x	17.39	x	40.4	x	0.63	x	1	=	306.71	(78)
West	0.9x	0.77	x	4.58	x	19.64	x	0.63	x	1	=	39.27	(80)
West	0.9x	0.77	x	4.58	x	38.42	x	0.63	x	1	=	76.82	(80)
West	0.9x	0.77	x	4.58	x	63.27	x	0.63	x	1	=	126.52	(80)

West	0.9x	0.77	x	4.58	x	92.28	x	0.63	x	1	=	184.52	(80)
West	0.9x	0.77	x	4.58	x	113.09	x	0.63	x	1	=	226.14	(80)
West	0.9x	0.77	x	4.58	x	115.77	x	0.63	x	1	=	231.49	(80)
West	0.9x	0.77	x	4.58	x	110.22	x	0.63	x	1	=	220.39	(80)
West	0.9x	0.77	x	4.58	x	94.68	x	0.63	x	1	=	189.31	(80)
West	0.9x	0.77	x	4.58	x	73.59	x	0.63	x	1	=	147.15	(80)
West	0.9x	0.77	x	4.58	x	45.59	x	0.63	x	1	=	91.16	(80)
West	0.9x	0.77	x	4.58	x	24.49	x	0.63	x	1	=	48.97	(80)
West	0.9x	0.77	x	4.58	x	16.15	x	0.63	x	1	=	32.3	(80)
Rooflights	0.9x	1	x	9	x	26	x	0.63	x	0.9	=	119.41	(82)
Rooflights	0.9x	1	x	9	x	54	x	0.63	x	0.9	=	248.01	(82)
Rooflights	0.9x	1	x	9	x	96	x	0.63	x	0.9	=	440.9	(82)
Rooflights	0.9x	1	x	9	x	150	x	0.63	x	0.9	=	688.9	(82)
Rooflights	0.9x	1	x	9	x	192	x	0.63	x	0.9	=	881.8	(82)
Rooflights	0.9x	1	x	9	x	200	x	0.63	x	0.9	=	918.54	(82)
Rooflights	0.9x	1	x	9	x	189	x	0.63	x	0.9	=	868.02	(82)
Rooflights	0.9x	1	x	9	x	157	x	0.63	x	0.9	=	721.05	(82)
Rooflights	0.9x	1	x	9	x	115	x	0.63	x	0.9	=	528.16	(82)
Rooflights	0.9x	1	x	9	x	66	x	0.63	x	0.9	=	303.12	(82)
Rooflights	0.9x	1	x	9	x	33	x	0.63	x	0.9	=	151.56	(82)
Rooflights	0.9x	1	x	9	x	21	x	0.63	x	0.9	=	96.45	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	756.81	1377.25	2093.96	2905.68	3509.62	3588.67	3416.97	2955.56	2376.05	1581.02	923.13	636.58	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1298.68	1916.86	2616.2	3399.57	3974.1	4025.25	3835.7	3380.87	2816.15	2049.71	1424.72	1163.45	(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	0.95	0.85	0.66	0.46	0.32	0.23	0.27	0.48	0.81	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	20.02	20.5	20.85	20.97	20.99	21	21	20.97	20.71	20.05	19.5	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.66	19.66	19.67	19.68	19.68	19.69	19.69	19.69	19.69	19.68	19.68	19.67	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.94	0.81	0.6	0.4	0.25	0.16	0.2	0.39	0.76	0.96	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.85	18.47	19.11	19.54	19.66	19.69	19.69	19.69	19.67	19.4	18.52	17.74	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

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(92)m=	18.66	19.2	19.77	20.15	20.27	20.3	20.31	20.31	20.28	20.02	19.24	18.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.66	19.2	19.77	20.15	20.27	20.3	20.31	20.31	20.28	20.02	19.24	18.57	(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=	0.98	0.93	0.82	0.62	0.43	0.28	0.19	0.23	0.43	0.77	0.95	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1271.83	1782.79	2139.72	2117.66	1707.52	1141.95	744.45	782.35	1223.23	1586.75	1356.25	1146.77	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2969.3	2949.41	2730.83	2292.17	1742.29	1146.73	745.18	783.84	1248.7	1913.76	2477.67	2944.97	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1262.92	783.97	439.78	125.65	25.87	0	0	0	0	243.29	807.43	1337.86	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5026.77 (98)

Space heating requirement in kWh/m²/year 37.35 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1890.38	1488.17	1525.11	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1862.16	1476.91	1505.88	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	4655.22	4439.75	3934.81	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	2011.01	2204.35	1807.13	0	0	0	0

Total = Sum(104)$_{6...8}$ = 6022.48 (104)

Cooled fraction f C = cooled area ÷ (4) = 0.91 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	455.69	499.5	409.49	0	0	0	0

Total = Sum(107)$_{6...8}$ = 1364.68 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 10.14 (108)

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 heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		5026.77	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	5278.11	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2388.47	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2507.9	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	77.86	(313)
Cooling System Energy Efficiency Ratio		4.77	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	286.37	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		462.78	(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) =	462.78	(331)
Energy for lighting (calculated in Appendix L)		477.34	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-362.72	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				132	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	1274.07	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	40.41	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1314.48	(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) =				1314.48	(376)

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CO2 associated with space cooling	(315) x	0.52	=	148.62	(377)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	240.18	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	247.74	(379)
Energy saving/generation technologies (333) to (334) as applicable					
Item 1		0.52	x 0.01 =	-188.25	(380)
Total CO2, kg/year	sum of (376)…(382) =			1762.78	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.1	(384)
EI rating (section 14)				86.85	(385)

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