156 West End Lane

FHP Energy Strategy - Appendices

March 2022

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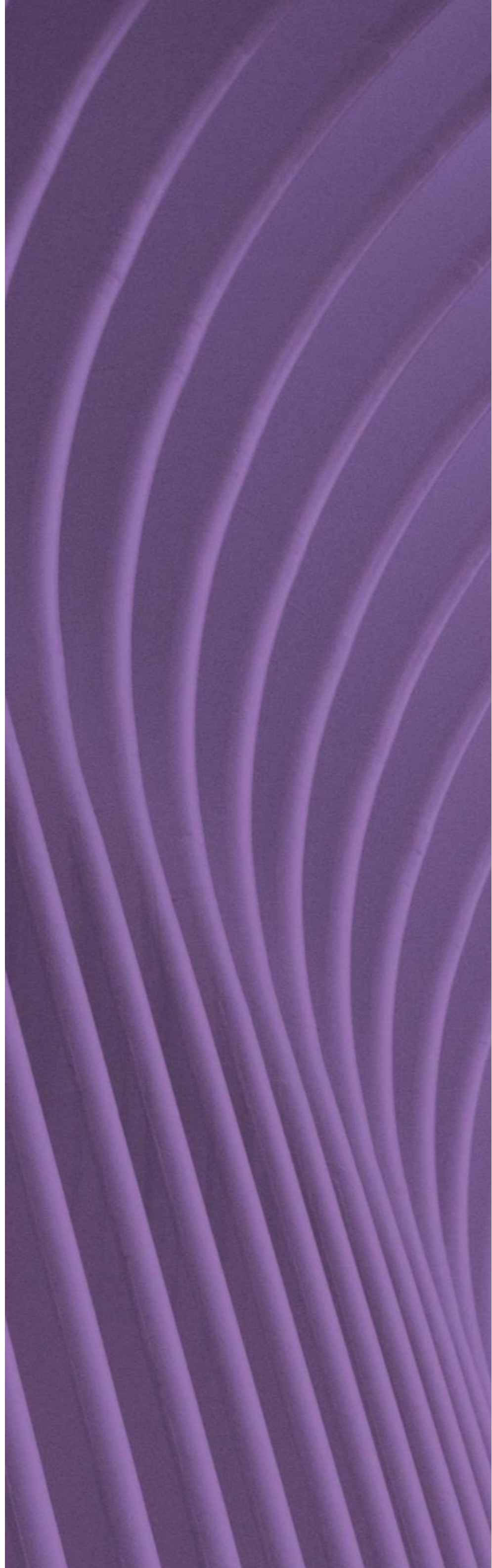
Rev – P7



Inspiring Built Environments

MEP
Sustainability & Building Physics
Digital Engineering

Appendices

Please refer to the separate appendices as follows:

- Appendix A – Renewable Technology Considerations
- Appendix B – CO_2 Emission Factors
- Appendix C – Air Source Heat Pump Documentation
- Appendix D – Site Compliance Report
- Appendix E – Sample SAP/SBEM Results
- Appendix F – PV Specification

Appendix A – Renewable Technology Considerations

Combined Heat and Power

CHP is the concurrent generation of both thermal (heat) energy and power (electricity) from one single source, usually natural gas. The power is generated via a reciprocating engine or turbine and generator and the thermal energy is recovered from the hot exhaust gases. The London Plan's Energy Hierarchy identifies combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. The CHP would be implemented as part of a development wide heat network, comprising CHP supplemented by alternative heat sources such as gas boilers.

The implementation of a CHP strategy should be decided according to good practice design. Key factors to be considered for the efficient implementation of the CHP system are:

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

To ensure that CHP is financially viable it is essential that the unit is selected to meet the base heat load and that this load is maintained over a large proportion of the day to ensure that the additional costs (maintenance) associated with running a CHP unit can be recovered.

The need to run the CHP plant, as far as possible continuously makes the building load profile of prime importance when reviewing the viability of such solutions and in particular the summer time heat load profile. CHP systems only make financial sense to operate when the waste heat associated with generating the electricity is usefully used. To enable the CHP plant to run continuously when it is operating, a thermal store is often used so that excess CHP capacity can be used to generate hot water for use at a later time.

For this scheme the CHP has been discounted as it is no longer a viable technology with the new SAP10 carbon factors and the GLAs guidance.

Wind Energy

Wind energy is the energy captured by wind turbines and harnessed to generate electricity. There are two types of wind turbines, the horizontal axis turbine and the vertical axis turbine. Most of the wind turbines used for electricity generation are horizontal axis turbines. Wind turbines can be found in many sizes and outputs, from small battery charging turbines (say a rotor diameter of 1 or 2 metres with an output of a few hundred Watts) to the largest machines used to supply electricity to the grid (Rotor diameters in excess of 70m and output powers of over two MW). Wind turbines can be grid-connected in the same way as photovoltaic panels.

Due to buildings obstructing the path of wind within built environments the wind within urban areas is generally very turbulent. Wind in inner-city environments is usually gusty and at low speeds. Large scale wind turbines need a considerable wind speed to even start operating and should be installed on the ground and therefore the use of large wind turbines is not deemed possible for this site.

Small-scale wind turbines are more common in an inner-city environment; however, it has been shown that these wind turbines are not particularly effective unless installed above the surrounding buildings.

There are two main concerns with wind turbines, the aesthetic considerations and the limited output in an urban environment. It is considered that in this location the visual impact of even a modest-sized unit would be unacceptable and the buildings nearby would create unsatisfactory wind conditions therefore Wind Energy is considered unsuitable for the scheme.

Solar Thermal Energy

Solar energy is the harnessing of energy from sun light and using it to raise the temperature of water. This is generally via a flat plate or evacuated tubes located on the roof space and orientated towards the sun.

Depending on the type of solar collector used, the weather conditions, and the hot water demand, the temperature of the water heated can vary from tepid to nearly boiling. Most solar systems are meant to furnish 20 to 85% of the annual demand for hot water, the remainder being met by conventional heating sources, which either raise the temperature of the water further or provide hot water when the solar water heating system cannot meet demand.

Allocation of the hot water to specific dwellings from the solar thermal hot water system is difficult on multiple dwelling buildings and is more suited to individual dwellings such as houses. There would also be a requirement for a large central water store increasing plant space within the building, therefore this technology has been discounted.

Bio Energy

In the UK at present the commercial bio-fuels that can be used in the context of emissions reduction are confined to either wood pellets or wood chips (biomass) or in special cases glycerine for CHP. Bio-diesel is not an acceptable fuel as it is easily replaced by petro-diesel so does not qualify under the applicable regulations.

Biomass is available from materials derived from biological sources. Biomass is any organic material which has stored sunlight in the form of chemical energy. As a fuel it may include wood, wood waste, straw, manure, sugar cane, and many other by products from a variety of agricultural processes. Energy from biomass is produced by burning organic matter. Biomass is carbon-based so when used as fuel it also generates carbon emissions. However, the carbon that is released during combustion is equivalent to the amount that was absorbed during growth, and so the technology is carbon-neutral.

Biomass is dependent on a large store on site for the fuel and a requirement for regular deliveries to maintain fuel levels. Due to these requirements biomass is not deemed economic to the development. The burning of the fuels also gives off large quantities of NO_x and this is judged to be unacceptable in this location and has been discounted for his and other practical constraints associated with this type of system.

Geothermal Energy (Ground Source Heat Pumps)

Geothermal energy is the heat from the Earth. It's clean and sustainable. Resources of geothermal energy range from the shallow ground to hot water and hot rock found a few miles beneath the Earth's surface. Almost everywhere, the shallow ground or upper 10 feet of the Earth's surface maintains a nearly constant temperature between 10° and 16°C. GSHPs can tap into this resource to heat and cool buildings. A GSHP consists of a heat pump, distribution system and a heat exchanger-a system of pipes buried in the shallow ground near the building. In the winter, the heat pump removes heat from the heat exchanger and pumps it into the indoor air delivery system. In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the heat exchanger. The heat removed from the indoor air during the summer can also be used to provide a free source of hot water.

Ground source energy can be gathered via horizontal ground loops, vertical bore holes or pipework within the building’s piles. Horizontal ground loops require a large surface area, which is not available on the site and bore holes are not considered cost effective for the project it has therefore been discounted.

Micro-Hydroelectricity

Large hydroelectric schemes are important energy sources in many countries, although in the UK only 0.8% of the electricity demand is produced in this way, mainly because there are very few suitable sites. The Government estimates that if all the rivers and streams in the UK could be harnessed the output would still only be 3% of the total demand, so while local schemes can be important, strategically, this is one of the less important technologies.

Micro-hydro is the term used for very small schemes, although it is applied to any scheme producing less than 1 MW. On-site micro-hydro is clearly totally dependent on the availability of a suitable river or stream that could be utilised in an environmentally acceptable way, and produce a worthwhile output, and such availability is so limited in typical urban sites as to make this a technology generally of no relevance.

The extraction of energy from flowing water will, by definition, reduce its velocity and change water levels, and introducing such changes even to a canalised urban river can have both upstream and downstream impacts. And where the site has a natural ecology the local impacts can be far greater and the necessary mitigation difficult to achieve. So, in conclusion, the most likely instance where a micro-hydro installation might be possible is one where an existing or historical site can be utilised, but these are very rare.

Micro-Hydroelectricity is clearly not suitable for this development.

Appendix B – CO_2 Emission Factors

The GLA has decided that from January 2019 and until central Government updates Part L with the latest carbon emission factors, planning applicants are encouraged to use the SAP10 emission factors for referable applications when estimating CO_2 emission performance against London Plan policies. This will ensure that the assessment of new developments better reflects the actual carbon emissions associated with their expected operation. This approach will remain in place until Government adopts new Building Regulations with updated emission factors. The timeline for this has not been confirmed but Part L is now in consultation.

Fuel	CO_2 emission factor $kgCO_2/kWh$
Natural gas	0.210
Grid supplied electricity	0.233
Grid displaced electricity	0.233

Appendix C – Air Source Heat Pump Documentation

The following documents are included to support the inclusion of the air source heat pumps:

- Air Source Heat Pump Documentation

Heat Pump Sizing Assessment

Project Ref SAV/HP/114544/RS(MD)/09 Nov 2021

Project Name West End Lane 156 (Rev 5)

Proposal 5no CAHV 43kW Heat Pump + Gas Boiler

Assessor Megan De Nysschen

Headlines

Source of emission factors:
SAP 10.1

Project Region:
1 Thames

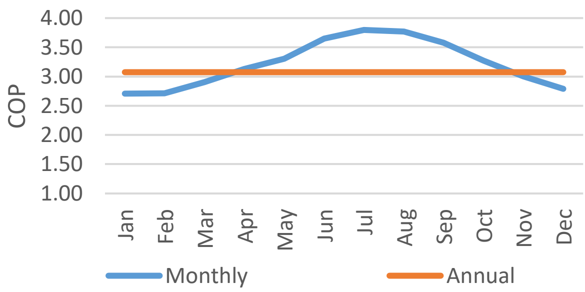
Annual Heat Demand
746,039 kWh

Site Temperatures
Flow: 60°C
Return: 30°C

Heat Pump Max Outlet Temperature
51°C

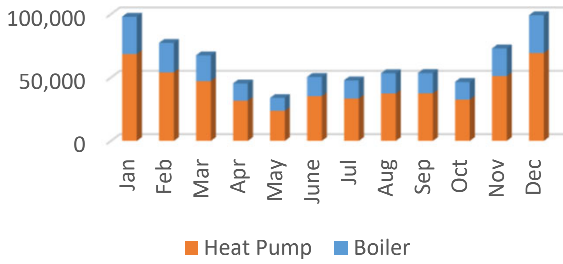
COP & SCOP

SCOP = 3.1



Heat Pump Share

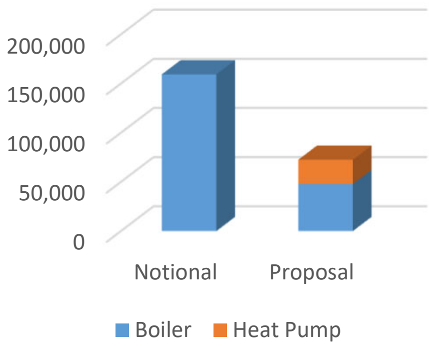
70%



Comparison with Notional Building

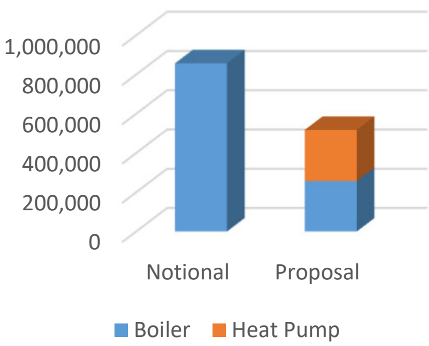
Carbon Footprint (kg/CO_2)

-54%



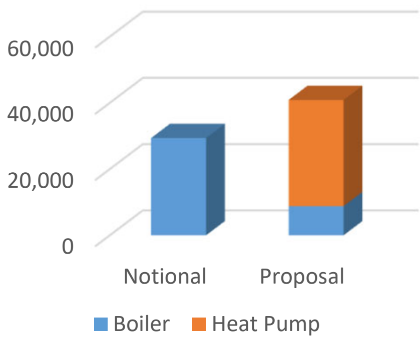
Primary Energy kWh

-40%



Operating Cost (£)

+39%



* Notional building with gas boiler

Report

NOTE: This assessment is specific to the CAHV Heat Pump only - As supplied by SAV Systems

Number of 43 kW CAHV heat pumps	5
Minimum HP Thermal Store Capacity	2000 litres
Type of Building	Multi-residential & Mixed Commercial
Data reference	BRUKL & SAP data from FHP Energy Strategy - Appendices dated October 2021 Ref 0001-L-FHP-DES-058-0001 Rev 4-P4. Data taken from 'Be Green' iterations of BRUKL & SAP

1.0 Summary of Usage:

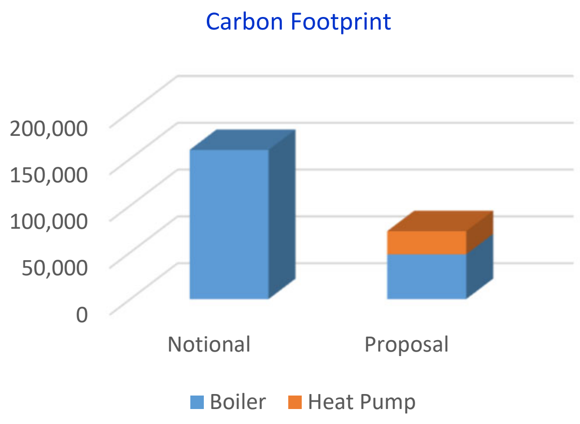
Annual heat demand	746,039 kWh	See Appendix Table 1
Site flow temperature	60°C	
Site return temperature	30°C	
Heat pump flow temperature	51°C	
Gas tariff	3.87 p/kWh	As PCDB Fuel prices (From January 2021)
Electricity tariff	18.9 p/kWh	As PCDB Fuel prices (From January 2021)

1.1 CO2 Emission Factors used:

Source of emission factors used	SAP 10.1
CO_2 Emmission Factor for Gas	0.210 kg CO2/kWh
CO_2 Emission factor for Grid Electricity	0.146 kg CO2/kWh

2.0 Carbon Footprint Comparison:

Notional Building (Gas Boiler)	159,378 kg CO_2 pa (See Appendix Table 6)
Heat Pump Solution	72,529 kg CO_2 pa (See Appendix Table 3)
Reduction	86,849 kg CO_2 pa

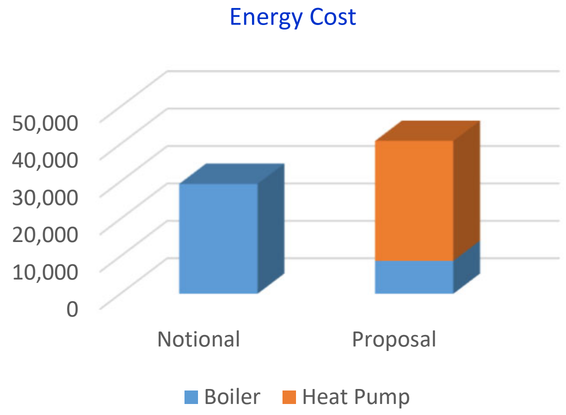


Carbon reduction due to proposed Heat Pump: 87 tonnes (compared with notional building)

86,849 / 159,378 = 54% reduction

3.0 Energy Cost Comparison:

Notional Building (Gas Boiler)	£29,371 (See Appendix Table 6)
Heat Pump Solution	£40,868 (See Appendix Table 4)
Increase	£11,497

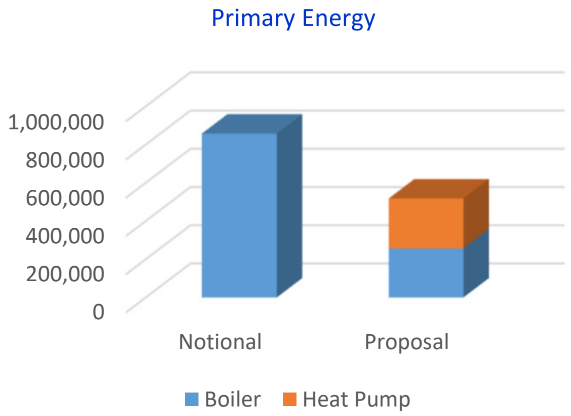


Energy cost increase due to proposed Heat Pump: £11,497 (compared with notional building)

£11,497 / £29,371 = 39% increase

4.0 Primary Energy Comparison:

Notional Building (Gas Boiler)	857,603 kWh pa (See Appendix Table 6)
Heat Pump Solution	518,307 kWh pa (See Appendix Table 5)
Reduction	339,297 kWh pa

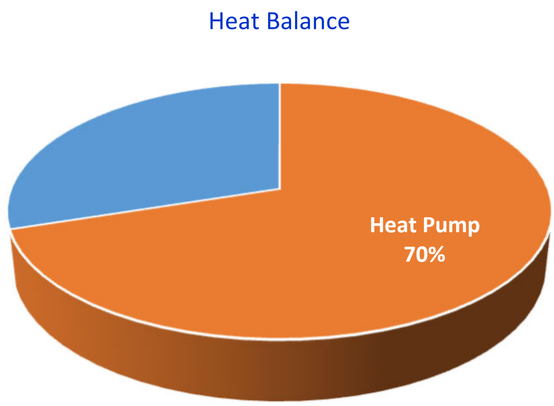


Primary Energy reduction due to proposed Heat Pump: 339,297 kWh (compared with notional building)

339,297 / 857,603 = 40% reduction

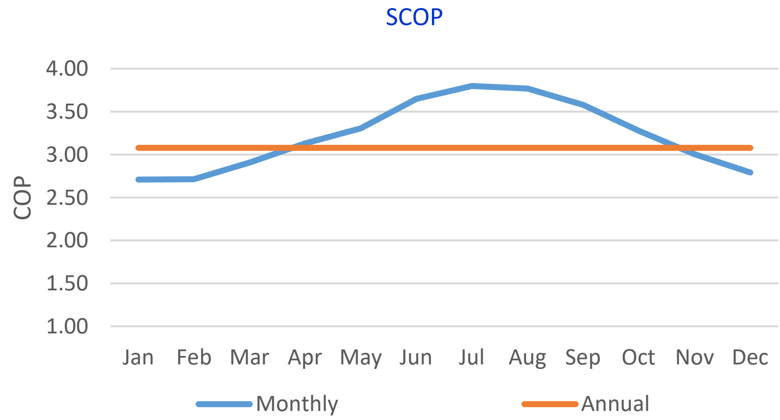
5.0 Heat Pump Share Of Heat

Building Heat Demand	746,039 kWh pa
Heat Pump Output	522,227 kWh pa (See Appendix Table 2)
Boiler Heat Output	223,812 kWh pa (See Appendix Table 2)
Heat Pump Share	**70.0%**
Boiler Heat Share	30.0%



6.0 Seasonal Coefficient of Performance - SCOP

Heat Pump SCOP	**3.08** See Appendix Table 2



COP = Instantaneous
= Power In / Power Out

SCOP* = Seasonal
= Energy In / Energy Out

* or SPF - Seasonal Performance Factor

7.0 Appendix

TABLE 1 - Heating & DHW Demands

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Project Space Heating Demand	kWh	35,218	31,086	32,754	29,510	29,027	26,091	25,204	27,454	27,343	30,593	32,163	34,420	360,864
Project DHW Demand	kWh	62,765	46,251	34,787	15,875	4,892	24,375	22,587	25,919	26,228	15,980	40,809	64,707	385,175
Total Heat Demand	kWh	97,983	77,338	67,541	45,385	33,919	50,465	47,791	53,373	53,571	46,573	72,972	99,127	746,039

TABLE 2 - Heat Pump / Boiler Share

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Project Heat Demand	kWh	97,983	77,338	67,541	45,385	33,919	50,465	47,791	53,373	53,571	46,573	72,972	99,127	746,039
Heat Pump Heat Output	kWh	68,588	54,136	47,279	31,770	23,743	35,326	33,453	37,361	37,500	32,601	51,081	69,389	522,227
COP		2.71	2.71	2.91	3.13	3.30	3.65	3.80	3.77	3.58	3.27	3.00	2.79	3.08
Heat Pump Energy Input (Electric)	kWh	25,300	19,967	16,274	10,149	7,184	9,683	8,806	9,914	10,478	9,957	17,020	24,877	169,611
Supplimentary Boiler Heat Output	kWh	29,395	23,201	20,262	13,616	10,176	15,140	14,337	16,012	16,071	13,972	21,892	29,738	223,812
Boiler Efficiency		98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Boiler Energy Input (Gas)	kWh	29,903	23,603	20,613	13,851	10,352	15,401	14,585	16,289	16,349	14,214	22,270	30,252	227,682
Share Of Heat From Heat Pump		70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Share Of Heat From Boiler		30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%

TABLE 3 - CO_2 Calculations

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Pump Energy Input (Electric)	kWh	25,300	19,967	16,274	10,149	7,184	9,683	8,806	9,914	10,478	9,957	17,020	24,877	169,611
CO_2 Factor Electric		0.163	0.160	0.153	0.143	0.132	0.120	0.111	0.112	0.122	0.136	0.151	0.163	0.146
Carbon Emission for Heat Pump	kg CO_2	4,124	3,195	2,490	1,451	948	1,162	978	1,110	1,278	1,354	2,570	4,055	24,716
Boiler Energy Input (Gas)	kWh	29,903	23,603	20,613	13,851	10,352	15,401	14,585	16,289	16,349	14,214	22,270	30,252	227,682
CO_2 Factor Gas		0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
Carbon Emission for Gas Boilers	kg CO_2	6,280	4,957	4,329	2,909	2,174	3,234	3,063	3,421	3,433	2,985	4,677	6,353	47,813
Carbon Emission for Proposal	kg CO_2	10,404	8,151	6,819	4,360	3,122	4,396	4,040	4,531	4,712	4,339	7,247	10,408	72,529

TABLE 4 - Energy Cost Calculations

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Pump Energy Input (Electric)	kWh	25,300	19,967	16,274	10,149	7,184	9,683	8,806	9,914	10,478	9,957	17,020	24,877	169,611
Fuel Tariff for Heat Pump Electric	p/kWh	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90
Heat Pump Energy Cost		£4,782	£3,774	£3,076	£1,918	£1,358	£1,830	£1,664	£1,874	£1,980	£1,882	£3,217	£4,702	£32,057
Boiler Energy Input (Gas)	kWh	29,903	23,603	20,613	13,851	10,352	15,401	14,585	16,289	16,349	14,214	22,270	30,252	227,682
Fuel Tariff for Boiler Gas	p/kWh	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87
Boiler Energy Cost		£1,157	£913	£798	£536	£401	£596	£564	£630	£633	£550	£862	£1,171	£8,811
Energy Cost for Proposal		£5,939	£4,687	£3,873	£2,454	£1,758	£2,426	£2,229	£2,504	£2,613	£2,432	£4,079	£5,873	£40,868

TABLE 5 - Primary Energy Calculations

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Pump Energy Input (Electric)		kWh	25,300	19,967	16,274	10,149	7,184	9,683	8,806	9,914	10,478	9,957	17,020	24,877	169,611
Primary Energy Factor	Electric		1.602	1.593	1.568	1.530	1.487	1.441	1.410	1.413	1.449	1.504	1.558	1.604	1.539
Primary Energy Input for Heat Pump		kWh	40,531	31,807	25,517	15,528	10,683	13,953	12,417	14,009	15,183	14,976	26,518	39,903	261,026
Boiler Energy Input (Gas)		kWh	29,903	23,603	20,613	13,851	10,352	15,401	14,585	16,289	16,349	14,214	22,270	30,252	227,682
Primary Energy Factor	Gas		1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130
Primary Energy Input for Gas Boilers		kWh	33,791	26,671	23,293	15,652	11,697	17,404	16,481	18,406	18,475	16,061	25,165	34,185	257,281
Primary Energy for Proposal		kWh	74,322	58,478	48,810	31,180	22,381	31,356	28,898	32,415	33,657	31,037	51,683	74,089	518,307

TABLE 6 - Notional Building

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Boiler Heat Output		kWh	97,983	77,338	67,541	45,385	33,919	50,465	47,791	53,373	53,571	46,573	72,972	99,127	746,039
Boiler Efficiency			98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Boiler Energy Input	Gas	kWh	99,678	78,675	68,710	46,170	34,506	51,338	48,617	54,296	54,497	47,379	74,234	100,841	758,941
CO_2 Factor	Gas		0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
Carbon Emission for Boilers		kg CO_2	20,932	16,522	14,429	9,696	7,246	10,781	10,210	11,402	11,444	9,950	15,589	21,177	159,378
Fuel Tariff for Boiler	Gas	p/kWh	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87
Boiler Energy Cost			£3,858	£3,045	£2,659	£1,787	£1,335	£1,987	£1,881	£2,101	£2,109	£1,834	£2,873	£3,903	£29,371
Primary Energy Factor	Gas		1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.13
Primary Energy Input for Boilers		kWh	112,636	88,903	77,642	52,172	38,992	58,012	54,937	61,355	61,582	53,538	83,885	113,951	857,603

8.0 References

Total DHW

Quantity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total DHW
180	35,217.96	31,086.47	32,754.48	29,510.31	29,026.69	26,090.77	25,204.05	27,454.48	27,342.78	30,593.29	32,162.94	34,420.27	360,864.48

Total Heating

Quantity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total DHW
180	62,765.39	46,251.14	34,786.98	15,874.90	4,892.49	0.00	0.00	0.00	0.00	15,980.04	40,809.23	64,706.61	286,066.78

Appendix D - Site Compliance Report

Be Lean Compliance

Block Compliance WorkSheet: East Block

FHP INSPIRING BUILT ENVIRONMENTS

User Details

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP

Software Version: Version: 1.0.5.12

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
EB1-01	18.25	19.07	55.5	58.6	81.9
EB1-02	19.61	21.44	53.6	56.5	50.1
EB1-03	17.04	17.84	50.3	50.4	76.8
EB1-04	16.2	17.33	46.1	46.2	72.7
EB1-05	16.03	17.13	45.1	45.5	72.9
EB1-06	17.72	19.17	45.1	44.4	50.4
EB1-07	18.14	19.08	53.4	54.4	69.7
EB1-08	18.56	19.79	54.7	57.2	69.9
EB1-09	19.93	21.58	54.5	57.1	49.7
EB1-10	17.48	18.91	51.2	54.3	75
E0-01	18.79	20.11	56	60.3	71
E0-02	18.74	19.71	49.8	47.9	50.4
E0-03	19.69	20.73	53.6	53.3	50.3
E0-04	17.15	18.72	52.8	56.5	83.6
E0-05	18.27	19.41	48.5	47	50.1
E0-06	15.29	17.48	35.3	37.1	50.2
E0-07	17.6	19.98	45.5	49.9	50.2
E0-08	19.92	20.89	56.8	57.2	55.3
E0-09	17.24	19.27	43.3	45.5	50.1
E0-10	14.93	16.77	32.8	32.5	50.3
E0-11	15.18	16.97	41.8	44.1	72.2
E0-12	14.65	16.51	39	41.6	71.1
E0-13	15.14	17.01	33.5	33.4	49.6
E0-14	15.32	17.22	35.4	36.2	51.9
E0-15	14.42	16.33	38.4	41.2	71.2
E0-16	15.4	17.75	42.5	46.7	70.1

Block Compliance WorkSheet: East BlockCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
E0-17	17.35	19.72	44.5	49	50.5
E0-18	18.83	20.19	50.4	51.3	50.5
E0-19	14.77	17.29	32.6	35.2	50.2
E0-20	16.94	19.78	42.2	48.2	50.2
E1-01	16.43	18.11	46.1	49.9	70.1
E1-02	16.43	17.79	39.2	37.7	49.8
E1-03	16.82	18.67	43	45.4	54.5
E1-04	13.62	16.19	34.5	38.6	70.1
E1-05	19.69	20.69	54.4	53.6	50.1
E1-06	15.17	17.47	34.8	37.3	50.3
E1-07	16.31	18.39	40	42	50.3
E1-08	17.11	19.74	43.5	48.2	50.8
E1-09	15.9	17.79	44.4	48.1	70.1
E1-10	15.16	16.92	34.9	34.5	52.6
E1-11	15.49	17.26	36	35.7	51.6
E1-12	13.77	15.49	36.5	38.3	76.7
E1-13	13.57	15.29	35.8	37.8	78.2
E1-14	16.04	17.8	37.7	37.4	49.5
E1-15	15.58	17.45	35.8	36.4	50.3
E1-16	13.98	15.7	36.6	38.7	73.1
E1-17	13.88	16.17	35.4	39.3	69.5
E1-18	15.7	17.93	36.7	39.3	50
E1-19	17.07	18.5	42.7	42.6	50.3
E1-20	14.93	17.49	33.1	36.2	50.2
E1-21	17.06	19.2	43.2	46.1	50.2
E2-01	19.7	21.06	59.7	65.2	70.1
E2-02	19.02	20.35	50.2	51	49.8
E2-03	20.71	21.94	59.3	62.2	54.5
E2-04	16.7	18.94	47.5	52.7	70.1
E2-05	22.97	23.39	67.2	67.6	50.1

Block Compliance WorkSheet: East BlockCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
E2-06	17.52	19.85	45.2	49.5	50.3
E2-07	16.71	18.91	41.7	44.7	50.3
E2-08	15.16	17.68	34.8	37.6	50.8
E2-09	13.87	15.87	35.6	38.3	70.1
E2-10	14.61	16.39	32.3	31.7	52.6
E2-11	14.94	16.72	33.5	32.9	51.6
E2-12	13.24	14.97	34.1	35.6	76.7
E2-13	13.06	14.81	33.6	35.3	78.2
E2-14	15.3	17.08	34.3	33.6	49.5
E2-15	15.12	16.86	33.6	33.3	50.3
E2-16	13.55	15.5	34.7	37.6	73.1
E2-17	14.65	16.73	38.8	42.2	69.5
E2-18	20.41	22.07	56.9	60.8	50
E2-19	22.22	23.07	64.3	66.3	50.3
E2-20	18.37	20.4	48.2	51.3	50.2
E2-21	17.19	18.34	42.9	41	50.2
E3-01	14.91	16.71	41.6	46.2	80.2
E3-02	16.43	16.63	42.9	42.6	70.9
E3-03	13.85	15.83	35.7	38.4	70.9
E3-04	14.64	16.4	32.4	31.8	52.6
E3-05	14.99	16.74	33.6	33	51.5
E3-06	13.24	14.97	34.1	35.6	76.7
E3-07	13.07	14.81	33.6	35.3	78.2
E3-08	15.3	17.08	34.3	33.6	49.5
E3-09	15.26	16.93	34.3	33.7	50.3
E3-10	13.75	15.5	34.7	37.6	73.1
E3-11	15.44	18.05	37.3	41.8	53.4
E3-12	15.21	17.25	41.6	46.8	73.9
E4-01	17.23	18.39	51.3	54.9	80.2
E4-02	17.68	19.24	51.4	55.9	70.9

Block Compliance WorkSheet: East BlockCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
E4-03	15.95	17.86	44.8	48.7	70.9
E4-04	15.32	17.13	35.7	35.7	52.6
E4-05	15.57	17.38	36.4	36.4	51.5
E4-06	15.22	16.83	42.7	45.2	76.7
E4-07	16.19	17.66	47	50.1	78.2
E4-08	18.14	19.6	47	46.8	49.5
E4-09	18.19	19.48	47.4	47	50.3
E4-10	17.66	18.88	51.4	55.1	73.1
E4-11	20.02	22.07	56.5	62.2	53.4
E4-12	19.39	20.87	58.9	65.4	73.9
E5-01	22.85	24.18	68.2	73.3	53.9
E5-02	22.01	22.7	64.3	65.3	52.3
E5-03	17.51	18.44	51.7	53.1	74.5
E5-04	18.23	19.53	47.9	49.4	54.9
E5-05	19.06	20.1	57.8	61.4	73.4

Calculation Summary

Total Floor Area	6126.10
Average TER	18.18
Average DER	16.52
Average DFEE	43.98
Average TFEE	46.11
Compliance	Pass
% Improvement DER|TER	9.13
% Improvement DFEE|TFEE	4.62

Block Compliance WorkSheet: West Block

User Details

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP **Software Version:** Version: 1.0.5.12

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
W1-01	18.39	20.51	48.6	52.6	50.8
W1-02	15.93	17.99	46.6	52.1	79.4
W1-03	14.95	16.96	43.7	49	86.4
W1-04	17.45	19.77	44.9	48.3	50.7
W1-05	15	16.94	41.9	46.3	76.9
W1-06	17.06	20.01	43.7	50.2	51.8
W1-07	17.89	20.85	47.1	54.6	51.8
W1-08	17.92	20.85	47.2	54.6	51.8
W1-09	16.95	19.07	50.2	56.7	75.1
W1-10	17.67	19.72	49.7	55.2	62.8
W1-11	18.18	20.88	48.7	55.8	51.8
W1-12	19.96	22.67	55.9	64.1	50.7
W2-01	14.53	17.28	43.6	53.1	94.3
W2-02	18.21	20.8	54.2	62.2	70.5
W2-03	17.28	18.69	48.1	50.6	64.7
W2-04	15.41	17.13	46.4	51	89.2
W2-05	15.9	17.79	48	53.2	86.1
W2-06	14.66	16.04	44	47.5	96.6
W2-07	15.7	17.66	36.7	37.7	50.8
W2-08	13.37	15.28	35.6	38.1	79.4
W2-09	12.55	14.35	33.1	35.5	86.4
W2-10	14.78	16.84	32.7	33.2	50.7
W2-11	12.71	14.47	31.7	33.5	76.9
W2-12	14.38	17.18	31.6	35.5	51.8
W2-13	14.37	17.16	31.5	35.4	51.8
W2-14	14.37	17.16	31.5	35.4	51.8

Block Compliance WorkSheet: West BlockCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
W2-15	18.72	19.54	57.5	59.1	75.1
W2-16	17.98	19.16	51	52.3	62.8
W2-17	14.63	17.29	33.1	37.3	51.8
W2-18	16.65	19.39	42	47.3	50.7
W3-01	12.78	14.81	36.2	40.6	94.3
W3-02	14.95	17.74	40.8	46.5	70.5
W3-03	14.95	16.13	38.1	37.3	64.7
W3-04	12.97	14.52	36	37.6	89.2
W3-05	13.36	15.07	37.2	39.4	86.1
W3-06	12.33	13.55	34.3	34.8	96.6
W3-07	15.49	17.46	35.8	36.7	50.8
W3-08	13.37	15.28	35.7	38.1	79.4
W3-09	12.55	14.35	33.1	35.5	86.4
W3-10	14.78	16.84	32.7	33.2	50.7
W3-11	12.71	14.47	31.7	33.5	76.9
W3-12	14.37	17.16	31.5	35.4	51.8
W3-13	14.37	17.16	31.5	35.4	51.8
W3-14	16.9	18.72	42.9	42.9	50.3
W3-15	16.52	18.82	41.6	45.1	52.1
W3-16	14.31	17.09	31.2	35	51.8
W3-17	16.65	19.39	42	47.3	50.7
W4-01	14.51	16.23	43.5	47.8	94.3
W4-02	14.92	17.71	40.7	46.3	70.5
W4-03	17	18.03	47	47.1	64.7
W4-04	13.77	15.27	39.5	41.4	89.2
W4-05	14.14	15.8	40.6	43.1	86.1
W4-06	14.26	15.18	42.7	43.1	96.6
W4-07	16.7	18.54	41.3	42.4	50.8
W4-08	14.88	16.41	42.2	43.9	79.4
W4-09	14.38	15.83	41	43.1	86.4

Block Compliance WorkSheet: West BlockCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
W4-10	15.91	17.82	38.1	38.3	50.7
W4-11	14.26	15.72	39	40	76.9
W4-12	14.37	17.16	31.5	35.4	51.8
W4-13	14.37	17.16	31.5	35.4	51.8
W4-14	21.12	21.83	60.2	58.9	50.3
W4-15	21.64	22.48	62.9	64.1	52.1
W4-16	14.37	17.15	31.5	35.3	51.8
W4-17	16.66	19.4	42.1	47.4	50.7
W5-01	15.66	17.06	47.3	50.6	90.3
W5-02	20.14	22.23	59.5	66.5	61.8
W5-03	20.61	20.91	56.9	53.8	48.7
W5-04	16.21	17.77	49.3	53.5	87.1
W5-05	16.47	17.66	49.4	51.9	82.5
W5-06	17.44	18.76	51.7	54.3	73.6
W5-07	18.7	20.33	49.2	50.4	48.9
W5-08	19.55	20.48	56.8	57.6	60.9
W5-09	17.95	19.08	51.4	53.8	68
W5-10	18.59	20.11	49.6	50.1	51.6
W5-11	20.54	20.84	57.8	55.3	51.4
W5-12	17.88	20.18	47.1	51.1	51.8
W5-13	20.41	21.06	61.8	62.5	64.2
W5-14	20.74	20.77	65.3	64.3	72.4
W5-15	19.69	22.08	54.8	61	50.7

Calculation Summary

Total Floor Area	5253.50

Block Compliance WorkSheet: West BlockCont...

Average TER	17.71
Average DER	15.86
Average DFEE	43.37
Average TFEE	46.50
Compliance	Pass
% Improvement DER|TER	10.45
% Improvement DFEE|TFEE	6.73

Be Green Compliance

Block Compliance WorkSheet: East Block

User Details

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP
Software Version: Version: 1.0.5.12

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
EB1-01	-105.95	19.07	55.5	58.6	81.9
EB1-02	17.86	21.44	53.6	56.5	50.1
EB1-03	15.55	17.84	50.3	50.4	76.8
EB1-04	14.81	17.33	46.1	46.2	72.7
EB1-05	14.65	17.13	45.1	45.5	72.9
EB1-06	16.18	19.17	45.1	44.4	50.4
EB1-07	16.54	19.08	53.4	54.4	69.7
EB1-08	16.93	19.79	54.7	57.2	69.9
EB1-09	18.15	21.58	54.5	57.1	49.7
EB1-10	15.96	18.91	51.2	54.3	75
E0-01	17.11	20.11	56	60.3	71
E0-02	17.08	19.71	49.8	47.9	50.4
E0-03	17.92	20.73	53.6	53.3	50.3
E0-04	15.65	18.72	52.8	56.5	83.6
E0-05	16.65	19.41	48.5	47	50.1
E0-06	14.01	17.48	35.3	37.1	50.2
E0-07	16.07	19.98	45.5	49.9	50.2
E0-08	18.13	20.89	56.8	57.2	55.3
E0-09	15.75	19.27	43.3	45.5	50.1
E0-10	13.69	16.77	32.8	32.5	50.3
E0-11	13.89	16.97	41.8	44.1	72.2
E0-12	13.42	16.51	39	41.6	71.1
E0-13	13.87	17.01	33.5	33.4	49.6
E0-14	14.03	17.22	35.4	36.2	51.9
E0-15	13.22	16.33	38.4	41.2	71.2
E0-16	14.11	17.75	42.5	46.7	70.1

Block Compliance WorkSheet: East BlockCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
E0-17	15.84	19.72	44.5	49	50.5
E0-18	17.16	20.19	50.4	51.3	50.5
E0-19	13.56	17.29	32.6	35.2	50.2
E0-20	15.49	19.78	42.2	48.2	50.2
E1-01	15.01	18.11	46.1	49.9	70.1
E1-02	15.02	17.79	39.2	37.7	49.8
E1-03	15.37	18.67	43	45.4	54.5
E1-04	12.52	16.19	34.5	38.6	70.1
E1-05	17.92	20.69	54.4	53.6	50.1
E1-06	13.9	17.47	34.8	37.3	50.3
E1-07	14.91	18.39	40	42	50.3
E1-08	15.64	19.74	43.5	48.2	50.8
E1-09	14.54	17.79	44.4	48.1	70.1
E1-10	13.89	16.92	34.9	34.5	52.6
E1-11	14.18	17.26	36	35.7	51.6
E1-12	12.64	15.49	36.5	38.3	76.7
E1-13	12.45	15.29	35.8	37.8	78.2
E1-14	14.67	17.8	37.7	37.4	49.5
E1-15	14.26	17.45	35.8	36.4	50.3
E1-16	12.83	15.7	36.6	38.7	73.1
E1-17	12.74	16.17	35.4	39.3	69.5
E1-18	14.37	17.93	36.7	39.3	50
E1-19	15.59	18.5	42.7	42.6	50.3
E1-20	13.7	17.49	33.1	36.2	50.2
E1-21	15.59	19.2	43.2	46.1	50.2
E2-01	17.92	21.06	59.7	65.2	70.1
E2-02	17.33	20.35	50.2	51	49.8
E2-03	18.83	21.94	59.3	62.2	54.5
E2-04	15.26	18.94	47.5	52.7	70.1
E2-05	20.85	23.39	67.2	67.6	50.1

Block Compliance WorkSheet: East BlockCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
E2-06	16	19.85	45.2	49.5	50.3
E2-07	15.27	18.91	41.7	44.7	50.3
E2-08	13.9	17.68	34.8	37.6	50.8
E2-09	12.73	15.87	35.6	38.3	70.1
E2-10	13.4	16.39	32.3	31.7	52.6
E2-11	13.7	16.72	33.5	32.9	51.6
E2-12	12.17	14.97	34.1	35.6	76.7
E2-13	12.01	14.81	33.6	35.3	78.2
E2-14	14.02	17.08	34.3	33.6	49.5
E2-15	13.85	16.86	33.6	33.3	50.3
E2-16	12.44	15.5	34.7	37.6	73.1
E2-17	13.43	16.73	38.8	42.2	69.5
E2-18	18.57	22.07	56.9	60.8	50
E2-19	20.18	23.07	64.3	66.3	50.3
E2-20	16.76	20.4	48.2	51.3	50.2
E2-21	15.7	18.34	42.9	41	50.2
E3-01	13.66	16.71	41.6	46.2	80.2
E3-02	15.03	16.63	42.9	42.6	70.9
E3-03	12.72	15.83	35.7	38.4	70.9
E3-04	13.43	16.4	32.4	31.8	52.6
E3-05	13.74	16.74	33.6	33	51.5
E3-06	12.16	14.97	34.1	35.6	76.7
E3-07	12.01	14.81	33.6	35.3	78.2
E3-08	14.02	17.08	34.3	33.6	49.5
E3-09	13.98	16.93	34.3	33.7	50.3
E3-10	12.63	15.5	34.7	37.6	73.1
E3-11	14.14	18.05	37.3	41.8	53.4
E3-12	13.94	17.25	41.6	46.8	73.9
E4-01	15.73	18.39	51.3	54.9	80.2
E4-02	16.14	19.24	51.4	55.9	70.9

Block Compliance WorkSheet: East BlockCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
E4-03	14.58	17.86	44.8	48.7	70.9
E4-04	14.03	17.13	35.7	35.7	52.6
E4-05	14.26	17.38	36.4	36.4	51.5
E4-06	13.93	16.83	42.7	45.2	76.7
E4-07	14.79	17.66	47	50.1	78.2
E4-08	16.55	19.6	47	46.8	49.5
E4-09	16.59	19.48	47.4	47	50.3
E4-10	16.12	18.88	51.4	55.1	73.1
E4-11	18.22	22.07	56.5	62.2	53.4
E4-12	17.66	20.87	58.9	65.4	73.9
E5-01	20.74	24.18	68.2	73.3	53.9
E5-02	19.99	22.7	64.3	65.3	52.3
E5-03	15.97	18.44	51.7	53.1	74.5
E5-04	16.64	19.53	47.9	49.4	54.9
E5-05	17.35	20.1	57.8	61.4	73.4

Calculation Summary

Total Floor Area	6126.10
Average TER	18.18
Average DER	13.46
Average DFEE	43.98
Average TFEE	46.11
Compliance	Pass
% Improvement DER|TER	25.96
% Improvement DFEE|TFEE	4.62

Block Compliance WorkSheet: West Block

INSPIRING BUILT ENVIRONMENTS

User Details

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP **Software Version:** Version: 1.0.5.12

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
W1-01	-865.54	20.51	48.6	52.6	50.8
W1-02	14.56	17.99	46.6	52.1	79.4
W1-03	13.69	16.96	43.7	49	86.4
W1-04	15.94	19.77	44.9	48.3	50.7
W1-05	13.74	16.94	41.9	46.3	76.9
W1-06	15.6	20.01	43.7	50.2	51.8
W1-07	16.35	20.85	47.1	54.6	51.8
W1-08	16.37	20.85	47.2	54.6	51.8
W1-09	15.48	19.07	50.2	56.7	75.1
W1-10	16.13	19.72	49.7	55.2	62.8
W1-11	16.59	20.88	48.7	55.8	51.8
W1-12	18.17	22.67	55.9	64.1	50.7
W2-01	13.31	17.28	43.6	53.1	94.3
W2-02	16.62	20.8	54.2	62.2	70.5
W2-03	15.78	18.69	48.1	50.6	64.7
W2-04	14.09	17.13	46.4	51	89.2
W2-05	14.53	17.79	48	53.2	86.1
W2-06	13.43	16.04	44	47.5	96.6
W2-07	14.37	17.66	36.7	37.7	50.8
W2-08	12.28	15.28	35.6	38.1	79.4
W2-09	11.56	14.35	33.1	35.5	86.4
W2-10	13.55	16.84	32.7	33.2	50.7
W2-11	11.7	14.47	31.7	33.5	76.9
W2-12	13.21	17.18	31.6	35.5	51.8
W2-13	14.36	18.81	37.6	44	51.8
W2-14	13.2	17.16	31.5	35.4	51.8

Block Compliance WorkSheet: West BlockCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
W2-15	17.06	19.54	57.5	59.1	75.1
W2-16	16.4	19.16	51	52.3	62.8
W2-17	13.42	17.29	33.1	37.3	51.8
W2-18	15.23	19.39	42	47.3	50.7
W3-01	11.75	14.81	36.2	40.6	94.3
W3-02	13.71	17.74	40.8	46.5	70.5
W3-03	13.71	16.13	38.1	37.3	64.7
W3-04	11.91	14.52	36	37.6	89.2
W3-05	12.26	15.07	37.2	39.4	86.1
W3-06	11.35	13.55	34.3	34.8	96.6
W3-07	14.19	17.46	35.8	36.7	50.8
W3-08	12.29	15.28	35.7	38.1	79.4
W3-09	11.56	14.35	33.1	35.5	86.4
W3-10	13.55	16.84	32.7	33.2	50.7
W3-11	11.7	14.47	31.7	33.5	76.9
W3-12	13.2	17.16	31.5	35.4	51.8
W3-13	13.2	17.16	31.5	35.4	51.8
W3-14	15.45	18.72	42.9	42.9	50.3
W3-15	15.11	18.82	41.6	45.1	52.1
W3-16	13.15	17.09	31.2	35	51.8
W3-17	15.23	19.39	42	47.3	50.7
W4-01	13.29	16.23	43.5	47.8	94.3
W4-02	13.68	17.71	40.7	46.3	70.5
W4-03	15.53	18.03	47	47.1	64.7
W4-04	12.63	15.27	39.5	41.4	89.2
W4-05	12.96	15.8	40.6	43.1	86.1
W4-06	13.06	15.18	42.7	43.1	96.6
W4-07	15.27	18.54	41.3	42.4	50.8
W4-08	13.63	16.41	42.2	43.9	79.4
W4-09	13.18	15.83	41	43.1	86.4

Block Compliance WorkSheet: West BlockCont...

FHP INSPIRING BUILT ENVIRONMENTS

Dwelling	DER	TER	DFEE	TFEE	TFA
W4-10	14.57	17.82	38.1	38.3	50.7
W4-11	13.08	15.72	39	40	76.9
W4-12	13.2	17.16	31.5	35.4	51.8
W4-13	13.2	17.16	31.5	35.4	51.8
W4-14	19.21	21.83	60.2	58.9	50.3
W4-15	19.67	22.48	62.9	64.1	52.1
W4-16	13.2	17.15	31.5	35.3	51.8
W4-17	15.24	19.4	42.1	47.4	50.7
W5-01	15.33	17.06	51.9	50.6	90.3
W5-02	18.34	22.23	59.5	66.5	61.8
W5-03	18.76	20.91	56.9	53.8	48.7
W5-04	14.81	17.77	49.3	53.5	87.1
W5-05	15.05	17.66	49.4	51.9	82.5
W5-06	15.92	18.76	51.7	54.3	73.6
W5-07	17.05	20.33	49.2	50.4	48.9
W5-08	17.8	20.48	56.8	57.6	60.9
W5-09	16.38	19.08	51.4	53.8	68
W5-10	16.97	20.11	49.6	50.1	51.6
W5-11	18.69	20.84	57.8	55.3	51.4
W5-12	16.33	20.18	47.1	51.1	51.8
W5-13	18.57	21.06	61.8	62.5	64.2
W5-14	18.86	20.77	65.3	64.3	72.4
W5-15	17.94	22.08	54.8	61	50.7

Calculation Summary

Total Floor Area	5253.50

Block Compliance WorkSheet: West BlockCont...

Average TER	17.72
Average DER	6.01
Average DFEE	43.51
Average TFEE	46.58
Compliance	Pass
% Improvement DER|TER	66.08
% Improvement DFEE|TFEE	6.59

Appendix E - SAMPLE SAP/SBEM Results

All areas of the site have been assessed in either SAP or SBEM. Therefore, certification is extensive, so sample dwelling reports are provided.

Be Lean & Baseline BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

156 West End Lane

As built

Date: Wed Aug 19 09:10:53 2020

Administrative information

Building Details

Address: 156 West End Lane, London, Postcode

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.2

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

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

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	13.9
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	13.9
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	21.8
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	0.35	0.35	SP00000C_W1
Floor	0.25	0.25	0.25	SP00000C_F
Roof	0.25	0.25	0.25	SP000010_C
Windows***, roof windows, and rooflights	2.2	2.2	2.2	SP00000C_W3_O0
Personnel doors	2.2	1.4	1.4	SP000034_W9_O0
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	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system (Copy)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.81	-	-	-	-
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					NO

* 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- Main system Office

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2	2.5	-	-	-
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					NO

* 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- SYST0001-DHW

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

2- SYST0002-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	-
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**
SBEM - Startup 04	0.3	-	-	-	-	-	-	-	-	-	N/A
SBEM - Community Room	0.3	-	-	-	-	-	-	-	-	-	N/A
SBEM - Startup 03	0.3	-	-	-	-	-	-	-	-	-	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
SBEM - Flex Space	0.3	-	-	-	-	-	-	-	-	-	N/A
SBEM - Startup 01	0.3	-	-	-	-	-	-	-	-	-	N/A
SBEM - Startup 02	0.3	-	-	-	-	-	-	-	-	-	N/A
SBEM - Flexible Employment Space	0.4	-	-	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Excluded from calculation?
SBEM - Startup 04	NO
SBEM - Community Room	NO
SBEM - Startup 03	NO
SBEM - Flex Space	NO
SBEM - Startup 01	NO
SBEM - Startup 02	NO
SBEM - Flexible Employment Space	NO

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
SBEM - Startup 04	-	55	-	1231
SBEM - Community Room	-	55	-	361
SBEM - Startup 03	-	55	-	447
SBEM - Flex Space	-	55	-	3535
SBEM - Startup 01	-	55	-	508
SBEM - Startup 02	-	55	-	652
SBEM - Flexible Employment Space	28	-	-	10058

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?
SBEM - Flexible Employment Space	NO (-59.6%)	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?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1691	1691
External area [m²]	2122	2122
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	1019.8	780.59
Average U-value [W/m²K]	0.48	0.37
Alpha value* [%]	11.44	12.36

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

Building Use

% Area	Building Type
72	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
28	**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/m²]

	Actual	Notional
Heating	28.95	22.94
Cooling	8.08	2.72
Auxiliary	2.97	2.23
Lighting	17.28	11.56
Hot water	0.88	0.92
Equipment*	17.54	17.54
TOTAL**	**58.16**	**40.38**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	183.47	167.29
Primary energy* [kWh/m²]	127.2	80.39
Total emissions [kg/m²]	21.8	13.9

* 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	100	85.6	38.4	0	3.7	0.72	0	0.81	0
	Notional	89.1	80.2	30.2	0	2.6	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	28.8	149.2	4.3	29.2	1.1	1.86	1.42	2	2
	Notional	34.6	127.4	4	9.8	1.1	2.43	3.6	----	----

Key to terms

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

Key Features

The 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	0.35	SP00000C_W1
Floor	0.2	0.25	SP00000C_F
Roof	0.15	0.25	SP000010_C
Windows, roof windows, and rooflights	1.5	2.2	SP00000C_W3_O0
Personnel doors	1.5	1.4	SP000034_W9_O0
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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

156 West End Lane

As built

Date: Wed Aug 19 09:19:29 2020

Administrative information

Building Details

Address: 156 West End Lane, London, Postcode

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.2

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

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

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	13.3
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	13.3
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	19.4
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and 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	0.16	0.16	SP00000C_W1
Floor	0.25	0.12	0.12	SP00000C_F
Roof	0.25	0.12	0.12	SP000010_C
Windows***, roof windows, and rooflights	2.2	1.2	1.2	SP00000C_W3_O0
Personnel doors	2.2	1.4	1.4	SP000034_W9_O0
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	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system (Copy)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.81	-	-	-	-
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					NO

* 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- Main system Office

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2	2.5	-	-	-
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					NO

* 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- SYST0001-DHW

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

2- SYST0002-DHW

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

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

Shell and core configuration

Zone	Excluded from calculation?
SBEM - Startup 04	NO
SBEM - Community Room	NO
SBEM - Startup 03	NO
SBEM - Flex Space	NO
SBEM - Startup 01	NO
SBEM - Startup 02	NO
SBEM - Flexible Employment Space	NO

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
SBEM - Startup 04	-	55	-	1231
SBEM - Community Room	-	55	-	361
SBEM - Startup 03	-	55	-	447

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
SBEM - Flex Space	-	55	-	3535
SBEM - Startup 01	-	55	-	508
SBEM - Startup 02	-	55	-	652
SBEM - Flexible Employment Space	28	-	-	10058

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?
SBEM - Flexible Employment Space	NO (-60.3%)	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?	YES
Is evidence of such assessment available as a separate submission?	YES
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]	1691	1691
External area [m^2]	2122	2122
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	522.01	780.59
Average U-value [W/m^2K]	0.25	0.37
Alpha value* [%]	22.34	12.36

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

Building Use

% Area	Building Type
72	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
28	**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	18.67	22.94
Cooling	9.34	2.72
Auxiliary	1.9	0.9
Lighting	17.28	11.56
Hot water	0.8	0.92
Equipment*	17.54	17.54
TOTAL**	**47.99**	**39.06**

* Energy used by equipment does not count towards the total for consumption or 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]	164.68	167.29
Primary energy* [kWh/m^2]	113.97	76.41
Total emissions [kg/m^2]	19.4	13.3

* 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	64.9	90.9	24.9	0	2.6	0.72	0	0.81	0
	Notional	89.1	80.2	30.2	0	1.2	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	15.6	172.3	2.3	33.7	0	1.86	1.42	2	2
	Notional	34.6	127.4	4	9.8	0	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	0.16	SP00000C_W1
Floor	0.2	0.12	SP00000C_F
Roof	0.15	0.12	SP000010_C
Windows, roof windows, and rooflights	1.5	1.2	SP00000C_W3_O0
Personnel doors	1.5	1.4	SP000034_W9_O0
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

Be Green BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

156 West End Lane

As built

Date: Wed Aug 19 10:25:22 2020

Administrative information

Building Details

Address: 156 West End Lane, London, Postcode

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.2

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

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

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	14.4
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	14.4
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	16.5
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and 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	0.16	0.16	SP00000C_W1
Floor	0.25	0.12	0.12	SP00000C_F
Roof	0.25	0.12	0.12	SP000010_C
Windows***, roof windows, and rooflights	2.2	1.2	1.2	SP00000C_W3_O0
Personnel doors	2.2	1.4	1.4	SP000034_W9_O0
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	4.05

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	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.6	4	-	-	-
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	NO				
* 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- SYST0000-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
SBEM - Startup 04	1.2	-	-	1.2	-	-	-	-	-	0.85	0.5
SBEM - Community Room	1.2	-	-	1.2	-	-	-	-	-	0.85	0.5
SBEM - Startup 03	1.2	-	-	1.2	-	-	-	-	-	0.85	0.5
SBEM - Flex Space	1.2	-	-	1.2	-	-	-	-	-	0.85	0.5
SBEM - Startup 01	1.2	-	-	1.2	-	-	-	-	-	0.85	0.5
SBEM - Startup 02	1.2	-	-	1.2	-	-	-	-	-	0.85	0.5
SBEM - Flexible Employment Space	1.2	-	-	1.2	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Excluded from calculation?
SBEM - Startup 04	NO
SBEM - Community Room	NO
SBEM - Startup 03	NO
SBEM - Flex Space	NO
SBEM - Startup 01	NO
SBEM - Startup 02	NO
SBEM - Flexible Employment Space	NO

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
SBEM - Startup 04	-	100	-	677
SBEM - Community Room	-	100	-	198
SBEM - Startup 03	-	100	-	246
SBEM - Flex Space	-	100	-	1944
SBEM - Startup 01	-	100	-	280
SBEM - Startup 02	-	100	-	358
SBEM - Flexible Employment Space	50	-	-	5532

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?
SBEM - Startup 04	YES (+10.4%)	NO
SBEM - Community Room	NO (-50.7%)	NO
SBEM - Startup 03	NO (-21.8%)	NO
SBEM - Flex Space	YES (+10%)	NO
SBEM - Startup 01	YES (+15.3%)	NO
SBEM - Startup 02	YES (+4.8%)	NO
SBEM - Flexible Employment Space	NO (-60.3%)	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?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1691	1691
External area [m^2]	2122	2122
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	4	3
Average conductance [W/K]	522.01	780.59
Average U-value [W/m^{2}K]	0.25	0.37
Alpha value* [%]	22.34	12.36

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

Building Use

% Area	Building Type
72	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
28	**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	1.59	3.51
Cooling	10.94	7.32
Auxiliary	10.5	5.45
Lighting	7.96	11.56
Hot water	0.8	0.92
Equipment*	17.54	17.54
TOTAL**	**31.77**	**28.76**

* Energy used by equipment does not count towards the total for consumption or 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]	125.66	125.49
Primary energy* [kWh/m^2]	97.55	84.35
Total emissions [kg/m^2]	16.5	14.4

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	13.8	111.8	1.6	10.9	10.5	2.42	2.84	2.6	4
	Notional	30.7	94.8	3.5	7.3	5.5	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	0.16	SP00000C_W1
Floor	0.2	0.12	SP00000C_F
Roof	0.15	0.12	SP000010_C
Windows, roof windows, and rooflights	1.5	1.2	SP00000C_W3_O0
Personnel doors	1.5	1.4	SP000034_W9_O0
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	4.05

Be Lean TER

TER WorkSheet: New dwelling design stage

User Details:

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

Property Address: E0-01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71	(1a) x	2.7	(2a) =	191.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	191.7	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.38	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

(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

0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.38	0.4	0.42	0.44

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			5.68	x1/[1/(1.4)+ 0.04]		=	7.53			(27)
Windows Type 2			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 3			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 4			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Floor			71	x	0.13	=	9.23			(28)
Walls Type1	65.34	15.88	49.46	x	0.18	=	8.9			(29)
Walls Type2	4.32	1.89	2.43	x	0.18	=	0.44			(29)
Walls Type3	7.29	0	7.29	x	0.18	=	1.31			(29)
Roof	6	0	6	x	0.13	=	0.78			(30)
Total area of elements, m²			153.95							(31)
Party wall			19.17	x	0	=	0			(32)
Party ceiling			65							(32b)

** 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) = 43.61 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 16.47 (36)

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

Total fabric heat loss	(33) + (36) =	60.07	(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=	38.9	38.62	38.34	37.04	36.8	35.67	35.67	35.46	36.1	36.8	37.29	37.8	(38)

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

(39)m=	98.97	98.69	98.41	97.11	96.87	95.74	95.74	95.53	96.18	96.87	97.36	97.88	

Average = Sum(39)1…12 /12= 97.11 (39)

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

(40)m=	1.39	1.39	1.39	1.37	1.36	1.35	1.35	1.35	1.35	1.36	1.37	1.38	

Average = Sum(40)1…12 /12= 1.37 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.12 (43)

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

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=	96.93	93.4	89.88	86.35	82.83	79.3	79.3	82.83	86.35	89.88	93.4	96.93

Total = Sum(44)1…12 = 1057.39 (44)

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

(45)m=	143.74	125.72	129.73	113.1	108.52	93.65	86.78	99.58	100.77	117.44	128.19	139.21

Total = Sum(45)1…12 = 1386.41 (45)

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

(46)m=	21.56	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

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

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

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

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

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

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

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

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

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

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

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

(62)m=	190.34	167.8	176.32	158.19	155.12	138.74	133.37	146.17	145.86	164.03	173.28	185.8	(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=	190.34	167.8	176.32	158.19	155.12	138.74	133.37	146.17	145.86	164.03	173.28	185.8	

Output from water heater (annual)1…12 | 1935.03 | (64)

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

(65)m=	85.07	75.47	80.41	73.68	73.36	67.21	66.13	70.39	69.58	76.32	78.7	83.56	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	(66)

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

(67)m=	17.8	15.81	12.85	9.73	7.27	6.14	6.64	8.63	11.58	14.7	17.16	18.29	(67)

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

(68)m=	199.62	201.69	196.47	185.36	171.33	158.15	149.34	147.27	152.49	163.6	177.63	190.81	(68)

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

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	(71)

Water heating gains (Table 5)

(72)m=	114.34	112.31	108.08	102.33	98.6	93.35	88.88	94.6	96.64	102.58	109.3	112.31	(72)

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

(73)m=	391.81	389.85	377.46	357.47	337.26	317.69	304.91	310.55	320.75	340.94	364.14	381.47	(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	2.04	x	10.63	x	0.63	x	0.7	=	13.26	(74)
North	0.9x	0.77	x	2.04	x	20.32	x	0.63	x	0.7	=	25.34	(74)
North	0.9x	0.77	x	2.04	x	34.53	x	0.63	x	0.7	=	43.06	(74)
North	0.9x	0.77	x	2.04	x	55.46	x	0.63	x	0.7	=	69.16	(74)
North	0.9x	0.77	x	2.04	x	74.72	x	0.63	x	0.7	=	93.16	(74)
North	0.9x	0.77	x	2.04	x	79.99	x	0.63	x	0.7	=	99.73	(74)
North	0.9x	0.77	x	2.04	x	74.68	x	0.63	x	0.7	=	93.11	(74)
North	0.9x	0.77	x	2.04	x	59.25	x	0.63	x	0.7	=	73.87	(74)
North	0.9x	0.77	x	2.04	x	41.52	x	0.63	x	0.7	=	51.77	(74)
North	0.9x	0.77	x	2.04	x	24.19	x	0.63	x	0.7	=	30.16	(74)
North	0.9x	0.77	x	2.04	x	13.12	x	0.63	x	0.7	=	16.36	(74)
North	0.9x	0.77	x	2.04	x	8.86	x	0.63	x	0.7	=	11.05	(74)
South	0.9x	0.77	x	5.68	x	46.75	x	0.63	x	0.7	=	81.16	(78)
South	0.9x	0.77	x	2.04	x	46.75	x	0.63	x	0.7	=	58.3	(78)
South	0.9x	0.77	x	5.68	x	76.57	x	0.63	x	0.7	=	132.91	(78)
South	0.9x	0.77	x	2.04	x	76.57	x	0.63	x	0.7	=	95.47	(78)
South	0.9x	0.77	x	5.68	x	97.53	x	0.63	x	0.7	=	169.31	(78)
South	0.9x	0.77	x	2.04	x	97.53	x	0.63	x	0.7	=	121.62	(78)
South	0.9x	0.77	x	5.68	x	110.23	x	0.63	x	0.7	=	191.35	(78)
South	0.9x	0.77	x	2.04	x	110.23	x	0.63	x	0.7	=	137.45	(78)
South	0.9x	0.77	x	5.68	x	114.87	x	0.63	x	0.7	=	199.4	(78)
South	0.9x	0.77	x	2.04	x	114.87	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	5.68	x	110.55	x	0.63	x	0.7	=	191.9	(78)
South	0.9x	0.77	x	2.04	x	110.55	x	0.63	x	0.7	=	137.84	(78)
South	0.9x	0.77	x	5.68	x	108.01	x	0.63	x	0.7	=	187.5	(78)
South	0.9x	0.77	x	2.04	x	108.01	x	0.63	x	0.7	=	134.68	(78)
South	0.9x	0.77	x	5.68	x	104.89	x	0.63	x	0.7	=	182.08	(78)
South	0.9x	0.77	x	2.04	x	104.89	x	0.63	x	0.7	=	130.79	(78)
South	0.9x	0.77	x	5.68	x	101.89	x	0.63	x	0.7	=	176.86	(78)
South	0.9x	0.77	x	2.04	x	101.89	x	0.63	x	0.7	=	127.04	(78)
South	0.9x	0.77	x	5.68	x	82.59	x	0.63	x	0.7	=	143.36	(78)
South	0.9x	0.77	x	2.04	x	82.59	x	0.63	x	0.7	=	102.98	(78)
South	0.9x	0.77	x	5.68	x	55.42	x	0.63	x	0.7	=	96.2	(78)
South	0.9x	0.77	x	2.04	x	55.42	x	0.63	x	0.7	=	69.1	(78)
South	0.9x	0.77	x	5.68	x	40.4	x	0.63	x	0.7	=	70.13	(78)
South	0.9x	0.77	x	2.04	x	40.4	x	0.63	x	0.7	=	50.37	(78)
West	0.9x	0.77	x	2.04	x	19.64	x	0.63	x	0.7	=	12.24	(80)
West	0.9x	0.77	x	2.04	x	38.42	x	0.63	x	0.7	=	23.95	(80)
West	0.9x	0.77	x	2.04	x	63.27	x	0.63	x	0.7	=	39.45	(80)

West	0.9x	0.77	x	2.04	x	92.28	x	0.63	x	0.7	=	57.53	(80)
West	0.9x	0.77	x	2.04	x	113.09	x	0.63	x	0.7	=	70.51	(80)
West	0.9x	0.77	x	2.04	x	115.77	x	0.63	x	0.7	=	72.18	(80)
West	0.9x	0.77	x	2.04	x	110.22	x	0.63	x	0.7	=	68.72	(80)
West	0.9x	0.77	x	2.04	x	94.68	x	0.63	x	0.7	=	59.03	(80)
West	0.9x	0.77	x	2.04	x	73.59	x	0.63	x	0.7	=	45.88	(80)
West	0.9x	0.77	x	2.04	x	45.59	x	0.63	x	0.7	=	28.42	(80)
West	0.9x	0.77	x	2.04	x	24.49	x	0.63	x	0.7	=	15.27	(80)
West	0.9x	0.77	x	2.04	x	16.15	x	0.63	x	0.7	=	10.07	(80)

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

(83)m=	164.95	277.68	373.43	455.5	506.31	501.65	484.01	445.78	401.55	304.92	196.92	141.62	(83)

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

(84)m=	556.76	667.53	750.88	812.97	843.57	819.34	788.92	756.33	722.3	645.86	561.06	523.09	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.84	0.68	0.52	0.56	0.78	0.94	0.99	1	(86)

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

(87)m=	19.61	19.82	20.11	20.47	20.76	20.93	20.98	20.98	20.87	20.49	19.98	19.57	(87)

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

(88)m=	19.77	19.77	19.77	19.79	19.79	19.8	19.8	19.81	19.8	19.79	19.79	19.78	(88)

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

(89)m=	0.99	0.98	0.96	0.9	0.78	0.58	0.39	0.42	0.69	0.92	0.98	0.99	(89)

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

(90)m=	17.95	18.26	18.69	19.19	19.56	19.76	19.8	19.8	19.7	19.24	18.51	17.91	(90)

fLA = Living area ÷ (4) = | 0.37 | (91)

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

(92)m=	18.56	18.83	19.21	19.66	20	20.19	20.23	20.23	20.13	19.7	19.05	18.52	(92)

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

(93)m=	18.56	18.83	19.21	19.66	20	20.19	20.23	20.23	20.13	19.7	19.05	18.52	(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	0.9	0.79	0.62	0.43	0.47	0.72	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	550.66	652.19	715.81	731.87	670.18	503.93	342.53	358.17	517.73	591.67	548.88	518.6	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1411.23	1375.12	1250.71	1044.47	803.92	535.09	347.74	365.83	580.11	881.25	1163.57	1401.54	(97)

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

(98)m=	640.26	485.81	397.97	225.07	99.5	0	0	0	0	215.45	442.58	656.91

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3163.55 (98)

Space heating requirement in kWh/m²/year 44.56 (99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	640.26	485.81	397.97	225.07	99.5	0	0	0	0	215.45	442.58	656.91	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	684.77	519.58	425.64	240.72	106.42	0	0	0	0	230.42	473.35	702.57	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3383.47 (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)

	190.34	167.8	176.32	158.19	155.12	138.74	133.37	146.17	145.86	164.03	173.28	185.8

Efficiency of water heater 79.8 (216)

(217)m=	87.8	87.49	86.92	85.75	83.67	79.8	79.8	79.8	79.8	85.54	87.21	87.9	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	216.78	191.8	202.85	184.47	185.4	173.86	167.13	183.17	182.78	191.75	198.69	211.37

Total = Sum(219a)$_{1...12}$ = 2290.08 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3383.47	
Water heating fuel used			2290.08	
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			314.27	(232)

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

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

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Space heating (main system 1)	(211) x	0.216	=	730.83	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	494.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1225.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	163.11	(268)
Total CO2, kg/year		sum of (265)…(271) =		1427.52	(272)

TER = 20.11 (273)

DRAFT

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User Details:

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

Property Address: E1-18

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50	(1a) x	2.7	(2a) =	135	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	135	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

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

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			5.3	x1/[1/(1.4)+ 0.04]		=	7.03			(27)
Windows Type 2			2.66	x1/[1/(1.4)+ 0.04]		=	3.53			(27)
Windows Type 3			2.66	x1/[1/(1.4)+ 0.04]		=	3.53			(27)
Walls Type1	22.95	10.62	12.33	x	0.18	=	2.22			(29)
Walls Type2	20.79	1.89	18.9	x	0.18	=	3.4			(29)
Total area of elements, m²			43.74							(31)
Party wall			35.37	x	0	=	0			(32)
Party floor			50							(32a)
Party ceiling			50							(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.59 (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 4.23 (36)

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

Total fabric heat loss (33) + (36) = 25.82 (37)

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

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

(38)m=	25.72	25.59	25.46	24.84	24.73	24.19	24.19	24.09	24.4	24.73	24.96	25.2	(38)

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

(39)m=	51.54	51.41	51.27	50.66	50.54	50.01	50.01	49.91	50.21	50.54	50.78	51.02	

Average = Sum(39)$_{1\ldots12}$ /12= 50.66 (39)

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

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

Average = Sum(40)$_{1\ldots12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.34 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.77	78.8	75.83	72.85	69.88	66.91	66.91	69.88	72.85	75.83	78.8	81.77	

Total = Sum(44)$_{1\ldots12}$ = 892.08 (44)

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

(45)m=	121.27	106.06	109.45	95.42	91.56	79.01	73.21	84.01	85.01	99.08	108.15	117.44	

Total = Sum(45)$_{1\ldots12}$ = 1169.66 (45)

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

(46)m=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

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

(62)m=	167.86	148.15	156.04	140.51	138.15	124.1	119.81	130.61	130.11	145.67	153.24	164.04	(62)

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

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

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

Output from water heater

(64)m=	167.86	148.15	156.04	140.51	138.15	124.1	119.81	130.61	130.11	145.67	153.24	164.04	

Output from water heater (annual)$_{1\ldots12}$ 1718.27 (64)

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

(65)m=	77.6	68.93	73.67	67.8	67.72	62.34	61.62	65.21	64.34	70.22	72.03	76.33	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.15	11.68	9.5	7.19	5.38	4.54	4.9	6.37	8.56	10.86	12.68	13.52	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	147.23	148.76	144.91	136.72	126.37	116.64	110.15	108.62	112.47	120.67	131.01	140.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	(71)
Water heating gains (Table 5)													
(72)m=	104.3	102.58	99.01	94.17	91.02	86.59	82.82	87.65	89.36	94.38	100.05	102.59	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	316.04	314.38	304.78	289.43	274.12	259.12	249.22	253.99	261.74	277.26	295.09	308.19	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.66	x	46.75	x	0.63	x	0.7	=	38.01	(78)
South	0.9x	0.77	x	2.66	x	76.57	x	0.63	x	0.7	=	62.24	(78)

South	0.9x	0.77	x	2.66	x	97.53	x	0.63	x	0.7	=	79.29	(78)
South	0.9x	0.77	x	2.66	x	110.23	x	0.63	x	0.7	=	89.61	(78)
South	0.9x	0.77	x	2.66	x	114.87	x	0.63	x	0.7	=	93.38	(78)
South	0.9x	0.77	x	2.66	x	110.55	x	0.63	x	0.7	=	89.87	(78)
South	0.9x	0.77	x	2.66	x	108.01	x	0.63	x	0.7	=	87.81	(78)
South	0.9x	0.77	x	2.66	x	104.89	x	0.63	x	0.7	=	85.27	(78)
South	0.9x	0.77	x	2.66	x	101.89	x	0.63	x	0.7	=	82.83	(78)
South	0.9x	0.77	x	2.66	x	82.59	x	0.63	x	0.7	=	67.14	(78)
South	0.9x	0.77	x	2.66	x	55.42	x	0.63	x	0.7	=	45.05	(78)
South	0.9x	0.77	x	2.66	x	40.4	x	0.63	x	0.7	=	32.84	(78)
West	0.9x	0.77	x	5.3	x	19.64	x	0.63	x	0.7	=	31.81	(80)
West	0.9x	0.77	x	2.66	x	19.64	x	0.63	x	0.7	=	15.97	(80)
West	0.9x	0.77	x	5.3	x	38.42	x	0.63	x	0.7	=	62.23	(80)
West	0.9x	0.77	x	2.66	x	38.42	x	0.63	x	0.7	=	31.23	(80)
West	0.9x	0.77	x	5.3	x	63.27	x	0.63	x	0.7	=	102.49	(80)
West	0.9x	0.77	x	2.66	x	63.27	x	0.63	x	0.7	=	51.44	(80)
West	0.9x	0.77	x	5.3	x	92.28	x	0.63	x	0.7	=	149.47	(80)
West	0.9x	0.77	x	2.66	x	92.28	x	0.63	x	0.7	=	75.02	(80)
West	0.9x	0.77	x	5.3	x	113.09	x	0.63	x	0.7	=	183.18	(80)
West	0.9x	0.77	x	2.66	x	113.09	x	0.63	x	0.7	=	91.94	(80)
West	0.9x	0.77	x	5.3	x	115.77	x	0.63	x	0.7	=	187.52	(80)
West	0.9x	0.77	x	2.66	x	115.77	x	0.63	x	0.7	=	94.11	(80)
West	0.9x	0.77	x	5.3	x	110.22	x	0.63	x	0.7	=	178.53	(80)
West	0.9x	0.77	x	2.66	x	110.22	x	0.63	x	0.7	=	89.6	(80)
West	0.9x	0.77	x	5.3	x	94.68	x	0.63	x	0.7	=	153.35	(80)
West	0.9x	0.77	x	2.66	x	94.68	x	0.63	x	0.7	=	76.96	(80)
West	0.9x	0.77	x	5.3	x	73.59	x	0.63	x	0.7	=	119.2	(80)
West	0.9x	0.77	x	2.66	x	73.59	x	0.63	x	0.7	=	59.82	(80)
West	0.9x	0.77	x	5.3	x	45.59	x	0.63	x	0.7	=	73.84	(80)
West	0.9x	0.77	x	2.66	x	45.59	x	0.63	x	0.7	=	37.06	(80)
West	0.9x	0.77	x	5.3	x	24.49	x	0.63	x	0.7	=	39.67	(80)
West	0.9x	0.77	x	2.66	x	24.49	x	0.63	x	0.7	=	19.91	(80)
West	0.9x	0.77	x	5.3	x	16.15	x	0.63	x	0.7	=	26.16	(80)
West	0.9x	0.77	x	2.66	x	16.15	x	0.63	x	0.7	=	13.13	(80)

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

(83)m=	85.78	155.71	233.21	314.1	368.5	371.5	355.93	315.59	261.85	178.04	104.62	72.13	(83)

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

(84)m=	401.82	470.08	537.99	603.53	642.62	630.62	605.16	569.58	523.59	455.3	399.72	380.33	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	0.99	0.98	0.95	0.85	0.69	0.5	0.36	0.4	0.64	0.9	0.98	0.99	(86)

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

(87)m=	20.11	20.3	20.55	20.81	20.95	20.99	21	21	20.98	20.78	20.4	20.08	(87)

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

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

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

(89)m=	0.99	0.97	0.93	0.82	0.64	0.43	0.29	0.32	0.56	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=	18.89	19.16	19.52	19.87	20.03	20.08	20.08	20.08	20.06	19.84	19.31	18.85	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	19.47	19.7	20.01	20.32	20.47	20.51	20.52	20.52	20.5	20.28	19.83	19.43	(92)

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

(93)m=	19.47	19.7	20.01	20.32	20.47	20.51	20.52	20.52	20.5	20.28	19.83	19.43	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.83	0.66	0.47	0.32	0.36	0.6	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	396.7	456.79	501.03	500.42	424.21	293.43	195.65	205.07	312.83	399.27	388.68	376.58	(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=	781.87	760.6	692.54	578.36	443.14	295.66	195.88	205.49	321.16	489.46	646.16	777.1	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	286.57	204.16	142.48	56.12	14.09	0	0	0	0	67.1	185.38	297.99	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1253.88 (98)

Space heating requirement in kWh/m²/year 25.08 (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)													
	286.57	204.16	142.48	56.12	14.09	0	0	0	0	67.1	185.38	297.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	306.49	218.35	152.39	60.02	15.06	0	0	0	0	71.77	198.27	318.7	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1341.05 (211)

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

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

Water heating

Output from water heater (calculated above)

	167.86	148.15	156.04	140.51	138.15	124.1	119.81	130.61	130.11	145.67	153.24	164.04		
Efficiency of water heater													79.8	(216)
(217)m=	86.23	85.67	84.57	82.59	80.68	79.8	79.8	79.8	79.8	82.89	85.32	86.39		(217)

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

(219)m=	194.67	172.93	184.51	170.14	171.23	155.51	150.13	163.67	163.04	175.74	179.6	189.88		
								Total = Sum(219a)$_{1...12}$ =					2071.04	(219)

Annual totals	kWh/year	kWh/year	
Space heating fuel used, main system 1		1341.05	
Water heating fuel used		2071.04	
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		232.27	(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	=	289.67	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	447.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			737.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	120.55	(268)
Total CO2, kg/year		sum of (265)…(271) =		896.49	(272)

TER = 17.93 (273)

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User Details:

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

Property Address: E2-07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.3	(1a) x	2.7	(2a) =	135.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	135.81	(5)

2. Ventilation rate:

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

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			8.01	x1/[1/(1.4)+ 0.04]		=	10.62			(27)
Windows Type 2			2.67	x1/[1/(1.4)+ 0.04]		=	3.54			(27)
Walls Type1	15.93	10.68	5.25	x	0.18	=	0.95			(29)
Walls Type2	25.11	1.89	23.22	x	0.18	=	4.18			(29)
Walls Type3	13.77	0	13.77	x	0.18	=	2.48			(29)
Total area of elements, m²			54.81							(31)
Party wall			23.49	x	0	=	0			(32)
Party floor			50.3							(32a)
Party ceiling			50.3							(32b)

* *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) = 23.65 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 4.35 (36)

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

Total fabric heat loss (33) + (36) = 28.01 (37)

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

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

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(38)m=	25.86	25.73	25.6	24.98	24.86	24.33	24.33	24.23	24.53	24.86	25.1	25.34	(38)

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

(39)m=	53.87	53.73	53.6	52.99	52.87	52.33	52.33	52.23	52.54	52.87	53.1	53.35	

Average = Sum(39)$_{1...12}$ /12= 52.99 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.55 (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=	82	79.02	76.04	73.06	70.08	67.09	67.09	70.08	73.06	76.04	79.02	82	

Total = Sum(44)$_{1...12}$ = 894.6 (44)

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

(45)m=	121.61	106.36	109.76	95.69	91.81	79.23	73.42	84.25	85.25	99.35	108.45	117.77	

Total = Sum(45)$_{1...12}$ = 1172.96 (45)

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

(46)m=	18.24	15.95	16.46	14.35	13.77	11.88	11.01	12.64	12.79	14.9	16.27	17.67	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

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

(62)m=	168.21	148.45	156.35	140.78	138.41	124.32	120.01	130.84	130.35	145.95	153.55	164.37	(62)

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

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

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

Output from water heater

(64)m=	168.21	148.45	156.35	140.78	138.41	124.32	120.01	130.84	130.35	145.95	153.55	164.37

Output from water heater (annual)$_{1...12}$ | 1721.58 | (64)

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

(65)m=	77.71	69.03	73.77	67.89	67.8	62.42	61.69	65.29	64.42	70.31	72.13	76.44	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	(66)

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

(67)m=	13.22	11.74	9.55	7.23	5.4	4.56	4.93	6.41	8.6	10.92	12.75	13.59	(67)

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

(68)m=	148.01	149.55	145.68	137.44	127.04	117.26	110.73	109.2	113.07	121.31	131.71	141.48	(68)

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

(69)m=	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	(71)

Water heating gains (Table 5)

(72)m=	104.45	102.73	99.15	94.29	91.13	86.69	82.91	87.75	89.47	94.5	100.19	102.74	(72)

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

(73)m=	317.17	315.51	305.87	290.44	275.06	260	250.06	254.84	262.62	278.22	296.12	309.29	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	8.01	x	19.64	x	0.63	x	0.7	=	48.08	(76)
East	0.9x	0.77	x	2.67	x	19.64	x	0.63	x	0.7	=	16.03	(76)

East	0.9x	0.77	x	8.01	x	38.42	x	0.63	x	0.7	=	94.05	(76)
East	0.9x	0.77	x	2.67	x	38.42	x	0.63	x	0.7	=	31.35	(76)
East	0.9x	0.77	x	8.01	x	63.27	x	0.63	x	0.7	=	154.89	(76)
East	0.9x	0.77	x	2.67	x	63.27	x	0.63	x	0.7	=	51.63	(76)
East	0.9x	0.77	x	8.01	x	92.28	x	0.63	x	0.7	=	225.9	(76)
East	0.9x	0.77	x	2.67	x	92.28	x	0.63	x	0.7	=	75.3	(76)
East	0.9x	0.77	x	8.01	x	113.09	x	0.63	x	0.7	=	276.85	(76)
East	0.9x	0.77	x	2.67	x	113.09	x	0.63	x	0.7	=	92.28	(76)
East	0.9x	0.77	x	8.01	x	115.77	x	0.63	x	0.7	=	283.4	(76)
East	0.9x	0.77	x	2.67	x	115.77	x	0.63	x	0.7	=	94.47	(76)
East	0.9x	0.77	x	8.01	x	110.22	x	0.63	x	0.7	=	269.81	(76)
East	0.9x	0.77	x	2.67	x	110.22	x	0.63	x	0.7	=	89.94	(76)
East	0.9x	0.77	x	8.01	x	94.68	x	0.63	x	0.7	=	231.76	(76)
East	0.9x	0.77	x	2.67	x	94.68	x	0.63	x	0.7	=	77.25	(76)
East	0.9x	0.77	x	8.01	x	73.59	x	0.63	x	0.7	=	180.14	(76)
East	0.9x	0.77	x	2.67	x	73.59	x	0.63	x	0.7	=	60.05	(76)
East	0.9x	0.77	x	8.01	x	45.59	x	0.63	x	0.7	=	111.6	(76)
East	0.9x	0.77	x	2.67	x	45.59	x	0.63	x	0.7	=	37.2	(76)
East	0.9x	0.77	x	8.01	x	24.49	x	0.63	x	0.7	=	59.95	(76)
East	0.9x	0.77	x	2.67	x	24.49	x	0.63	x	0.7	=	19.98	(76)
East	0.9x	0.77	x	8.01	x	16.15	x	0.63	x	0.7	=	39.54	(76)
East	0.9x	0.77	x	2.67	x	16.15	x	0.63	x	0.7	=	13.18	(76)

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

(83)m=	64.1	125.4	206.52	301.2	369.13	377.87	359.75	309.02	240.19	148.8	79.93	52.72	(83)

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

(84)m=	381.27	440.91	512.39	591.64	644.19	637.87	609.81	563.86	502.82	427.02	376.06	362.01	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.88	0.71	0.52	0.38	0.42	0.68	0.93	0.99	1	(86)

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

(87)m=	20.01	20.18	20.46	20.77	20.94	20.99	21	21	20.96	20.71	20.3	19.98	(87)

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

(88)m=	20.02	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	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	0.95	0.84	0.65	0.44	0.3	0.34	0.6	0.9	0.98	0.99	(89)

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

(90)m=	18.72	18.97	19.36	19.78	19.99	20.04	20.05	20.05	20.02	19.72	19.15	18.69	(90)

fLA = Living area ÷ (4) = | 0.59 | (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(92)m=	19.48	19.68	20.01	20.36	20.54	20.6	20.61	20.61	20.57	20.3	19.83	19.45		(92)

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

(93)m=	19.48	19.68	20.01	20.36	20.54	20.6	20.61	20.61	20.57	20.3	19.83	19.45		(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.98	0.95	0.85	0.69	0.49	0.34	0.39	0.65	0.91	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	377.74	432.21	485.82	505.48	441.56	310.58	209.24	218.9	325.78	388.57	368.79	359.38		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	817.75	794.38	724	607.21	467.59	313.96	209.65	219.69	340.1	512.91	675.87	813.36		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	327.36	243.38	177.21	73.24	19.37	0	0	0	0	92.5	221.1	337.76		
									Total per year (kWh/year) = Sum(98)1...5,9...12 =				1491.92	(98)

Space heating requirement in kWh/m²/year	29.66	(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)														
	327.36	243.38	177.21	73.24	19.37	0	0	0	0	92.5	221.1	337.76		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	350.12	260.3	189.53	78.33	20.72	0	0	0	0	98.93	236.47	361.24		
									Total (kWh/year) =Sum(211)1...5,10...12=				1595.64	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)1...5,10...12=				0	(215)

Water heating

Output from water heater (calculated above)														
	168.21	148.45	156.35	140.78	138.41	124.32	120.01	130.84	130.35	145.95	153.55	164.37		
Efficiency of water heater													79.8	(216)
(217)m=	86.56	86.12	85.15	83.16	80.98	79.8	79.8	79.8	79.8	83.64	85.79	86.69		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	194.32	172.36	183.62	169.28	170.93	155.79	150.39	163.96	163.34	174.51	178.99	189.59		
									Total = Sum(219a)1...12 =				2067.08	(219)

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Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1595.64	
Water heating fuel used			2067.08	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			233.51	(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	=	344.66	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	446.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =				791.15	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	121.19	(268)
Total CO2, kg/year			sum of (265)…(271) =		951.26	(272)
TER =					18.91	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.5.12

Property Address: E5-03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.7	(2a) =	201.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	201.15	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

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

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

0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			3.72	x1/[1/(1.4)+ 0.04]		=	4.93			(27)
Windows Type 2			1.87	x1/[1/(1.4)+ 0.04]		=	2.48			(27)
Windows Type 3			3.72	x1/[1/(1.4)+ 0.04]		=	4.93			(27)
Walls Type1	46.17	16.75	29.42	x	0.18	=	5.3			(29)
Walls Type2	11.07	1.89	9.18	x	0.18	=	1.65			(29)
Roof	74.5	0	74.5	x	0.13	=	9.68			(30)
Total area of elements, m²			131.74							(31)
Party wall			35.64	x	0	=	0			(32)
Party floor			74.5							(32a)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.73 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 15.75 (36)

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

Total fabric heat loss (33) + (36) = 56.48 (37)

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

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

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(38)m=	39.4	39.16	38.92	37.81	37.6	36.64	36.64	36.46	37.01	37.6	38.02	38.46	(38)

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

(39)m=	95.88	95.64	95.41	94.3	94.09	93.12	93.12	92.94	93.49	94.09	94.51	94.95	

Average = Sum(39)$_{1...12}$ /12= 94.3 (39)

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

(40)m=	1.29	1.28	1.28	1.27	1.26	1.25	1.25	1.25	1.25	1.26	1.27	1.27	

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (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=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02	

Total = Sum(44)$_{1...12}$ = 1080.22 (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=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21	

Total = Sum(45)$_{1...12}$ = 1416.34 (45)

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

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

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

(62)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81	(62)

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

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

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

Output from water heater

(64)m=	193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81

Output from water heater (annual)1…12 | 1964.96 | (64)

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

(65)m=	86.1	76.37	81.34	74.49	74.14	67.88	66.75	71.1	70.3	77.17	79.62	84.56	(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=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)

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

(67)m=	18.5	16.43	13.36	10.12	7.56	6.39	6.9	8.97	12.04	15.28	17.84	19.02	(67)

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

(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)

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

(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)

Water heating gains (Table 5)

(72)m=	115.73	113.65	109.33	103.46	99.65	94.28	89.72	95.57	97.64	103.72	110.58	113.66	(72)

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

(73)m=	403.05	401.05	388.24	367.57	346.62	326.36	313.16	318.92	329.49	350.37	374.37	392.33	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	1.87	x	46.75	x	0.63	x	0.7	=	26.72	(78)
South	0.9x	0.77	x	3.72	x	46.75	x	0.63	x	0.7	=	106.3	(78)

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South	0.9x	0.77	x	1.87	x	76.57	x	0.63	x	0.7	=	43.76	(78)
South	0.9x	0.77	x	3.72	x	76.57	x	0.63	x	0.7	=	174.1	(78)
South	0.9x	0.77	x	1.87	x	97.53	x	0.63	x	0.7	=	55.74	(78)
South	0.9x	0.77	x	3.72	x	97.53	x	0.63	x	0.7	=	221.77	(78)
South	0.9x	0.77	x	1.87	x	110.23	x	0.63	x	0.7	=	63	(78)
South	0.9x	0.77	x	3.72	x	110.23	x	0.63	x	0.7	=	250.65	(78)
South	0.9x	0.77	x	1.87	x	114.87	x	0.63	x	0.7	=	65.65	(78)
South	0.9x	0.77	x	3.72	x	114.87	x	0.63	x	0.7	=	261.19	(78)
South	0.9x	0.77	x	1.87	x	110.55	x	0.63	x	0.7	=	63.18	(78)
South	0.9x	0.77	x	3.72	x	110.55	x	0.63	x	0.7	=	251.36	(78)
South	0.9x	0.77	x	1.87	x	108.01	x	0.63	x	0.7	=	61.73	(78)
South	0.9x	0.77	x	3.72	x	108.01	x	0.63	x	0.7	=	245.59	(78)
South	0.9x	0.77	x	1.87	x	104.89	x	0.63	x	0.7	=	59.95	(78)
South	0.9x	0.77	x	3.72	x	104.89	x	0.63	x	0.7	=	238.51	(78)
South	0.9x	0.77	x	1.87	x	101.89	x	0.63	x	0.7	=	58.23	(78)
South	0.9x	0.77	x	3.72	x	101.89	x	0.63	x	0.7	=	231.66	(78)
South	0.9x	0.77	x	1.87	x	82.59	x	0.63	x	0.7	=	47.2	(78)
South	0.9x	0.77	x	3.72	x	82.59	x	0.63	x	0.7	=	187.78	(78)
South	0.9x	0.77	x	1.87	x	55.42	x	0.63	x	0.7	=	31.67	(78)
South	0.9x	0.77	x	3.72	x	55.42	x	0.63	x	0.7	=	126.01	(78)
South	0.9x	0.77	x	1.87	x	40.4	x	0.63	x	0.7	=	23.09	(78)
South	0.9x	0.77	x	3.72	x	40.4	x	0.63	x	0.7	=	91.86	(78)
West	0.9x	0.77	x	3.72	x	19.64	x	0.63	x	0.7	=	44.66	(80)
West	0.9x	0.77	x	3.72	x	38.42	x	0.63	x	0.7	=	87.36	(80)
West	0.9x	0.77	x	3.72	x	63.27	x	0.63	x	0.7	=	143.87	(80)
West	0.9x	0.77	x	3.72	x	92.28	x	0.63	x	0.7	=	209.82	(80)
West	0.9x	0.77	x	3.72	x	113.09	x	0.63	x	0.7	=	257.15	(80)
West	0.9x	0.77	x	3.72	x	115.77	x	0.63	x	0.7	=	263.23	(80)
West	0.9x	0.77	x	3.72	x	110.22	x	0.63	x	0.7	=	250.61	(80)
West	0.9x	0.77	x	3.72	x	94.68	x	0.63	x	0.7	=	215.27	(80)
West	0.9x	0.77	x	3.72	x	73.59	x	0.63	x	0.7	=	167.32	(80)
West	0.9x	0.77	x	3.72	x	45.59	x	0.63	x	0.7	=	103.66	(80)
West	0.9x	0.77	x	3.72	x	24.49	x	0.63	x	0.7	=	55.68	(80)
West	0.9x	0.77	x	3.72	x	16.15	x	0.63	x	0.7	=	36.72	(80)

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

(83)m=	177.68	305.21	421.38	523.47	583.98	577.77	557.93	513.72	457.22	338.64	213.36	151.67	(83)

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

(84)m=	580.73	706.27	809.62	891.04	930.6	904.13	871.09	832.64	786.7	689	587.73	544	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.46	0.5	0.73	0.93	0.99	1	(86)

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

(87)m=	19.74	19.96	20.26	20.59	20.84	20.96	20.99	20.99	20.92	20.59	20.09	19.7	(87)

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

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

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

(89)m=	0.99	0.98	0.95	0.88	0.74	0.53	0.35	0.39	0.64	0.91	0.98	0.99	(89)

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

(90)m=	18.2	18.52	18.95	19.41	19.72	19.86	19.88	19.88	19.82	19.42	18.73	18.15	(90)

fLA = Living area ÷ (4) = 0.36 (91)

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

(92)m=	18.76	19.04	19.42	19.84	20.12	20.25	20.28	20.28	20.21	19.84	19.22	18.71	(92)

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

(93)m=	18.76	19.04	19.42	19.84	20.12	20.25	20.28	20.28	20.21	19.84	19.22	18.71	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.75	0.56	0.39	0.43	0.67	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	574.49	688.89	765.51	782.02	699.4	508.37	339.96	356.39	529.77	623.02	574.56	539.53	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1386.09	1352.44	1232.47	1031.29	792.35	526.48	342.55	360.38	571.46	869.33	1145.39	1377.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	603.83	445.91	347.42	179.47	69.16	0	0	0	0	183.26	411	623.57	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2863.62 (98)

Space heating requirement in kWh/m²/year 38.44 (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)													
	603.83	445.91	347.42	179.47	69.16	0	0	0	0	183.26	411	623.57	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	645.8	476.91	371.58	191.95	73.97	0	0	0	0	196	439.57	666.92	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3062.69 (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)

193.44	170.52	179.12	160.63	157.46	140.76	135.25	148.32	148.03	166.56	176.05	188.81

Efficiency of water heater 79.8 (216)

(217)m=	87.65	87.26	86.55	85.11	82.79	79.8	79.8	79.8	79.8	85.07	87	87.76	(217)

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

(219)m=	220.7	195.4	206.96	188.74	190.2	176.39	169.48	185.87	185.51	195.8	202.35	215.13

Total = Sum(219a)$_{1...12}$ = 2332.52 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3062.69	
Water heating fuel used		2332.52	
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		326.75	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	661.54	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1165.37	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	169.58	(268)
Total CO2, kg/year		sum of (265)…(271) =		1373.88	(272)

TER = 18.44 (273)

TER WorkSheet: New dwelling design stage

User Details:

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

Property Address: EB1-04

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	72.7	(1a)	x	2.7	(2a)	=	196.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.7	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	196.29	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

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

TER WorkSheet: New dwelling design stage

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

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

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

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			2.55	x1/[1/(1.4)+ 0.04]		=	3.38			(27)
Windows Type 2			2.55	x1/[1/(1.4)+ 0.04]		=	3.38			(27)
Windows Type 3			5.07	x1/[1/(1.4)+ 0.04]		=	6.72			(27)
Windows Type 4			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Windows Type 5			2.04	x1/[1/(1.4)+ 0.04]		=	2.7			(27)
Floor			72.7	x	0.13	=	9.450999			(28)
Walls	43.2	18.18	25.02	x	0.18	=	4.5			(29)
Total area of elements, m²			115.9							(31)
Party wall			49.14	x	0	=	0			(32)
Party ceiling			72.7							(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.44 (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 8.84 (36)

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

Total fabric heat loss (33) + (36) = 46.28 (37)

TER WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.56	38.32	38.09	36.98	36.78	35.81	35.81	35.64	36.19	36.78	37.19	37.63	(38)

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

(39)m=	84.85	84.61	84.37	83.27	83.06	82.1	82.1	81.92	82.47	83.06	83.48	83.91	

Average = Sum(39)$_{1\ldots12}$ /12= 83.27 (39)

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

(40)m=	1.17	1.16	1.16	1.15	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.15	

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 2.31 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.06 (43)

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

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

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

(44)m=	97.96	94.4	90.84	87.28	83.72	80.15	80.15	83.72	87.28	90.84	94.4	97.96	

Total = Sum(44)$_{1\ldots12}$ = 1068.71 (44)

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

(45)m=	145.28	127.06	131.12	114.31	109.68	94.65	87.71	100.64	101.85	118.69	129.56	140.69	

Total = Sum(45)$_{1\ldots12}$ = 1401.24 (45)

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

(46)m=	21.79	19.06	19.67	17.15	16.45	14.2	13.16	15.1	15.28	17.8	19.43	21.1	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

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

(62)m=	191.87	169.15	177.71	159.4	156.28	139.74	134.3	147.24	146.94	165.29	174.65	187.29	(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=	191.87	169.15	177.71	159.4	156.28	139.74	134.3	147.24	146.94	165.29	174.65	187.29

Output from water heater (annual)$_{1...12}$ — 1949.86 (64)

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

(65)m=	85.58	75.92	80.87	74.08	73.75	67.54	66.44	70.74	69.94	76.74	79.15	84.06	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	(66)

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

(67)m=	18.14	16.11	13.1	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)

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

(68)m=	203.51	205.63	200.3	188.98	174.67	161.23	152.25	150.14	155.46	166.79	181.09	194.54	(68)

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

(69)m=	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	(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=	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	(71)

Water heating gains (Table 5)

(72)m=	115.03	112.97	108.7	102.89	99.12	93.81	89.3	95.08	97.14	103.15	109.93	112.98	(72)

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

(73)m=	397.33	395.36	382.76	362.44	341.86	321.95	308.96	314.66	325.05	345.57	369.17	386.81	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	2.55	x	10.63	x	0.63	x	0.7	=	8.29	(74)
North	0.9x	0.77	x	2.04	x	10.63	x	0.63	x	0.7	=	6.63	(74)
North	0.9x	0.77	x	2.55	x	20.32	x	0.63	x	0.7	=	15.84	(74)
North	0.9x	0.77	x	2.04	x	20.32	x	0.63	x	0.7	=	12.67	(74)
North	0.9x	0.77	x	2.55	x	34.53	x	0.63	x	0.7	=	26.91	(74)
North	0.9x	0.77	x	2.04	x	34.53	x	0.63	x	0.7	=	21.53	(74)
North	0.9x	0.77	x	2.55	x	55.46	x	0.63	x	0.7	=	43.22	(74)
North	0.9x	0.77	x	2.04	x	55.46	x	0.63	x	0.7	=	34.58	(74)
North	0.9x	0.77	x	2.55	x	74.72	x	0.63	x	0.7	=	58.23	(74)
North	0.9x	0.77	x	2.04	x	74.72	x	0.63	x	0.7	=	46.58	(74)
North	0.9x	0.77	x	2.55	x	79.99	x	0.63	x	0.7	=	62.33	(74)
North	0.9x	0.77	x	2.04	x	79.99	x	0.63	x	0.7	=	49.87	(74)
North	0.9x	0.77	x	2.55	x	74.68	x	0.63	x	0.7	=	58.2	(74)
North	0.9x	0.77	x	2.04	x	74.68	x	0.63	x	0.7	=	46.56	(74)
North	0.9x	0.77	x	2.55	x	59.25	x	0.63	x	0.7	=	46.17	(74)
North	0.9x	0.77	x	2.04	x	59.25	x	0.63	x	0.7	=	36.94	(74)
North	0.9x	0.77	x	2.55	x	41.52	x	0.63	x	0.7	=	32.35	(74)
North	0.9x	0.77	x	2.04	x	41.52	x	0.63	x	0.7	=	25.88	(74)
North	0.9x	0.77	x	2.55	x	24.19	x	0.63	x	0.7	=	18.85	(74)
North	0.9x	0.77	x	2.04	x	24.19	x	0.63	x	0.7	=	15.08	(74)
North	0.9x	0.77	x	2.55	x	13.12	x	0.63	x	0.7	=	10.22	(74)
North	0.9x	0.77	x	2.04	x	13.12	x	0.63	x	0.7	=	8.18	(74)
North	0.9x	0.77	x	2.55	x	8.86	x	0.63	x	0.7	=	6.91	(74)
North	0.9x	0.77	x	2.04	x	8.86	x	0.63	x	0.7	=	5.53	(74)
South	0.9x	0.77	x	2.55	x	46.75	x	0.63	x	0.7	=	36.43	(78)
South	0.9x	0.77	x	5.07	x	46.75	x	0.63	x	0.7	=	72.44	(78)
South	0.9x	0.77	x	2.04	x	46.75	x	0.63	x	0.7	=	58.3	(78)
South	0.9x	0.77	x	2.55	x	76.57	x	0.63	x	0.7	=	59.67	(78)
South	0.9x	0.77	x	5.07	x	76.57	x	0.63	x	0.7	=	118.64	(78)
South	0.9x	0.77	x	2.04	x	76.57	x	0.63	x	0.7	=	95.47	(78)
South	0.9x	0.77	x	2.55	x	97.53	x	0.63	x	0.7	=	76.01	(78)
South	0.9x	0.77	x	5.07	x	97.53	x	0.63	x	0.7	=	151.12	(78)
South	0.9x	0.77	x	2.04	x	97.53	x	0.63	x	0.7	=	121.62	(78)
South	0.9x	0.77	x	2.55	x	110.23	x	0.63	x	0.7	=	85.91	(78)
South	0.9x	0.77	x	5.07	x	110.23	x	0.63	x	0.7	=	170.8	(78)
South	0.9x	0.77	x	2.04	x	110.23	x	0.63	x	0.7	=	137.45	(78)
South	0.9x	0.77	x	2.55	x	114.87	x	0.63	x	0.7	=	89.52	(78)
South	0.9x	0.77	x	5.07	x	114.87	x	0.63	x	0.7	=	177.99	(78)
South	0.9x	0.77	x	2.04	x	114.87	x	0.63	x	0.7	=	143.23	(78)
South	0.9x	0.77	x	2.55	x	110.55	x	0.63	x	0.7	=	86.15	(78)
South	0.9x	0.77	x	5.07	x	110.55	x	0.63	x	0.7	=	171.29	(78)

South	0.9x	0.77	x	2.04	x	110.55	x	0.63	x	0.7	=	137.84	(78)
South	0.9x	0.77	x	2.55	x	108.01	x	0.63	x	0.7	=	84.18	(78)
South	0.9x	0.77	x	5.07	x	108.01	x	0.63	x	0.7	=	167.36	(78)
South	0.9x	0.77	x	2.04	x	108.01	x	0.63	x	0.7	=	134.68	(78)
South	0.9x	0.77	x	2.55	x	104.89	x	0.63	x	0.7	=	81.75	(78)
South	0.9x	0.77	x	5.07	x	104.89	x	0.63	x	0.7	=	162.53	(78)
South	0.9x	0.77	x	2.04	x	104.89	x	0.63	x	0.7	=	130.79	(78)
South	0.9x	0.77	x	2.55	x	101.89	x	0.63	x	0.7	=	79.4	(78)
South	0.9x	0.77	x	5.07	x	101.89	x	0.63	x	0.7	=	157.87	(78)
South	0.9x	0.77	x	2.04	x	101.89	x	0.63	x	0.7	=	127.04	(78)
South	0.9x	0.77	x	2.55	x	82.59	x	0.63	x	0.7	=	64.36	(78)
South	0.9x	0.77	x	5.07	x	82.59	x	0.63	x	0.7	=	127.96	(78)
South	0.9x	0.77	x	2.04	x	82.59	x	0.63	x	0.7	=	102.98	(78)
South	0.9x	0.77	x	2.55	x	55.42	x	0.63	x	0.7	=	43.19	(78)
South	0.9x	0.77	x	5.07	x	55.42	x	0.63	x	0.7	=	85.87	(78)
South	0.9x	0.77	x	2.04	x	55.42	x	0.63	x	0.7	=	69.1	(78)
South	0.9x	0.77	x	2.55	x	40.4	x	0.63	x	0.7	=	31.48	(78)
South	0.9x	0.77	x	5.07	x	40.4	x	0.63	x	0.7	=	62.6	(78)
South	0.9x	0.77	x	2.04	x	40.4	x	0.63	x	0.7	=	50.37	(78)

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

(83)m=	182.09	302.29	397.19	471.97	515.55	507.48	490.97	458.18	422.55	329.23	216.55	156.89	(83)

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

(84)m=	579.42	697.65	779.94	834.4	857.41	829.44	799.93	772.84	747.6	674.8	585.72	543.69	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.61	0.45	0.48	0.71	0.92	0.98	0.99	(86)

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

(87)m=	19.92	20.13	20.39	20.67	20.88	20.97	21	20.99	20.95	20.68	20.25	19.88	(87)

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

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

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

(89)m=	0.99	0.98	0.95	0.87	0.73	0.52	0.35	0.38	0.62	0.89	0.98	0.99	(89)

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

(90)m=	18.53	18.83	19.2	19.6	19.85	19.96	19.98	19.98	19.93	19.63	19.01	18.48	(90)

fLA = Living area ÷ (4) = | 0.5 | (91)

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

(92)m=	19.22	19.48	19.8	20.14	20.37	20.47	20.49	20.49	20.44	20.16	19.63	19.18	(92)

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

(93)m=	19.22	19.48	19.8	20.14	20.37	20.47	20.49	20.49	20.44	20.16	19.63	19.18	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.88	0.75	0.57	0.4	0.43	0.66	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	572.89	679.29	736.23	732.92	646.7	468.75	317.39	332.16	494.16	603.68	571.36	539.04	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1266.19	1233.77	1121.87	935.66	719.78	481.89	319.17	334.82	523.03	793.92	1046.14	1257.12	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	515.82	372.61	286.91	145.97	54.37	0	0	0	0	141.54	341.84	534.26	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2393.32 (98)

Space heating requirement in kWh/m²/year 32.92 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [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)													
	515.82	372.61	286.91	145.97	54.37	0	0	0	0	141.54	341.84	534.26	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	551.68	398.51	306.86	156.12	58.15	0	0	0	0	151.38	365.6	571.4	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2559.71 (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)													
	191.87	169.15	177.71	159.4	156.28	139.74	134.3	147.24	146.94	165.29	174.65	187.29	
Efficiency of water heater												79.8	(216)
(217)m=	87.33	86.86	86.09	84.58	82.31	79.8	79.8	79.8	79.8	84.4	86.57	87.46	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	219.72	194.73	206.44	188.46	189.86	175.11	168.3	184.51	184.13	195.83	201.74	214.15	

Total = Sum(219a)$_{1...12}$ = 2322.98 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2559.71

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Water heating fuel used			2322.98	
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			320.39	(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	=	552.9	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	501.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1054.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	166.28	(268)
Total CO2, kg/year		sum of (265)…(271) =		1259.87	(272)

TER = 17.33	(273)

DRAFT

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.12

Property Address: W1-03

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	233.28	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(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) =	0.32	(21)

Infiltration rate modified for monthly wind speed

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			5.28	x1/[1/(1.4)+ 0.04]		=	7			(27)
Windows Type 2			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 3			5.28	x1/[1/(1.4)+ 0.04]		=	7			(27)
Windows Type 4			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 5			2.18	x1/[1/(1.4)+ 0.04]		=	2.89			(27)
Floor			86.4	x	0.13	=	11.232			(28)
Walls Type1	48.6	18.02	30.58	x	0.18	=	5.5			(29)
Walls Type2	14.31	1.89	12.42	x	0.18	=	2.24			(29)
Total area of elements, m²			149.31							(31)
Party wall			43.75	x	0	=	0			(32)
Party ceiling			86.4							(32b)

** 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) = 44.75 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6480 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.44 (36)

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

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Total fabric heat loss	(33) + (36) =	56.2	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

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

(39)m=	101.17	100.91	100.67	99.51	99.29	98.28	98.28	98.1	98.67	99.29	99.73	100.19	

Average = Sum(39)$_{1…12}$ /12= 99.51 (39)

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

(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.15	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 — 2.57 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 95.31 (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=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1…12}$ = 1143.75 (44)

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

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1…12}$ = 1499.64 (45)

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

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		150	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

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

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

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

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

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

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

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

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

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

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

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

(62)m=	202.08	178.07	186.92	167.43	163.98	146.39	140.46	154.31	154.09	173.62	183.75	197.17	(62)

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

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

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

Output from water heater

(64)m=	202.08	178.07	186.92	167.43	163.98	146.39	140.46	154.31	154.09	173.62	183.75	197.17	

Output from water heater (annual)$_{1...12}$ | 2048.26 | (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=	88.97	78.88	83.93	76.75	76.31	69.75	68.49	73.09	72.32	79.51	82.18	87.34	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

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

(67)m=	20.78	18.45	15.01	11.36	8.49	7.17	7.75	10.07	13.52	17.16	20.03	21.35	(67)

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

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

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

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(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=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	119.59	117.39	112.81	106.6	102.56	96.88	92.05	98.24	100.44	106.87	114.14	117.4	(72)

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

(73)m=	437.26	435.14	421.05	398.26	375.03	352.68	338.18	344.28	356	379.01	405.47	425.39	(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	5.28	x	10.63	x	0.63	x	0.7	=	17.16	(74)
North	0.9x	0.77	x	2.64	x	10.63	x	0.63	x	0.7	=	8.58	(74)
North	0.9x	0.77	x	5.28	x	20.32	x	0.63	x	0.7	=	32.79	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.63	x	0.7	=	16.4	(74)
North	0.9x	0.77	x	5.28	x	34.53	x	0.63	x	0.7	=	55.72	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.63	x	0.7	=	27.86	(74)
North	0.9x	0.77	x	5.28	x	55.46	x	0.63	x	0.7	=	89.5	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.63	x	0.7	=	44.75	(74)
North	0.9x	0.77	x	5.28	x	74.72	x	0.63	x	0.7	=	120.56	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.63	x	0.7	=	60.28	(74)
North	0.9x	0.77	x	5.28	x	79.99	x	0.63	x	0.7	=	129.07	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.63	x	0.7	=	64.53	(74)
North	0.9x	0.77	x	5.28	x	74.68	x	0.63	x	0.7	=	120.5	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.63	x	0.7	=	60.25	(74)
North	0.9x	0.77	x	5.28	x	59.25	x	0.63	x	0.7	=	95.6	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.63	x	0.7	=	47.8	(74)
North	0.9x	0.77	x	5.28	x	41.52	x	0.63	x	0.7	=	66.99	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.63	x	0.7	=	33.5	(74)
North	0.9x	0.77	x	5.28	x	24.19	x	0.63	x	0.7	=	39.03	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.63	x	0.7	=	19.52	(74)
North	0.9x	0.77	x	5.28	x	13.12	x	0.63	x	0.7	=	21.17	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.63	x	0.7	=	10.58	(74)
North	0.9x	0.77	x	5.28	x	8.86	x	0.63	x	0.7	=	14.3	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.63	x	0.7	=	7.15	(74)
South	0.9x	0.77	x	5.28	x	46.75	x	0.63	x	0.7	=	75.44	(78)
South	0.9x	0.77	x	2.64	x	46.75	x	0.63	x	0.7	=	37.72	(78)
South	0.9x	0.77	x	2.18	x	46.75	x	0.63	x	0.7	=	31.15	(78)
South	0.9x	0.77	x	5.28	x	76.57	x	0.63	x	0.7	=	123.55	(78)
South	0.9x	0.77	x	2.64	x	76.57	x	0.63	x	0.7	=	61.78	(78)
South	0.9x	0.77	x	2.18	x	76.57	x	0.63	x	0.7	=	51.01	(78)
South	0.9x	0.77	x	5.28	x	97.53	x	0.63	x	0.7	=	157.38	(78)
South	0.9x	0.77	x	2.64	x	97.53	x	0.63	x	0.7	=	78.69	(78)
South	0.9x	0.77	x	2.18	x	97.53	x	0.63	x	0.7	=	64.98	(78)
South	0.9x	0.77	x	5.28	x	110.23	x	0.63	x	0.7	=	177.88	(78)
South	0.9x	0.77	x	2.64	x	110.23	x	0.63	x	0.7	=	88.94	(78)
South	0.9x	0.77	x	2.18	x	110.23	x	0.63	x	0.7	=	73.44	(78)
South	0.9x	0.77	x	5.28	x	114.87	x	0.63	x	0.7	=	185.36	(78)
South	0.9x	0.77	x	2.64	x	114.87	x	0.63	x	0.7	=	92.68	(78)
South	0.9x	0.77	x	2.18	x	114.87	x	0.63	x	0.7	=	76.53	(78)

South	0.9x	0.77	x	5.28	x	110.55	x	0.63	x	0.7	=	178.38	(78)
South	0.9x	0.77	x	2.64	x	110.55	x	0.63	x	0.7	=	89.19	(78)
South	0.9x	0.77	x	2.18	x	110.55	x	0.63	x	0.7	=	73.65	(78)
South	0.9x	0.77	x	5.28	x	108.01	x	0.63	x	0.7	=	174.29	(78)
South	0.9x	0.77	x	2.64	x	108.01	x	0.63	x	0.7	=	87.15	(78)
South	0.9x	0.77	x	2.18	x	108.01	x	0.63	x	0.7	=	71.96	(78)
South	0.9x	0.77	x	5.28	x	104.89	x	0.63	x	0.7	=	169.26	(78)
South	0.9x	0.77	x	2.64	x	104.89	x	0.63	x	0.7	=	84.63	(78)
South	0.9x	0.77	x	2.18	x	104.89	x	0.63	x	0.7	=	69.88	(78)
South	0.9x	0.77	x	5.28	x	101.89	x	0.63	x	0.7	=	164.41	(78)
South	0.9x	0.77	x	2.64	x	101.89	x	0.63	x	0.7	=	82.2	(78)
South	0.9x	0.77	x	2.18	x	101.89	x	0.63	x	0.7	=	67.88	(78)
South	0.9x	0.77	x	5.28	x	82.59	x	0.63	x	0.7	=	133.26	(78)
South	0.9x	0.77	x	2.64	x	82.59	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.18	x	82.59	x	0.63	x	0.7	=	55.02	(78)
South	0.9x	0.77	x	5.28	x	55.42	x	0.63	x	0.7	=	89.42	(78)
South	0.9x	0.77	x	2.64	x	55.42	x	0.63	x	0.7	=	44.71	(78)
South	0.9x	0.77	x	2.18	x	55.42	x	0.63	x	0.7	=	36.92	(78)
South	0.9x	0.77	x	5.28	x	40.4	x	0.63	x	0.7	=	65.19	(78)
South	0.9x	0.77	x	2.64	x	40.4	x	0.63	x	0.7	=	32.59	(78)
South	0.9x	0.77	x	2.18	x	40.4	x	0.63	x	0.7	=	26.91	(78)

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

(83)m=	170.05	285.53	384.64	474.51	535.42	534.83	514.15	467.18	414.98	313.47	202.81	146.15	(83)

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

(84)m=	607.31	720.67	805.69	872.77	910.45	887.51	852.33	811.46	770.98	692.48	608.28	571.55	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.67	0.5	0.54	0.78	0.95	0.99	1	(86)

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

(87)m=	19.83	20.01	20.27	20.58	20.83	20.96	20.99	20.99	20.91	20.59	20.15	19.79	(87)

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

(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95	(88)

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

(89)m=	0.99	0.99	0.97	0.91	0.79	0.58	0.39	0.43	0.7	0.93	0.99	1	(89)

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

(90)m=	18.39	18.66	19.04	19.48	19.8	19.94	19.97	19.97	19.9	19.51	18.87	18.35	(90)

fLA = Living area ÷ (4) = | 0.23 | (91)

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

(92)m=	18.73	18.98	19.33	19.73	20.04	20.18	20.21	20.21	20.14	19.76	19.17	18.69	(92)

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

(93)m=	18.73	18.98	19.33	19.73	20.04	20.18	20.21	20.21	20.14	19.76	19.17	18.69	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.91	0.79	0.6	0.41	0.46	0.71	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	602.67	708.24	774.81	792.81	721.18	529.31	352.09	369.43	549.18	640.49	598.27	568.23	(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=	1459.49	1420.88	1291.08	1078.17	827.88	548.63	354.53	373.38	595.74	909.58	1203.84	1451.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	637.47	478.9	384.1	205.46	79.39	0	0	0	0	200.21	436.01	657.06	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3078.6 (98)

Space heating requirement in kWh/m²/year 35.63 (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)													
	637.47	478.9	384.1	205.46	79.39	0	0	0	0	200.21	436.01	657.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	681.79	512.19	410.8	219.74	84.91	0	0	0	0	214.12	466.32	702.74	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3292.62 (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)

202.08	178.07	186.92	167.43	163.98	146.39	140.46	154.31	154.09	173.62	183.75	197.17

Efficiency of water heater 79.8 (216)

(217)m=	87.67	87.33	86.69	85.36	83	79.8	79.8	79.8	79.8	85.19	87.04	87.78	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	230.49	203.91	215.61	196.14	197.56	183.44	176.01	193.37	193.09	203.79	211.11	224.61

Total = Sum(219a)$_{1...12}$ = 2429.15 (219)

TER WorkSheet: New dwelling design stage

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			3292.62	
Water heating fuel used			2429.15	
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			366.92	(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	=	711.21	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	524.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1235.9	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	190.43	(268)
Total CO2, kg/year			sum of (265)…(271) =		1465.26	(272)
TER =					16.96	(273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.12

Property Address: W2-01

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	94.3	(1a) x	2.7	(2a) =	254.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	254.61	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.12	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.37	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

TER WorkSheet: New dwelling design stage

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			6.48	x1/[1/(1.4)+ 0.04]		=	8.59			(27)
Windows Type 2			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Floor			94.3	x	0.13	=	12.259			(28)
Walls Type1	66.42	19.68	46.74	x	0.18	=	8.41			(29)
Walls Type2	5.67	1.89	3.78	x	0.18	=	0.68			(29)
Total area of elements, m²			166.39							(31)
Party wall			42.75	x	0	=	0			(32)
Party ceiling			94.3							(32b)

** 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) = 49.33 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7072.5 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.8 (36)

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

Total fabric heat loss (33) + (36) = 61.13 (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=	48.69	48.43	48.17	46.98	46.76	45.72	45.72	45.52	46.12	46.76	47.21	47.68	(38)

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

(39)m=	109.82	109.56	109.3	108.11	107.89	106.85	106.85	106.66	107.25	107.89	108.34	108.81	

Average = Sum(39)$_{1…12}$ /12= 108.11 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	1.16	1.16	1.16	1.15	1.14	1.13	1.13	1.13	1.14	1.14	1.15	1.15		
										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	2.68	(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	97.85	(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=	107.64	103.72	99.81	95.9	91.98	88.07	88.07	91.98	95.9	99.81	103.72	107.64		
										Total = Sum(44)1…12 =			1174.24	(44)

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

(45)m=	159.62	139.61	144.06	125.6	120.51	103.99	96.37	110.58	111.9	130.41	142.35	154.59		
										Total = Sum(45)1…12 =			1539.61	(45)

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

(46)m=	23.94	20.94	21.61	18.84	18.08	15.6	14.45	16.59	16.79	19.56	21.35	23.19	(46)

Water storage loss:

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

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

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

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

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

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

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

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

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

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

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

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

(62)m=	206.22	181.69	190.66	170.69	167.11	149.09	142.96	157.18	156.99	177.01	187.45	201.18	(62)

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

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

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

Output from water heater

(64)m=	206.22	181.69	190.66	170.69	167.11	149.09	142.96	157.18	156.99	177.01	187.45	201.18

Output from water heater (annual)$_{1...12}$ | 2088.23 | (64)

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

(65)m=	90.35	80.09	85.18	77.83	77.35	70.65	69.32	74.04	73.28	80.64	83.41	88.68	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	22.07	19.6	15.94	12.07	9.02	7.62	8.23	10.7	14.36	18.23	21.28	22.68	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	246.77	249.33	242.88	229.14	211.8	195.5	184.61	182.05	188.51	202.24	219.58	235.88	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	(71)
Water heating gains (Table 5)													
(72)m=	121.44	119.18	114.49	108.1	103.96	98.13	93.17	99.52	101.78	108.38	115.84	119.19	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	456.48	454.31	439.51	415.52	390.98	367.45	352.21	358.47	370.84	395.06	422.91	443.96	(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)	
West	0.9x	0.77	x	6.48	x	19.64	x	0.63	x	0.7	=	38.9	(80)
West	0.9x	0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	79.23	(80)
West	0.9x	0.77	x	6.48	x	38.42	x	0.63	x	0.7	=	76.09	(80)
West	0.9x	0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	154.99	(80)
West	0.9x	0.77	x	6.48	x	63.27	x	0.63	x	0.7	=	125.3	(80)

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West	0.9x	0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	255.25	(80)
West	0.9x	0.77	x	6.48	x	92.28	x	0.63	x	0.7	=	182.75	(80)
West	0.9x	0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	372.27	(80)
West	0.9x	0.77	x	6.48	x	113.09	x	0.63	x	0.7	=	223.97	(80)
West	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	456.23	(80)
West	0.9x	0.77	x	6.48	x	115.77	x	0.63	x	0.7	=	229.27	(80)
West	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	467.03	(80)
West	0.9x	0.77	x	6.48	x	110.22	x	0.63	x	0.7	=	218.27	(80)
West	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	444.63	(80)
West	0.9x	0.77	x	6.48	x	94.68	x	0.63	x	0.7	=	187.49	(80)
West	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	381.93	(80)
West	0.9x	0.77	x	6.48	x	73.59	x	0.63	x	0.7	=	145.73	(80)
West	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	296.87	(80)
West	0.9x	0.77	x	6.48	x	45.59	x	0.63	x	0.7	=	90.28	(80)
West	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	183.91	(80)
West	0.9x	0.77	x	6.48	x	24.49	x	0.63	x	0.7	=	48.5	(80)
West	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	98.79	(80)
West	0.9x	0.77	x	6.48	x	16.15	x	0.63	x	0.7	=	31.99	(80)
West	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	65.16	(80)

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

(83)m=	118.13	231.08	380.55	555.02	680.19	696.3	662.9	569.42	442.6	274.19	147.29	97.14	(83)

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

(84)m=	574.61	685.39	820.06	970.53	1071.18	1063.74	1015.12	927.9	813.44	669.25	570.19	541.1	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.62	0.46	0.52	0.79	0.97	1	1	(86)

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

(87)m=	19.75	19.92	20.22	20.6	20.86	20.97	20.99	20.99	20.91	20.53	20.07	19.72	(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	19.96	(88)

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

(89)m=	1	0.99	0.98	0.91	0.75	0.53	0.35	0.41	0.71	0.95	0.99	1	(89)

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

(90)m=	18.28	18.54	18.98	19.5	19.84	19.96	19.97	19.97	19.9	19.42	18.75	18.24	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	18.84	19.07	19.45	19.92	20.23	20.34	20.36	20.36	20.28	19.84	19.25	18.81	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.84	19.07	19.45	19.92	20.23	20.34	20.36	20.36	20.28	19.84	19.25	18.81	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	0.99	0.97	0.91	0.77	0.56	0.39	0.45	0.74	0.95	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	572.33	678.84	796.6	880.37	819.81	597.37	399.84	418.24	601.93	636.95	565.36	539.48		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1596.93	1552.34	1415.8	1191.52	919.97	613.78	402.03	422.46	663.12	997.32	1316.86	1589.46		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	762.3	586.99	460.68	224.03	74.52	0	0	0	0	268.12	541.08	781.18		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													3698.9	(98)
Space heating requirement in kWh/m²/year													39.22	(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)														
	762.3	586.99	460.68	224.03	74.52	0	0	0	0	268.12	541.08	781.18		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	815.3	627.8	492.71	239.6	79.7	0	0	0	0	286.75	578.69	835.49		
Total (kWh/year) =Sum(211)1...5,10...12=													3956.05	(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)														
	206.22	181.69	190.66	170.69	167.11	149.09	142.96	157.18	156.99	177.01	187.45	201.18		
Efficiency of water heater													79.8	(216)
(217)m=	87.99	87.72	87.08	85.54	82.82	79.8	79.8	79.8	79.8	85.92	87.48	88.08		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	234.37	207.13	218.94	199.54	201.77	186.83	179.15	196.96	196.73	206.02	214.27	228.41		
Total = Sum(219a)1...12 =													2470.12	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3956.05

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Water heating fuel used		2470.12	
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		389.76	(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	=	854.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1388.05	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.29	(268)
Total CO2, kg/year		sum of (265)…(271) =		1629.27	(272)

TER = 17.28 (273)

DRAFT

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User Details:

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

Property Address: W3-12

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.8	(1a) x	2.7	(2a) =	139.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.8	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		139.86	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

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

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

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

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.39	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	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			5.28	x1/[1/(1.4)+ 0.04]		=	7			(27)
Windows Type 2			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Walls Type1	18.36	7.92	10.44	x	0.18	=	1.88			(29)
Walls Type2	18.36	1.89	16.47	x	0.18	=	2.96			(29)
Total area of elements, m²			36.72							(31)
Party wall			37.5	x	0	=	0			(32)
Party floor			51.8							(32a)
Party ceiling			51.8							(32b)

** 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) = 17.23 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 2.82 (36)

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

Total fabric heat loss (33) + (36) = 20.06 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.56	26.42	26.29	25.67	25.55	25.01	25.01	24.91	25.22	25.55	25.79	26.03	(38)

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

(39)m=	46.61	46.48	46.35	45.72	45.61	45.06	45.06	44.96	45.27	45.61	45.84	46.09	

Average = Sum(39)$_{1…12}$ /12= 45.72 (39)

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

(40)m=	0.9	0.9	0.89	0.88	0.88	0.87	0.87	0.87	0.87	0.88	0.88	0.89

Average = Sum(40)$_{1…12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.74 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.6 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	83.16	80.14	77.11	74.09	71.06	68.04	68.04	71.06	74.09	77.11	80.14	83.16	
										Total = Sum(44)$_{1…12}$ =		907.2	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	123.32	107.86	111.3	97.04	93.11	80.35	74.45	85.43	86.45	100.75	109.98	119.43	
										Total = Sum(45)$_{1…12}$ =		1189.49	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.5	16.18	16.7	14.56	13.97	12.05	11.17	12.82	12.97	15.11	16.5	17.91	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

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

(62)m=	169.92	149.95	157.9	142.13	139.7	125.44	121.05	132.03	131.55	147.35	155.07	166.03	(62)

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

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

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

Output from water heater

(64)m=	169.92	149.95	157.9	142.13	139.7	125.44	121.05	132.03	131.55	147.35	155.07	166.03	

Output from water heater (annual)$_{1...12}$ 1738.1 (64)

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

(65)m=	78.28	69.53	74.28	68.34	68.23	62.79	62.03	65.68	64.82	70.78	72.64	76.99	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.26	12.66	10.3	7.8	5.83	4.92	5.32	6.91	9.28	11.78	13.75	14.66	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	151.91	153.48	149.51	141.05	130.38	120.35	113.64	112.07	116.04	124.5	135.17	145.2	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	(71)
Water heating gains (Table 5)													
(72)m=	105.22	103.47	99.84	94.91	91.71	87.21	83.38	88.28	90.03	95.13	100.89	103.48	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	323.53	321.77	311.8	295.91	280.07	264.62	254.48	259.41	267.49	283.55	301.96	315.49	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.28	x	19.64	x	0.63	x	0.7	=	31.69	(76)
East	0.9x	0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(76)
East	0.9x	0.77	x	5.28	x	38.42	x	0.63	x	0.7	=	62	(76)
East	0.9x	0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(76)
East	0.9x	0.77	x	5.28	x	63.27	x	0.63	x	0.7	=	102.1	(76)

East	0.9x	0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(76)
East	0.9x	0.77	x	5.28	x	92.28	x	0.63	x	0.7	=	148.91	(76)
East	0.9x	0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(76)
East	0.9x	0.77	x	5.28	x	113.09	x	0.63	x	0.7	=	182.49	(76)
East	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(76)
East	0.9x	0.77	x	5.28	x	115.77	x	0.63	x	0.7	=	186.81	(76)
East	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(76)
East	0.9x	0.77	x	5.28	x	110.22	x	0.63	x	0.7	=	177.85	(76)
East	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(76)
East	0.9x	0.77	x	5.28	x	94.68	x	0.63	x	0.7	=	152.77	(76)
East	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(76)
East	0.9x	0.77	x	5.28	x	73.59	x	0.63	x	0.7	=	118.75	(76)
East	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(76)
East	0.9x	0.77	x	5.28	x	45.59	x	0.63	x	0.7	=	73.56	(76)
East	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(76)
East	0.9x	0.77	x	5.28	x	24.49	x	0.63	x	0.7	=	39.52	(76)
East	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(76)
East	0.9x	0.77	x	5.28	x	16.15	x	0.63	x	0.7	=	26.06	(76)
East	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(76)

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

(83)m=	47.54	93	153.15	223.36	273.74	280.22	266.78	229.16	178.12	110.35	59.27	39.09	(83)

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

(84)m=	371.07	414.76	464.95	519.27	553.8	544.84	521.26	488.57	445.61	393.9	361.23	354.58	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.89	0.73	0.52	0.38	0.42	0.68	0.93	0.99	1	(86)

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

(87)m=	20.22	20.36	20.58	20.82	20.96	21	21	21	20.98	20.79	20.47	20.2	(87)

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

(88)m=	20.17	20.17	20.17	20.18	20.18	20.19	20.19	20.19	20.19	20.18	20.18	20.18	(88)

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

(89)m=	0.99	0.98	0.96	0.86	0.67	0.46	0.31	0.35	0.61	0.9	0.98	0.99	(89)

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

(90)m=	19.13	19.33	19.65	19.99	20.15	20.19	20.19	20.19	20.17	19.96	19.5	19.11	(90)

fLA = Living area ÷ (4) = | 0.45 | (91)

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

(92)m=	19.63	19.79	20.07	20.37	20.51	20.55	20.56	20.56	20.54	20.33	19.93	19.6	(92)

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

(93)m=	19.63	19.79	20.07	20.37	20.51	20.55	20.56	20.56	20.54	20.33	19.93	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=	0.99	0.98	0.95	0.87	0.7	0.49	0.34	0.38	0.64	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	367.85	407.49	443.72	449.71	385.51	266.75	178.2	186.69	284.19	357.7	354.36	352.17	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	714.39	692.25	628.7	524.24	401.95	268.31	178.33	186.96	291.49	443.95	588.38	709.75	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	257.82	191.36	137.63	53.66	12.23	0	0	0	0	64.17	168.49	266.04	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1151.4 (98)

Space heating requirement in kWh/m²/year 22.23 (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)														
	257.82	191.36	137.63	53.66	12.23	0	0	0	0	64.17	168.49	266.04		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	275.74	204.66	147.19	57.39	13.08	0	0	0	0	68.63	180.2	284.53		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													1231.44	(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)														
	169.92	149.95	157.9	142.13	139.7	125.44	121.05	132.03	131.55	147.35	155.07	166.03		
Efficiency of water heater													79.8	(216)
(217)m=	85.92	85.47	84.45	82.47	80.57	79.8	79.8	79.8	79.8	82.77	85.04	86.07		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	197.76	175.45	186.97	172.33	173.4	157.19	151.69	165.45	164.85	178.03	182.36	192.91		
Total = Sum(219a)$_{1...12}$ =													2098.38	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1231.44

Water heating fuel used			2098.38	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			251.82	(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	=	265.99	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	453.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			719.24	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	130.69	(268)
Total CO2, kg/year		sum of (265)…(271) =		888.86	(272)

TER = 17.16 (273)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.12

Property Address: W4-09

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	233.28	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(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) =	0.32	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			5.28	x1/[1/(1.4)+ 0.04]		=	7			(27)
Windows Type 2			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Windows Type 3			5.28	x1/[1/(1.4)+ 0.04]		=	7			(27)
Windows Type 4			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Walls Type1	48.6	18.48	30.12	x	0.18	=	5.42			(29)
Walls Type2	14.31	1.89	12.42	x	0.18	=	2.24			(29)
Roof	18.7	0	18.7	x	0.13	=	2.43			(30)
Total area of elements, m²			81.61							(31)
Party wall			43.75	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			67.7							(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.48 (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 12.46 (36)

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

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Total fabric heat loss	(33) + (36) =	48.94	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.97	44.72	44.47	43.31	43.1	42.09	42.09	41.9	42.48	43.1	43.54	43.99	(38)

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

(39)m=	93.91	93.66	93.41	92.25	92.04	91.03	91.03	90.84	91.42	92.04	92.47	92.93	

Average = $Sum(39)_{1...12}$ /12= 92.25 (39)

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

(40)m=	1.09	1.08	1.08	1.07	1.07	1.05	1.05	1.05	1.06	1.07	1.07	1.08	

Average = $Sum(40)_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = $Sum(44)_{1...12}$ = 1143.75 (44)

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

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = $Sum(45)_{1...12}$ = 1499.64 (45)

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

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

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

(62)m=	202.08	178.07	186.92	167.43	163.98	146.39	140.46	154.31	154.09	173.62	183.75	197.17	(62)

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

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

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

Output from water heater

(64)m=	202.08	178.07	186.92	167.43	163.98	146.39	140.46	154.31	154.09	173.62	183.75	197.17

Output from water heater (annual)$_{1...12}$ | 2048.26 | (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=	88.97	78.88	83.93	76.75	76.31	69.75	68.49	73.09	72.32	79.51	82.18	87.34	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

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

(67)m=	20.74	18.42	14.98	11.34	8.48	7.16	7.73	10.05	13.49	17.13	20	21.32	(67)

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

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

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

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(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=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	119.59	117.39	112.81	106.6	102.56	96.88	92.05	98.24	100.44	106.87	114.14	117.4	(72)

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

(73)m=	437.22	435.11	421.03	398.24	375.02	352.67	338.17	344.27	355.98	378.98	405.44	425.36	(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	5.28	x	10.63	x	0.63	x	0.7	=	17.16	(74)
North	0.9x	0.77	x	2.64	x	10.63	x	0.63	x	0.7	=	8.58	(74)
North	0.9x	0.77	x	5.28	x	20.32	x	0.63	x	0.7	=	32.79	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.63	x	0.7	=	16.4	(74)
North	0.9x	0.77	x	5.28	x	34.53	x	0.63	x	0.7	=	55.72	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.63	x	0.7	=	27.86	(74)
North	0.9x	0.77	x	5.28	x	55.46	x	0.63	x	0.7	=	89.5	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.63	x	0.7	=	44.75	(74)
North	0.9x	0.77	x	5.28	x	74.72	x	0.63	x	0.7	=	120.56	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.63	x	0.7	=	60.28	(74)
North	0.9x	0.77	x	5.28	x	79.99	x	0.63	x	0.7	=	129.07	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.63	x	0.7	=	64.53	(74)
North	0.9x	0.77	x	5.28	x	74.68	x	0.63	x	0.7	=	120.5	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.63	x	0.7	=	60.25	(74)
North	0.9x	0.77	x	5.28	x	59.25	x	0.63	x	0.7	=	95.6	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.63	x	0.7	=	47.8	(74)
North	0.9x	0.77	x	5.28	x	41.52	x	0.63	x	0.7	=	66.99	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.63	x	0.7	=	33.5	(74)
North	0.9x	0.77	x	5.28	x	24.19	x	0.63	x	0.7	=	39.03	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.63	x	0.7	=	19.52	(74)
North	0.9x	0.77	x	5.28	x	13.12	x	0.63	x	0.7	=	21.17	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.63	x	0.7	=	10.58	(74)
North	0.9x	0.77	x	5.28	x	8.86	x	0.63	x	0.7	=	14.3	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.63	x	0.7	=	7.15	(74)
South	0.9x	0.77	x	5.28	x	46.75	x	0.63	x	0.7	=	75.44	(78)
South	0.9x	0.77	x	2.64	x	46.75	x	0.63	x	0.7	=	75.44	(78)
South	0.9x	0.77	x	5.28	x	76.57	x	0.63	x	0.7	=	123.55	(78)
South	0.9x	0.77	x	2.64	x	76.57	x	0.63	x	0.7	=	123.55	(78)
South	0.9x	0.77	x	5.28	x	97.53	x	0.63	x	0.7	=	157.38	(78)
South	0.9x	0.77	x	2.64	x	97.53	x	0.63	x	0.7	=	157.38	(78)
South	0.9x	0.77	x	5.28	x	110.23	x	0.63	x	0.7	=	177.88	(78)
South	0.9x	0.77	x	2.64	x	110.23	x	0.63	x	0.7	=	177.88	(78)
South	0.9x	0.77	x	5.28	x	114.87	x	0.63	x	0.7	=	185.36	(78)
South	0.9x	0.77	x	2.64	x	114.87	x	0.63	x	0.7	=	185.36	(78)
South	0.9x	0.77	x	5.28	x	110.55	x	0.63	x	0.7	=	178.38	(78)
South	0.9x	0.77	x	2.64	x	110.55	x	0.63	x	0.7	=	178.38	(78)
South	0.9x	0.77	x	5.28	x	108.01	x	0.63	x	0.7	=	174.29	(78)
South	0.9x	0.77	x	2.64	x	108.01	x	0.63	x	0.7	=	174.29	(78)
South	0.9x	0.77	x	5.28	x	104.89	x	0.63	x	0.7	=	169.26	(78)

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South	0.9x	0.77	x	2.64	x	104.89	x	0.63	x	0.7	=	169.26	(78)
South	0.9x	0.77	x	5.28	x	101.89	x	0.63	x	0.7	=	164.41	(78)
South	0.9x	0.77	x	2.64	x	101.89	x	0.63	x	0.7	=	164.41	(78)
South	0.9x	0.77	x	5.28	x	82.59	x	0.63	x	0.7	=	133.26	(78)
South	0.9x	0.77	x	2.64	x	82.59	x	0.63	x	0.7	=	133.26	(78)
South	0.9x	0.77	x	5.28	x	55.42	x	0.63	x	0.7	=	89.42	(78)
South	0.9x	0.77	x	2.64	x	55.42	x	0.63	x	0.7	=	89.42	(78)
South	0.9x	0.77	x	5.28	x	40.4	x	0.63	x	0.7	=	65.19	(78)
South	0.9x	0.77	x	2.64	x	40.4	x	0.63	x	0.7	=	65.19	(78)

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

(83)m=	176.62	296.29	398.35	490.01	551.57	550.37	529.34	481.93	429.3	325.08	210.6	151.83	(83)

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

(84)m=	613.84	731.41	819.37	888.25	926.58	903.04	867.5	826.19	785.28	704.06	616.03	577.19	(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	0.92	0.81	0.62	0.46	0.5	0.74	0.94	0.99	1	(86)

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

(87)m=	19.95	20.14	20.38	20.67	20.88	20.98	21	20.99	20.94	20.67	20.25	19.91	(87)

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

(88)m=	20.01	20.01	20.02	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.03	20.02	(88)

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

(89)m=	0.99	0.98	0.96	0.9	0.75	0.54	0.36	0.4	0.66	0.92	0.99	1	(89)

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

(90)m=	18.62	18.89	19.25	19.65	19.92	20.02	20.04	20.04	19.99	19.67	19.08	18.58	(90)

fLA = Living area ÷ (4) = 0.23 (91)

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

(92)m=	18.93	19.18	19.52	19.89	20.14	20.25	20.26	20.26	20.22	19.9	19.35	18.89	(92)

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

(93)m=	18.93	19.18	19.52	19.89	20.14	20.25	20.26	20.26	20.22	19.9	19.35	18.89	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.89	0.76	0.56	0.38	0.42	0.67	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	608.9	717.34	783.11	792.56	704.32	503.15	332.14	348.83	529.82	642.26	604.84	573.71	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1373.79	1337.83	1215.86	1014.08	777.09	514.05	333.32	350.81	559.11	856.3	1132.89	1365.03	(97)

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

(98)m=	569.08	416.97	321.96	159.5	54.14	0	0	0	0	159.24	380.2	588.74		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				2649.83	(98)

Space heating requirement in kWh/m²/year	30.67	(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)														
	569.08	416.97	321.96	159.5	54.14	0	0	0	0	159.24	380.2	588.74		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	608.64	445.96	344.35	170.59	57.9	0	0	0	0	170.31	406.63	629.67		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2834.04	(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)														
	202.08	178.07	186.92	167.43	163.98	146.39	140.46	154.31	154.09	173.62	183.75	197.17		
Efficiency of water heater													79.8	(216)
(217)m=	87.43	87.01	86.25	84.68	82.21	79.8	79.8	79.8	79.8	84.58	86.71	87.55		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	231.13	204.66	216.71	197.71	199.46	183.44	176.01	193.37	193.09	205.26	211.91	225.2		
Total = Sum(219a)$_{1...12}$ =													2437.96	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2834.04	
Water heating fuel used			2437.96	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			366.31	(232)

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

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

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Space heating (main system 1)	(211) x	0.216	=	612.15	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	526.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1138.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	190.12	(268)
Total CO2, kg/year		sum of (265)…(271) =		1367.79	(272)

TER = 15.83 (273)

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User Details:

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

Property Address: W5-12

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.8	(1a) x	2.7	(2a) =	139.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.8	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		139.86	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		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	0.34	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	
Doors			1.89	x	1	=	1.89			(26)
Windows Type 1			5.28	x1/[1/(1.4)+ 0.04]		=	7			(27)
Windows Type 2			2.64	x1/[1/(1.4)+ 0.04]		=	3.5			(27)
Walls Type1	18.36	7.92	10.44	x	0.18	=	1.88			(29)
Walls Type2	18.36	1.89	16.47	x	0.18	=	2.96			(29)
Roof	51.8	0	51.8	x	0.13	=	6.73			(30)
Total area of elements, m²			88.52							(31)
Party wall			37.5	x	0	=	0			(32)
Party floor			51.8							(32a)

** 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) = 23.97 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.34 (36)

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

Total fabric heat loss (33) + (36) = 32.3 (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=	26.56	26.42	26.29	25.67	25.55	25.01	25.01	24.91	25.22	25.55	25.79	26.03	(38)

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

(39)m=	58.86	58.73	58.59	57.97	57.86	57.31	57.31	57.21	57.52	57.86	58.09	58.34	

Average = $Sum(39)_{1...12}$ /12= 57.97 (39)

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

(40)m=	1.14	1.13	1.13	1.12	1.12	1.11	1.11	1.1	1.11	1.12	1.12	1.13	

Average = Sum(40)$_{1...12}$ /12= 1.12 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.74 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.6 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	83.16	80.14	77.11	74.09	71.06	68.04	68.04	71.06	74.09	77.11	80.14	83.16	
										Total = Sum(44)$_{1...12}$ =		907.2	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	123.32	107.86	111.3	97.04	93.11	80.35	74.45	85.43	86.45	100.75	109.98	119.43	
										Total = Sum(45)$_{1...12}$ =		1189.49	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.5	16.18	16.7	14.56	13.97	12.05	11.17	12.82	12.97	15.11	16.5	17.91	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

(62)m=	169.92	149.95	157.9	142.13	139.7	125.44	121.05	132.03	131.55	147.35	155.07	166.03	(62)

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

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

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

Output from water heater

(64)m=	169.92	149.95	157.9	142.13	139.7	125.44	121.05	132.03	131.55	147.35	155.07	166.03	

Output from water heater (annual)$_{1...12}$ 1738.1 (64)

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

(65)m=	78.28	69.53	74.28	68.34	68.23	62.79	62.03	65.68	64.82	70.78	72.64	76.99	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	(66)

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

(67)m=	14.26	12.66	10.3	7.8	5.83	4.92	5.32	6.91	9.28	11.78	13.75	14.66	(67)

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

(68)m=	151.91	153.48	149.51	141.05	130.38	120.35	113.64	112.07	116.04	124.5	135.17	145.2	(68)

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

(69)m=	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	(71)

Water heating gains (Table 5)

(72)m=	105.22	103.47	99.84	94.91	91.71	87.21	83.38	88.28	90.03	95.13	100.89	103.48	(72)

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

(73)m=	323.53	321.77	311.8	295.91	280.07	264.62	254.48	259.41	267.49	283.55	301.96	315.49	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.28	x	19.64	x	0.63	x	0.7	=	31.69	(76)
East	0.9x	0.77	x	2.64	x	19.64	x	0.63	x	0.7	=	15.85	(76)
East	0.9x	0.77	x	5.28	x	38.42	x	0.63	x	0.7	=	62	(76)
East	0.9x	0.77	x	2.64	x	38.42	x	0.63	x	0.7	=	31	(76)
East	0.9x	0.77	x	5.28	x	63.27	x	0.63	x	0.7	=	102.1	(76)

East	0.9x	0.77	x	2.64	x	63.27	x	0.63	x	0.7	=	51.05	(76)
East	0.9x	0.77	x	5.28	x	92.28	x	0.63	x	0.7	=	148.91	(76)
East	0.9x	0.77	x	2.64	x	92.28	x	0.63	x	0.7	=	74.45	(76)
East	0.9x	0.77	x	5.28	x	113.09	x	0.63	x	0.7	=	182.49	(76)
East	0.9x	0.77	x	2.64	x	113.09	x	0.63	x	0.7	=	91.25	(76)
East	0.9x	0.77	x	5.28	x	115.77	x	0.63	x	0.7	=	186.81	(76)
East	0.9x	0.77	x	2.64	x	115.77	x	0.63	x	0.7	=	93.41	(76)
East	0.9x	0.77	x	5.28	x	110.22	x	0.63	x	0.7	=	177.85	(76)
East	0.9x	0.77	x	2.64	x	110.22	x	0.63	x	0.7	=	88.93	(76)
East	0.9x	0.77	x	5.28	x	94.68	x	0.63	x	0.7	=	152.77	(76)
East	0.9x	0.77	x	2.64	x	94.68	x	0.63	x	0.7	=	76.39	(76)
East	0.9x	0.77	x	5.28	x	73.59	x	0.63	x	0.7	=	118.75	(76)
East	0.9x	0.77	x	2.64	x	73.59	x	0.63	x	0.7	=	59.37	(76)
East	0.9x	0.77	x	5.28	x	45.59	x	0.63	x	0.7	=	73.56	(76)
East	0.9x	0.77	x	2.64	x	45.59	x	0.63	x	0.7	=	36.78	(76)
East	0.9x	0.77	x	5.28	x	24.49	x	0.63	x	0.7	=	39.52	(76)
East	0.9x	0.77	x	2.64	x	24.49	x	0.63	x	0.7	=	19.76	(76)
East	0.9x	0.77	x	5.28	x	16.15	x	0.63	x	0.7	=	26.06	(76)
East	0.9x	0.77	x	2.64	x	16.15	x	0.63	x	0.7	=	13.03	(76)

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

(83)m=	47.54	93	153.15	223.36	273.74	280.22	266.78	229.16	178.12	110.35	59.27	39.09	(83)

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

(84)m=	371.07	414.76	464.95	519.27	553.8	544.84	521.26	488.57	445.61	393.9	361.23	354.58	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.64	0.48	0.53	0.79	0.96	0.99	1	(86)

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

(87)m=	19.88	20.03	20.28	20.61	20.85	20.97	20.99	20.99	20.91	20.59	20.18	19.86	(87)

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

(88)m=	19.97	19.97	19.98	19.99	19.99	20	20	20	19.99	19.99	19.98	19.98	(88)

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

(89)m=	0.99	0.99	0.97	0.91	0.77	0.55	0.37	0.42	0.71	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=	18.5	18.71	19.07	19.53	19.85	19.98	19.99	19.99	19.93	19.52	18.94	18.47	(90)

fLA = Living area ÷ (4) = | 0.45 | (91)

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

(92)m=	19.12	19.3	19.62	20.02	20.3	20.42	20.45	20.44	20.37	20.01	19.5	19.09	(92)

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

(93)m=	19.12	19.3	19.62	20.02	20.3	20.42	20.45	20.44	20.37	20.01	19.5	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=	0.99	0.99	0.97	0.91	0.79	0.59	0.42	0.47	0.74	0.94	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	368.27	409.04	450.06	473.99	437.2	323.11	218.94	228.84	329.17	369.99	355.93	352.42	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	872.58	845.92	768.76	644.53	497.63	333.83	220.41	231.38	360.87	544.19	720.29	868.93	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	375.21	293.58	237.11	122.78	44.97	0	0	0	0	129.6	262.34	384.28	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1849.87 (98)

Space heating requirement in kWh/m²/year 35.71 (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)														
	375.21	293.58	237.11	122.78	44.97	0	0	0	0	129.6	262.34	384.28		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	401.29	313.99	253.59	131.32	48.09	0	0	0	0	138.61	280.58	411		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1978.48	(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)														
	169.92	149.95	157.9	142.13	139.7	125.44	121.05	132.03	131.55	147.35	155.07	166.03		
Efficiency of water heater													79.8	(216)
(217)m=	86.87	86.58	85.9	84.43	82.17	79.8	79.8	79.8	79.8	84.47	86.21	86.98		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	195.6	173.2	183.82	168.34	170.03	157.19	151.69	165.45	164.85	174.43	179.89	190.88		
Total = Sum(219a)$_{1...12}$ =													2075.37	(219)

Annual totals	kWh/year	kWh/year
Space heating fuel used, main system 1		1978.48

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Water heating fuel used		2075.37	
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		251.82	(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	=	427.35	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	448.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			875.63	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	130.69	(268)
Total CO2, kg/year		sum of (265)…(271) =		1045.25	(272)

TER = 20.18 (273)

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FHP

DER WorkSheet: New dwelling design stage

User Details:

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

Property Address: E0-01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71	(1a) x	2.7	(2a) =	191.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	191.7	(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		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

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

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

(24a)m=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			7.58	x1/[1/(1.2)+ 0.04]		=	8.68			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 3			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 4			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Floor			71	x	0.12	=	8.52			(28)
Walls Type1	65.34	21.18	44.16	x	0.16	=	7.07			(29)
Walls Type2	4.32	1.89	2.43	x	0.15	=	0.37			(29)
Walls Type3	7.29	0	7.29	x	0.16	=	1.17			(29)
Roof	6	0	6	x	0.12	=	0.72			(30)
Total area of elements, m²			153.95							(31)
Party wall			19.17	x	0	=	0			(32)
Party ceiling			65							(32b)

** 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) = 44.74 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 19.84 (36)

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

Total fabric heat loss	(33) + (36) =	64.58	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	18.62	18.4	18.19	17.09	16.87	15.77	15.77	15.55	16.21	16.87	17.31	17.75	(38)

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

(39)m=	83.2	82.98	82.77	81.67	81.45	80.35	80.35	80.13	80.79	81.45	81.89	82.33	

Average = Sum(39)1…12 /12= 81.61 (39)

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

(40)m=	1.17	1.17	1.17	1.15	1.15	1.13	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 2.27 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.12 (43)

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

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=	96.93	93.4	89.88	86.35	82.83	79.3	79.3	82.83	86.35	89.88	93.4	96.93	

Total = Sum(44)1…12 = 1057.39 (44)

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

(45)m=	143.74	125.72	129.73	113.1	108.52	93.65	86.78	99.58	100.77	117.44	128.19	139.21	

Total = Sum(45)1…12 = 1386.41 (45)

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

(46)m=	21.56	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

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

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

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

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

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

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

(62)m=	199.02	175.64	185.01	166.59	163.8	147.14	142.05	154.86	154.26	172.71	181.68	194.48	(62)

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

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

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

Output from water heater

(64)m=	199.02	175.64	185.01	166.59	163.8	147.14	142.05	154.86	154.26	172.71	181.68	194.48	

Output from water heater (annual)$_{1...12}$ | 2037.25 | (64)

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

(65)m=	92.02	81.74	87.36	80.4	80.31	73.93	73.07	77.33	76.3	83.27	85.42	90.51	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	(66)

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

(67)m=	17.8	15.81	12.85	9.73	7.27	6.14	6.64	8.63	11.58	14.7	17.16	18.29	(67)

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

(68)m=	199.62	201.69	196.47	185.36	171.33	158.15	149.34	147.27	152.49	163.6	177.63	190.81	(68)

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

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	(71)

Water heating gains (Table 5)

(72)m=	123.68	121.64	117.41	111.67	107.94	102.68	98.22	103.94	105.97	111.92	118.64	121.65	(72)

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

(73)m=	398.14	396.19	383.79	363.81	343.59	324.02	311.25	316.89	327.09	347.27	370.47	387.8	(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	2.72	x	10.63	x	0.4	x	0.7	=	11.22	(74)
North	0.9x	0.77	x	2.72	x	20.32	x	0.4	x	0.7	=	21.45	(74)
North	0.9x	0.77	x	2.72	x	34.53	x	0.4	x	0.7	=	36.45	(74)
North	0.9x	0.77	x	2.72	x	55.46	x	0.4	x	0.7	=	58.55	(74)
North	0.9x	0.77	x	2.72	x	74.72	x	0.4	x	0.7	=	78.87	(74)
North	0.9x	0.77	x	2.72	x	79.99	x	0.4	x	0.7	=	84.43	(74)
North	0.9x	0.77	x	2.72	x	74.68	x	0.4	x	0.7	=	78.83	(74)
North	0.9x	0.77	x	2.72	x	59.25	x	0.4	x	0.7	=	62.54	(74)
North	0.9x	0.77	x	2.72	x	41.52	x	0.4	x	0.7	=	43.82	(74)
North	0.9x	0.77	x	2.72	x	24.19	x	0.4	x	0.7	=	25.53	(74)
North	0.9x	0.77	x	2.72	x	13.12	x	0.4	x	0.7	=	13.85	(74)
North	0.9x	0.77	x	2.72	x	8.86	x	0.4	x	0.7	=	9.36	(74)
South	0.9x	0.77	x	7.58	x	46.75	x	0.4	x	0.7	=	68.76	(78)
South	0.9x	0.77	x	2.72	x	46.75	x	0.4	x	0.7	=	49.35	(78)
South	0.9x	0.77	x	7.58	x	76.57	x	0.4	x	0.7	=	112.62	(78)
South	0.9x	0.77	x	2.72	x	76.57	x	0.4	x	0.7	=	80.82	(78)
South	0.9x	0.77	x	7.58	x	97.53	x	0.4	x	0.7	=	143.46	(78)
South	0.9x	0.77	x	2.72	x	97.53	x	0.4	x	0.7	=	102.95	(78)
South	0.9x	0.77	x	7.58	x	110.23	x	0.4	x	0.7	=	162.14	(78)
South	0.9x	0.77	x	2.72	x	110.23	x	0.4	x	0.7	=	116.36	(78)
South	0.9x	0.77	x	7.58	x	114.87	x	0.4	x	0.7	=	168.96	(78)
South	0.9x	0.77	x	2.72	x	114.87	x	0.4	x	0.7	=	121.26	(78)
South	0.9x	0.77	x	7.58	x	110.55	x	0.4	x	0.7	=	162.6	(78)
South	0.9x	0.77	x	2.72	x	110.55	x	0.4	x	0.7	=	116.69	(78)
South	0.9x	0.77	x	7.58	x	108.01	x	0.4	x	0.7	=	158.87	(78)
South	0.9x	0.77	x	2.72	x	108.01	x	0.4	x	0.7	=	114.01	(78)
South	0.9x	0.77	x	7.58	x	104.89	x	0.4	x	0.7	=	154.28	(78)
South	0.9x	0.77	x	2.72	x	104.89	x	0.4	x	0.7	=	110.72	(78)
South	0.9x	0.77	x	7.58	x	101.89	x	0.4	x	0.7	=	149.86	(78)
South	0.9x	0.77	x	2.72	x	101.89	x	0.4	x	0.7	=	107.55	(78)
South	0.9x	0.77	x	7.58	x	82.59	x	0.4	x	0.7	=	121.47	(78)
South	0.9x	0.77	x	2.72	x	82.59	x	0.4	x	0.7	=	87.18	(78)
South	0.9x	0.77	x	7.58	x	55.42	x	0.4	x	0.7	=	81.51	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.4	x	0.7	=	58.5	(78)
South	0.9x	0.77	x	7.58	x	40.4	x	0.4	x	0.7	=	59.42	(78)
South	0.9x	0.77	x	2.72	x	40.4	x	0.4	x	0.7	=	42.64	(78)
West	0.9x	0.77	x	2.72	x	19.64	x	0.4	x	0.7	=	10.37	(80)
West	0.9x	0.77	x	2.72	x	38.42	x	0.4	x	0.7	=	20.28	(80)
West	0.9x	0.77	x	2.72	x	63.27	x	0.4	x	0.7	=	33.39	(80)

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West	0.9x	0.77	x	2.72	x	92.28	x	0.4	x	0.7	=	48.7	(80)
West	0.9x	0.77	x	2.72	x	113.09	x	0.4	x	0.7	=	59.69	(80)
West	0.9x	0.77	x	2.72	x	115.77	x	0.4	x	0.7	=	61.1	(80)
West	0.9x	0.77	x	2.72	x	110.22	x	0.4	x	0.7	=	58.17	(80)
West	0.9x	0.77	x	2.72	x	94.68	x	0.4	x	0.7	=	49.97	(80)
West	0.9x	0.77	x	2.72	x	73.59	x	0.4	x	0.7	=	38.84	(80)
West	0.9x	0.77	x	2.72	x	45.59	x	0.4	x	0.7	=	24.06	(80)
West	0.9x	0.77	x	2.72	x	24.49	x	0.4	x	0.7	=	12.93	(80)
West	0.9x	0.77	x	2.72	x	16.15	x	0.4	x	0.7	=	8.52	(80)

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

(83)m=	139.7	235.17	316.25	385.75	428.77	424.82	409.88	377.51	340.07	258.24	166.78	119.94	(83)

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

(84)m=	537.85	631.36	700.05	749.56	772.36	748.85	721.13	694.4	667.16	605.51	537.25	507.75	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.83	0.65	0.48	0.52	0.75	0.94	0.99	1	(86)

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

(87)m=	19.87	20.06	20.31	20.61	20.84	20.96	20.99	20.99	20.93	20.63	20.2	19.84	(87)

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

(88)m=	19.94	19.95	19.95	19.96	19.96	19.98	19.98	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=	0.99	0.98	0.96	0.9	0.77	0.56	0.37	0.41	0.67	0.91	0.98	0.99	(89)

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

(90)m=	18.46	18.73	19.1	19.52	19.81	19.95	19.97	19.97	19.92	19.56	18.94	18.42	(90)

fLA = Living area ÷ (4) = 0.37 (91)

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

(92)m=	18.98	19.22	19.54	19.92	20.19	20.32	20.35	20.35	20.29	19.95	19.4	18.94	(92)

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

(93)m=	18.98	19.22	19.54	19.92	20.19	20.32	20.35	20.35	20.29	19.95	19.4	18.94	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.79	0.59	0.41	0.45	0.7	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	532.62	618.21	669.14	674.69	606.34	444.25	298.98	313.08	464.69	553.35	526.28	503.92	(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=	1221.32	1188.24	1079.42	899.88	691.53	459.88	301.04	316.22	499.77	761.61	1007.31	1213.57	(97)

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

(98)m=	512.39	383.06	305.25	162.14	63.38	0	0	0	0	154.95	346.34	527.98

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2455.5	(98)
Space heating requirement in kWh/m²/year		34.58	(99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2455.5	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2578.27	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2037.25	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2139.11	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.17	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		154.94	(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) =	154.94	(331)
Energy for lighting (calculated in Appendix L)		314.29	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1065.85	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	24.48	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	1090.34	(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) =			1090.34	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	80.41	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	163.12	(379)
Total CO2, kg/year	sum of (376)…(382) =			1333.87	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.79	(384)
EI rating (section 14)				84.59	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.12

Property Address: E1-18

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50	(1a) x	2.7	(2a) =	135	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		135	(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

DER WorkSheet: New dwelling design stage

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

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

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

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

(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(24a)

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

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

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

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

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

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

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

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

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

(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.42	x1/[1/(1.2)+ 0.04]		=	6.21			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 3			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Walls Type1	22.95	10.86	12.09	x	0.16	=	1.93			(29)
Walls Type2	20.79	1.89	18.9	x	0.15	=	2.84			(29)
Total area of elements, m²			43.74							(31)
Party wall			35.37	x	0	=	0			(32)
Party floor			50							(32a)
Party ceiling			50							(32b)

** 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) = 19.86 (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 6.55 (36)

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

Total fabric heat loss (33) + (36) = 26.41 (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=	11.84	11.71	11.58	10.93	10.8	10.15	10.15	10.03	10.41	10.8	11.06	11.32	(38)

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

(39)m=	38.25	38.12	37.99	37.34	37.21	36.57	36.57	36.44	36.82	37.21	37.47	37.73	

Average = Sum(39)$_{1...12}$ /12= 37.31 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 0.75 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.34 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	81.77	78.8	75.83	72.85	69.88	66.91	66.91	69.88	72.85	75.83	78.8	81.77	

Total = Sum(44)$_{1...12}$ = 892.08 (44)

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

(45)m=	121.27	106.06	109.45	95.42	91.56	79.01	73.21	84.01	85.01	99.08	108.15	117.44	

Total = Sum(45)$_{1...12}$ = 1169.66 (45)

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

(46)m=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

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

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

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

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

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

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

(62)m=	176.55	155.99	164.72	148.91	146.83	132.5	128.49	139.29	138.51	154.35	161.64	172.72	(62)

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

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

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

Output from water heater

(64)m=	176.55	155.99	164.72	148.91	146.83	132.5	128.49	139.29	138.51	154.35	161.64	172.72

Output from water heater (annual)$_{1…12}$	1820.5	(64)

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

(65)m=	84.54	75.21	80.61	74.52	74.66	69.06	68.56	72.15	71.06	77.16	78.75	83.27	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.14	11.67	9.49	7.18	5.37	4.53	4.9	6.37	8.55	10.85	12.67	13.5	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	147.23	148.76	144.91	136.72	126.37	116.64	110.15	108.62	112.47	120.67	131.01	140.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	(71)
Water heating gains (Table 5)													
(72)m=	113.63	111.92	108.35	103.5	100.35	95.92	92.16	96.98	98.7	103.71	109.38	111.92	(72)
Total internal gains =	(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m												
(73)m=	322.36	320.7	311.1	295.75	280.44	265.45	255.55	260.32	268.07	283.59	301.41	314.51	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.72	x	46.75	x	0.4	x	0.7	=	24.68	(78)
South	0.9x	0.77	x	2.72	x	76.57	x	0.4	x	0.7	=	40.41	(78)

South	0.9x	0.77	x	2.72	x	97.53	x	0.4	x	0.7	=	51.48	(78)
South	0.9x	0.77	x	2.72	x	110.23	x	0.4	x	0.7	=	58.18	(78)
South	0.9x	0.77	x	2.72	x	114.87	x	0.4	x	0.7	=	60.63	(78)
South	0.9x	0.77	x	2.72	x	110.55	x	0.4	x	0.7	=	58.35	(78)
South	0.9x	0.77	x	2.72	x	108.01	x	0.4	x	0.7	=	57.01	(78)
South	0.9x	0.77	x	2.72	x	104.89	x	0.4	x	0.7	=	55.36	(78)
South	0.9x	0.77	x	2.72	x	101.89	x	0.4	x	0.7	=	53.77	(78)
South	0.9x	0.77	x	2.72	x	82.59	x	0.4	x	0.7	=	43.59	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.4	x	0.7	=	29.25	(78)
South	0.9x	0.77	x	2.72	x	40.4	x	0.4	x	0.7	=	21.32	(78)
West	0.9x	0.77	x	5.42	x	19.64	x	0.4	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.72	x	19.64	x	0.4	x	0.7	=	10.37	(80)
West	0.9x	0.77	x	5.42	x	38.42	x	0.4	x	0.7	=	40.41	(80)
West	0.9x	0.77	x	2.72	x	38.42	x	0.4	x	0.7	=	20.28	(80)
West	0.9x	0.77	x	5.42	x	63.27	x	0.4	x	0.7	=	66.54	(80)
West	0.9x	0.77	x	2.72	x	63.27	x	0.4	x	0.7	=	33.39	(80)
West	0.9x	0.77	x	5.42	x	92.28	x	0.4	x	0.7	=	97.05	(80)
West	0.9x	0.77	x	2.72	x	92.28	x	0.4	x	0.7	=	48.7	(80)
West	0.9x	0.77	x	5.42	x	113.09	x	0.4	x	0.7	=	118.94	(80)
West	0.9x	0.77	x	2.72	x	113.09	x	0.4	x	0.7	=	59.69	(80)
West	0.9x	0.77	x	5.42	x	115.77	x	0.4	x	0.7	=	121.76	(80)
West	0.9x	0.77	x	2.72	x	115.77	x	0.4	x	0.7	=	61.1	(80)
West	0.9x	0.77	x	5.42	x	110.22	x	0.4	x	0.7	=	115.92	(80)
West	0.9x	0.77	x	2.72	x	110.22	x	0.4	x	0.7	=	58.17	(80)
West	0.9x	0.77	x	5.42	x	94.68	x	0.4	x	0.7	=	99.57	(80)
West	0.9x	0.77	x	2.72	x	94.68	x	0.4	x	0.7	=	49.97	(80)
West	0.9x	0.77	x	5.42	x	73.59	x	0.4	x	0.7	=	77.39	(80)
West	0.9x	0.77	x	2.72	x	73.59	x	0.4	x	0.7	=	38.84	(80)
West	0.9x	0.77	x	5.42	x	45.59	x	0.4	x	0.7	=	47.95	(80)
West	0.9x	0.77	x	2.72	x	45.59	x	0.4	x	0.7	=	24.06	(80)
West	0.9x	0.77	x	5.42	x	24.49	x	0.4	x	0.7	=	25.76	(80)
West	0.9x	0.77	x	2.72	x	24.49	x	0.4	x	0.7	=	12.93	(80)
West	0.9x	0.77	x	5.42	x	16.15	x	0.4	x	0.7	=	16.99	(80)
West	0.9x	0.77	x	2.72	x	16.15	x	0.4	x	0.7	=	8.52	(80)

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

(83)m=	55.7	101.1	151.42	203.94	239.26	241.2	231.1	204.9	170.01	115.6	67.93	46.83	(83)

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

(84)m=	378.05	421.79	462.52	499.69	519.7	506.66	486.65	465.22	438.07	399.18	369.34	361.35	(84)

7. Mean internal temperature (heating season)

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

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

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

(86)m=	0.99	0.98	0.94	0.83	0.65	0.46	0.33	0.36	0.58	0.86	0.97	0.99	(86)

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

(87)m=	20.47	20.59	20.76	20.92	20.99	21	21	21	21	20.91	20.67	20.44	(87)

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

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

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

(89)m=	0.99	0.97	0.92	0.8	0.61	0.41	0.28	0.31	0.52	0.83	0.97	0.99	(89)

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

(90)m=	19.58	19.76	20	20.22	20.29	20.31	20.31	20.32	20.31	20.21	19.89	19.55	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	20	20.16	20.36	20.55	20.62	20.64	20.64	20.64	20.63	20.55	20.26	19.97	(92)

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

(93)m=	20	20.16	20.36	20.55	20.62	20.64	20.64	20.64	20.63	20.55	20.26	19.97	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.81	0.63	0.44	0.3	0.33	0.55	0.84	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	372.56	408.87	428.05	404.53	327.13	220.5	147.66	154.45	239.18	336.38	356.49	357.24	(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=	600.47	581.52	526.66	435.16	331.97	220.78	147.68	154.48	240.57	370.12	493.14	595.19	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	169.56	116.02	73.37	22.05	3.6	0	0	0	0	25.1	98.39	177.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 685.12 (98)

Space heating requirement in kWh/m²/year 13.7 (99)

9b. Energy requirements – Community heating scheme

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

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

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

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

Space heating	**kWh/year**
Annual space heating requirement	685.12

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	719.38	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1820.5	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1911.52	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	26.31	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		109.11	(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) =	109.11	(331)
Energy for lighting (calculated in Appendix L)		232	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	594.43	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	13.65	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	608.08	(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) =				608.08	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	56.63	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	120.41	(379)
Total CO2, kg/year	sum of (376)…(382) =				785.12	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.7	(384)
EI rating (section 14)					88.93	(385)

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User Details:

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

Property Address: E2-07

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)		Volume(m³)	
Ground floor	50.3	(1a)	x	2.7	(2a) =	135.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.3	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	135.81	(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

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) = 76.5 (23c)

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

(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(24a)

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

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

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

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			8.16	x1/[1/(1.2)+ 0.04]		=	9.34			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Walls Type1	15.93	10.88	5.05	x	0.16	=	0.81			(29)
Walls Type2	25.11	1.89	23.22	x	0.15	=	3.49			(29)
Walls Type3	13.77	0	13.77	x	0.14	=	1.93			(29)
Total area of elements, m²			54.81							(31)
Party wall			23.49	x	0	=	0			(32)
Party floor			50.3							(32a)
Party ceiling			50.3							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.33 (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 7.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 29.21 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	11.91	11.78	11.65	11	10.87	10.22	10.22	10.09	10.48	10.87	11.13	11.39	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	41.12	40.99	40.86	40.2	40.07	39.42	39.42	39.29	39.68	40.07	40.33	40.59	

Average = Sum(39)$_{1…12}$ /12= 40.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	0.81	

Average = Sum(40)$_{1…12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.55 (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=	82	79.02	76.04	73.06	70.08	67.09	67.09	70.08	73.06	76.04	79.02	82	

Total = Sum(44)$_{1…12}$ = 894.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.61	106.36	109.76	95.69	91.81	79.23	73.42	84.25	85.25	99.35	108.45	117.77	

Total = Sum(45)$_{1…12}$ = 1172.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.24	15.95	16.46	14.35	13.77	11.88	11.01	12.64	12.79	14.9	16.27	17.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.89	156.29	165.03	149.18	147.09	132.72	128.69	139.52	138.75	154.63	161.95	173.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.89	156.29	165.03	149.18	147.09	132.72	128.69	139.52	138.75	154.63	161.95	173.05

Output from water heater (annual)$_{1...12}$ | 1823.8 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.66	75.31	80.72	74.61	74.75	69.14	68.63	72.23	71.14	77.26	78.86	83.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.21	11.73	9.54	7.22	5.4	4.56	4.93	6.4	8.59	10.91	12.73	13.58	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.01	149.55	145.68	137.44	127.04	117.26	110.73	109.2	113.07	121.31	131.71	141.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	(71)

Water heating gains (Table 5)

(72)m=	113.79	112.06	108.49	103.63	100.47	96.03	92.25	97.09	98.81	103.84	109.52	112.07	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	323.49	321.83	312.19	296.77	281.39	266.33	256.39	261.17	268.95	284.54	302.45	315.61	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	8.16	x	19.64	x	0.4	x	0.7	=	31.1	(76)
East	0.9x	0.77	x	2.72	x	19.64	x	0.4	x	0.7	=	10.37	(76)

East	0.9x	0.77	x	8.16	x	38.42	x	0.4	x	0.7	=	60.83	(76)
East	0.9x	0.77	x	2.72	x	38.42	x	0.4	x	0.7	=	20.28	(76)
East	0.9x	0.77	x	8.16	x	63.27	x	0.4	x	0.7	=	100.18	(76)
East	0.9x	0.77	x	2.72	x	63.27	x	0.4	x	0.7	=	33.39	(76)
East	0.9x	0.77	x	8.16	x	92.28	x	0.4	x	0.7	=	146.11	(76)
East	0.9x	0.77	x	2.72	x	92.28	x	0.4	x	0.7	=	48.7	(76)
East	0.9x	0.77	x	8.16	x	113.09	x	0.4	x	0.7	=	179.07	(76)
East	0.9x	0.77	x	2.72	x	113.09	x	0.4	x	0.7	=	59.69	(76)
East	0.9x	0.77	x	8.16	x	115.77	x	0.4	x	0.7	=	183.31	(76)
East	0.9x	0.77	x	2.72	x	115.77	x	0.4	x	0.7	=	61.1	(76)
East	0.9x	0.77	x	8.16	x	110.22	x	0.4	x	0.7	=	174.52	(76)
East	0.9x	0.77	x	2.72	x	110.22	x	0.4	x	0.7	=	58.17	(76)
East	0.9x	0.77	x	8.16	x	94.68	x	0.4	x	0.7	=	149.91	(76)
East	0.9x	0.77	x	2.72	x	94.68	x	0.4	x	0.7	=	49.97	(76)
East	0.9x	0.77	x	8.16	x	73.59	x	0.4	x	0.7	=	116.52	(76)
East	0.9x	0.77	x	2.72	x	73.59	x	0.4	x	0.7	=	38.84	(76)
East	0.9x	0.77	x	8.16	x	45.59	x	0.4	x	0.7	=	72.18	(76)
East	0.9x	0.77	x	2.72	x	45.59	x	0.4	x	0.7	=	24.06	(76)
East	0.9x	0.77	x	8.16	x	24.49	x	0.4	x	0.7	=	38.78	(76)
East	0.9x	0.77	x	2.72	x	24.49	x	0.4	x	0.7	=	12.93	(76)
East	0.9x	0.77	x	8.16	x	16.15	x	0.4	x	0.7	=	25.57	(76)
East	0.9x	0.77	x	2.72	x	16.15	x	0.4	x	0.7	=	8.52	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.46	81.11	133.58	194.82	238.76	244.41	232.69	199.88	155.36	96.25	51.7	34.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364.96	402.94	445.77	491.59	520.15	510.74	489.08	461.05	424.31	380.79	354.15	349.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.87	0.69	0.49	0.35	0.39	0.63	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.36	20.48	20.67	20.88	20.98	21	21	21	20.99	20.86	20.58	20.33	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.25	20.26	20.27	20.27	20.27	20.26	20.26	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.84	0.65	0.44	0.3	0.33	0.57	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.38	19.56	19.84	20.12	20.24	20.27	20.27	20.27	20.26	20.1	19.71	19.36	(90)

fLA = Living area ÷ (4) = | 0.59 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.95	20.1	20.33	20.57	20.67	20.7	20.7	20.7	20.69	20.55	20.22	19.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.95	20.1	20.33	20.57	20.67	20.7	20.7	20.7	20.69	20.55	20.22	19.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.85	0.67	0.47	0.33	0.37	0.61	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	361.3	394.91	422.83	418.01	349.97	239.6	161.46	168.77	257.69	339.27	346.08	346.95	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	643.61	622.91	564.88	469.05	359.46	240.3	161.51	168.87	261.37	398.58	529.17	638.62	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	210.04	153.21	105.68	36.75	7.06	0	0	0	0	44.12	131.83	217	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 905.7 (98)

Space heating requirement in kWh/m²/year 18.01 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		905.7	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	950.99	(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		1823.8	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1914.99	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	28.66	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

DER WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):				
mechanical ventilation - balanced, extract or positive input from outside			109.77	(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) =		109.77	(331)
Energy for lighting (calculated in Appendix L)			233.27	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			95.6	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22 =	647.54	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	14.87	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	662.42	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			662.42	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	56.97	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	121.07	(379)
Total CO2, kg/year	sum of (376)…(382) =			840.45	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.71	(384)
EI rating (section 14)				88.18	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: E5-03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.7	(2a) =	201.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	201.15	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.42	x1/[1/(1.2)+ 0.04]		=	6.21			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 3			5.42	x1/[1/(1.2)+ 0.04]		=	6.21			(27)
Walls Type1	46.17	24.4	21.77	x	0.16	=	3.48			(29)
Walls Type2	11.07	1.89	9.18	x	0.15	=	1.38			(29)
Roof	74.5	0	74.5	x	0.12	=	8.94			(30)
Total area of elements, m²			131.74							(31)
Party wall			35.64	x	0	=	0			(32)
Party floor			74.5							(32a)

** 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) =	44.39	(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	20.56	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	64.95	(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=	18.59	18.38	18.17	17.11	16.9	15.84	15.84	15.63	16.26	16.9	17.32	17.74	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.54	83.32	83.11	82.05	81.84	80.78	80.78	80.57	81.21	81.84	82.27	82.69	

Average = Sum(39)$_{1...12}$ /12= 82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.12	1.12	1.12	1.1	1.1	1.08	1.08	1.08	1.09	1.1	1.1	1.11

Average = Sum(40)$_{1...12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (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=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02

Total = Sum(44)$_{1...12}$ = 1080.22 (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=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21

Total = Sum(45)$_{1...12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	

Output from water heater (annual)1…12 2067.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.05	82.65	88.29	81.21	81.08	74.6	73.7	78.05	77.02	84.11	86.34	91.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

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Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.5	16.44	13.37	10.12	7.56	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)
Water heating gains (Table 5)													
(72)m=	125.06	122.98	118.67	112.8	108.98	103.62	99.06	104.9	106.98	113.05	119.91	122.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	409.39	407.39	394.58	373.9	352.95	332.7	319.49	325.25	335.83	356.7	380.71	398.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.72	x	46.75	x	0.4	x	0.7	=	24.68	(78)
South	0.9x	0.77	x	5.42	x	46.75	x	0.4	x	0.7	=	98.34	(78)

South	0.9x	0.77	x	2.72	x	76.57	x	0.4	x	0.7	=	40.41	(78)
South	0.9x	0.77	x	5.42	x	76.57	x	0.4	x	0.7	=	161.05	(78)
South	0.9x	0.77	x	2.72	x	97.53	x	0.4	x	0.7	=	51.48	(78)
South	0.9x	0.77	x	5.42	x	97.53	x	0.4	x	0.7	=	205.15	(78)
South	0.9x	0.77	x	2.72	x	110.23	x	0.4	x	0.7	=	58.18	(78)
South	0.9x	0.77	x	5.42	x	110.23	x	0.4	x	0.7	=	231.87	(78)
South	0.9x	0.77	x	2.72	x	114.87	x	0.4	x	0.7	=	60.63	(78)
South	0.9x	0.77	x	5.42	x	114.87	x	0.4	x	0.7	=	241.62	(78)
South	0.9x	0.77	x	2.72	x	110.55	x	0.4	x	0.7	=	58.35	(78)
South	0.9x	0.77	x	5.42	x	110.55	x	0.4	x	0.7	=	232.53	(78)
South	0.9x	0.77	x	2.72	x	108.01	x	0.4	x	0.7	=	57.01	(78)
South	0.9x	0.77	x	5.42	x	108.01	x	0.4	x	0.7	=	227.19	(78)
South	0.9x	0.77	x	2.72	x	104.89	x	0.4	x	0.7	=	55.36	(78)
South	0.9x	0.77	x	5.42	x	104.89	x	0.4	x	0.7	=	220.63	(78)
South	0.9x	0.77	x	2.72	x	101.89	x	0.4	x	0.7	=	53.77	(78)
South	0.9x	0.77	x	5.42	x	101.89	x	0.4	x	0.7	=	214.31	(78)
South	0.9x	0.77	x	2.72	x	82.59	x	0.4	x	0.7	=	43.59	(78)
South	0.9x	0.77	x	5.42	x	82.59	x	0.4	x	0.7	=	173.71	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.4	x	0.7	=	29.25	(78)
South	0.9x	0.77	x	5.42	x	55.42	x	0.4	x	0.7	=	116.56	(78)
South	0.9x	0.77	x	2.72	x	40.4	x	0.4	x	0.7	=	21.32	(78)
South	0.9x	0.77	x	5.42	x	40.4	x	0.4	x	0.7	=	84.97	(78)
West	0.9x	0.77	x	5.42	x	19.64	x	0.4	x	0.7	=	41.31	(80)
West	0.9x	0.77	x	5.42	x	38.42	x	0.4	x	0.7	=	80.81	(80)
West	0.9x	0.77	x	5.42	x	63.27	x	0.4	x	0.7	=	133.09	(80)
West	0.9x	0.77	x	5.42	x	92.28	x	0.4	x	0.7	=	194.1	(80)
West	0.9x	0.77	x	5.42	x	113.09	x	0.4	x	0.7	=	237.88	(80)
West	0.9x	0.77	x	5.42	x	115.77	x	0.4	x	0.7	=	243.51	(80)
West	0.9x	0.77	x	5.42	x	110.22	x	0.4	x	0.7	=	231.83	(80)
West	0.9x	0.77	x	5.42	x	94.68	x	0.4	x	0.7	=	199.14	(80)
West	0.9x	0.77	x	5.42	x	73.59	x	0.4	x	0.7	=	154.79	(80)
West	0.9x	0.77	x	5.42	x	45.59	x	0.4	x	0.7	=	95.89	(80)
West	0.9x	0.77	x	5.42	x	24.49	x	0.4	x	0.7	=	51.51	(80)
West	0.9x	0.77	x	5.42	x	16.15	x	0.4	x	0.7	=	33.97	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.32	282.28	389.72	484.15	540.13	534.38	516.03	475.14	422.87	313.19	197.32	140.27	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	573.71	689.67	784.29	858.05	893.08	867.08	835.52	800.39	758.69	669.89	578.03	538.94	(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

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.96	0.89	0.77	0.58	0.42	0.46	0.69	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.95	20.16	20.43	20.71	20.9	20.98	21	21	20.96	20.7	20.27	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.99	19.99	20	20	20.01	20.01	20.02	20.01	20	20	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.86	0.71	0.5	0.33	0.36	0.61	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.91	19.28	19.68	19.91	20	20.01	20.01	19.98	19.68	19.08	18.56	(90)

fLA = Living area ÷ (4) = 0.36 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.36	19.69	20.05	20.27	20.35	20.37	20.37	20.33	20.05	19.51	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.09	19.36	19.69	20.05	20.27	20.35	20.37	20.37	20.33	20.05	19.51	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.86	0.72	0.53	0.36	0.4	0.64	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	567.65	672.32	738.75	741.82	646.35	456.66	303.35	318.15	484.03	598.08	564.54	534.63	(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=	1235.69	1204.56	1096.64	915.12	701.26	464.9	304.3	319.66	505.86	773.25	1020.6	1227.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	497.02	357.66	266.27	124.77	40.86	0	0	0	0	130.33	328.37	515.71	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2260.99 (98)

Space heating requirement in kWh/m²/year 30.35 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 2260.99

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Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	2374.04	(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		2067.18	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2170.54	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.45	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		162.58	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	162.58	(331)
Energy for lighting (calculated in Appendix L)		326.8	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1026.81	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.59	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1050.4	(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) =				1050.4	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	84.38	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	169.61	(379)
Total CO2, kg/year	sum of (376)…(382) =				1304.38	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.51	(384)
EI rating (section 14)					85.37	(385)

DER WorkSheet: New dwelling design stage

FHP

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: EB1-04

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	72.7	(1a)	x	2.7	(2a)	=	196.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.7	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			196.29	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 3			5.42	x1/[1/(1.2)+ 0.04]		=	6.21			(27)
Windows Type 4			2.18	x1/[1/(1.2)+ 0.04]		=	2.5			(27)
Windows Type 5			2.18	x1/[1/(1.2)+ 0.04]		=	2.5			(27)
Floor			72.7	x	0.12	=	8.723999			(28)
Walls	43.2	19.29	23.91	x	0.16	=	3.83			(29)
Total area of elements, m²			115.9							(31)
Party wall			49.14	x	0	=	0			(32)
Party ceiling			72.7							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.12 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.08 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.2 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	18.14	17.93	17.73	16.7	16.49	15.46	15.46	15.25	15.87	16.49	16.9	17.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.34	68.13	67.93	66.89	66.69	65.66	65.66	65.45	66.07	66.69	67.1	67.51	

Average = Sum(39)$_{1...12}$ /12= 66.84 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.93	

Average = Sum(40)$_{1...12}$ /12= 0.92 (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 2.31 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.06 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.96	94.4	90.84	87.28	83.72	80.15	80.15	83.72	87.28	90.84	94.4	97.96	

Total = Sum(44)$_{1...12}$ = 1068.71 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.28	127.06	131.12	114.31	109.68	94.65	87.71	100.64	101.85	118.69	129.56	140.69	

Total = Sum(45)$_{1...12}$ = 1401.24 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.79	19.06	19.67	17.15	16.45	14.2	13.16	15.1	15.28	17.8	19.43	21.1	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.56	176.99	186.39	167.8	164.96	148.14	142.98	155.92	155.34	173.97	183.05	195.97	(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=	200.56	176.99	186.39	167.8	164.96	148.14	142.98	155.92	155.34	173.97	183.05	195.97

Output from water heater (annual)$_{1...12}$ — 2052.08 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.53	82.19	87.82	80.8	80.69	74.27	73.38	77.69	76.66	83.69	85.87	91	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.14	16.11	13.11	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	203.51	205.63	200.3	188.98	174.67	161.23	152.25	150.14	155.46	166.79	181.09	194.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	(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=	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	(71)

Water heating gains (Table 5)

(72)m=	124.36	122.31	118.03	112.23	108.46	103.15	98.63	104.42	106.47	112.48	119.27	122.32	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	403.67	401.7	389.09	368.77	348.19	328.29	315.3	321	331.38	351.91	375.5	393.15	(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)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.72	x	10.63	x	0.4	x	0.7	=	5.61	(74)
North	0.9x	0.77	x	2.18	x	10.63	x	0.4	x	0.7	=	4.5	(74)
North	0.9x	0.77	x	2.72	x	20.32	x	0.4	x	0.7	=	10.73	(74)
North	0.9x	0.77	x	2.18	x	20.32	x	0.4	x	0.7	=	8.6	(74)
North	0.9x	0.77	x	2.72	x	34.53	x	0.4	x	0.7	=	18.22	(74)
North	0.9x	0.77	x	2.18	x	34.53	x	0.4	x	0.7	=	14.61	(74)
North	0.9x	0.77	x	2.72	x	55.46	x	0.4	x	0.7	=	29.27	(74)
North	0.9x	0.77	x	2.18	x	55.46	x	0.4	x	0.7	=	23.46	(74)
North	0.9x	0.77	x	2.72	x	74.72	x	0.4	x	0.7	=	39.43	(74)
North	0.9x	0.77	x	2.18	x	74.72	x	0.4	x	0.7	=	31.61	(74)
North	0.9x	0.77	x	2.72	x	79.99	x	0.4	x	0.7	=	42.22	(74)
North	0.9x	0.77	x	2.18	x	79.99	x	0.4	x	0.7	=	33.83	(74)
North	0.9x	0.77	x	2.72	x	74.68	x	0.4	x	0.7	=	39.41	(74)
North	0.9x	0.77	x	2.18	x	74.68	x	0.4	x	0.7	=	31.59	(74)
North	0.9x	0.77	x	2.72	x	59.25	x	0.4	x	0.7	=	31.27	(74)
North	0.9x	0.77	x	2.18	x	59.25	x	0.4	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	2.72	x	41.52	x	0.4	x	0.7	=	21.91	(74)
North	0.9x	0.77	x	2.18	x	41.52	x	0.4	x	0.7	=	17.56	(74)
North	0.9x	0.77	x	2.72	x	24.19	x	0.4	x	0.7	=	12.77	(74)
North	0.9x	0.77	x	2.18	x	24.19	x	0.4	x	0.7	=	10.23	(74)
North	0.9x	0.77	x	2.72	x	13.12	x	0.4	x	0.7	=	6.92	(74)
North	0.9x	0.77	x	2.18	x	13.12	x	0.4	x	0.7	=	5.55	(74)
North	0.9x	0.77	x	2.72	x	8.86	x	0.4	x	0.7	=	4.68	(74)
North	0.9x	0.77	x	2.18	x	8.86	x	0.4	x	0.7	=	3.75	(74)
South	0.9x	0.77	x	2.72	x	46.75	x	0.4	x	0.7	=	24.68	(78)
South	0.9x	0.77	x	5.42	x	46.75	x	0.4	x	0.7	=	49.17	(78)
South	0.9x	0.77	x	2.18	x	46.75	x	0.4	x	0.7	=	39.55	(78)
South	0.9x	0.77	x	2.72	x	76.57	x	0.4	x	0.7	=	40.41	(78)
South	0.9x	0.77	x	5.42	x	76.57	x	0.4	x	0.7	=	80.53	(78)
South	0.9x	0.77	x	2.18	x	76.57	x	0.4	x	0.7	=	64.78	(78)
South	0.9x	0.77	x	2.72	x	97.53	x	0.4	x	0.7	=	51.48	(78)
South	0.9x	0.77	x	5.42	x	97.53	x	0.4	x	0.7	=	102.58	(78)
South	0.9x	0.77	x	2.18	x	97.53	x	0.4	x	0.7	=	82.52	(78)
South	0.9x	0.77	x	2.72	x	110.23	x	0.4	x	0.7	=	58.18	(78)
South	0.9x	0.77	x	5.42	x	110.23	x	0.4	x	0.7	=	115.93	(78)
South	0.9x	0.77	x	2.18	x	110.23	x	0.4	x	0.7	=	93.26	(78)
South	0.9x	0.77	x	2.72	x	114.87	x	0.4	x	0.7	=	60.63	(78)
South	0.9x	0.77	x	5.42	x	114.87	x	0.4	x	0.7	=	120.81	(78)
South	0.9x	0.77	x	2.18	x	114.87	x	0.4	x	0.7	=	97.18	(78)
South	0.9x	0.77	x	2.72	x	110.55	x	0.4	x	0.7	=	58.35	(78)
South	0.9x	0.77	x	5.42	x	110.55	x	0.4	x	0.7	=	116.26	(78)

South	0.9x	0.77	x	2.18	x	110.55	x	0.4	x	0.7	=	93.53	(78)
South	0.9x	0.77	x	2.72	x	108.01	x	0.4	x	0.7	=	57.01	(78)
South	0.9x	0.77	x	5.42	x	108.01	x	0.4	x	0.7	=	113.6	(78)
South	0.9x	0.77	x	2.18	x	108.01	x	0.4	x	0.7	=	91.38	(78)
South	0.9x	0.77	x	2.72	x	104.89	x	0.4	x	0.7	=	55.36	(78)
South	0.9x	0.77	x	5.42	x	104.89	x	0.4	x	0.7	=	110.32	(78)
South	0.9x	0.77	x	2.18	x	104.89	x	0.4	x	0.7	=	88.74	(78)
South	0.9x	0.77	x	2.72	x	101.89	x	0.4	x	0.7	=	53.77	(78)
South	0.9x	0.77	x	5.42	x	101.89	x	0.4	x	0.7	=	107.15	(78)
South	0.9x	0.77	x	2.18	x	101.89	x	0.4	x	0.7	=	86.2	(78)
South	0.9x	0.77	x	2.72	x	82.59	x	0.4	x	0.7	=	43.59	(78)
South	0.9x	0.77	x	5.42	x	82.59	x	0.4	x	0.7	=	86.86	(78)
South	0.9x	0.77	x	2.18	x	82.59	x	0.4	x	0.7	=	69.87	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.4	x	0.7	=	29.25	(78)
South	0.9x	0.77	x	5.42	x	55.42	x	0.4	x	0.7	=	58.28	(78)
South	0.9x	0.77	x	2.18	x	55.42	x	0.4	x	0.7	=	46.88	(78)
South	0.9x	0.77	x	2.72	x	40.4	x	0.4	x	0.7	=	21.32	(78)
South	0.9x	0.77	x	5.42	x	40.4	x	0.4	x	0.7	=	42.49	(78)
South	0.9x	0.77	x	2.18	x	40.4	x	0.4	x	0.7	=	34.18	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.51	205.04	269.4	320.11	349.66	344.18	332.99	310.75	286.6	223.31	146.89	106.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.18	606.73	658.49	688.88	697.85	672.47	648.29	631.75	617.98	575.22	522.39	499.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.8	0.61	0.44	0.47	0.7	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.33	20.53	20.76	20.92	20.99	21	21	20.97	20.78	20.44	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.75	0.54	0.36	0.39	0.63	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=	19.03	19.27	19.56	19.88	20.08	20.16	20.16	20.17	20.14	19.91	19.43	19	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.61	19.8	20.05	20.32	20.5	20.57	20.58	20.58	20.56	20.35	19.94	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.61	19.8	20.05	20.32	20.5	20.57	20.58	20.58	20.56	20.35	19.94	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.77	0.57	0.4	0.43	0.67	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	522.63	594.93	630.2	618.71	540.4	386.08	260.91	272.91	411.73	520.55	511.93	496.28	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1045.95	1015.2	920.18	764.02	586.85	392.22	261.51	273.82	426.61	650.22	861.35	1037.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	389.35	282.43	215.74	104.63	34.55	0	0	0	0	96.47	251.59	403.01	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1777.77 (98)

Space heating requirement in kWh/m²/year 24.45 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community 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		1777.77	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1866.65	(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		2052.08	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2154.69	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.21	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		158.65	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			158.65	(331)
Energy for lighting (calculated in Appendix L)				320.42	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	908.59	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.87	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	929.46	(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) =				929.46	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	82.34	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	166.3	(379)
Total CO2, kg/year	sum of (376)…(382) =				1178.1	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.2	(384)
EI rating (section 14)					86.59	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: W1-03

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Windows Type 3			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 4			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Windows Type 5			2.18	x1/[1/(1.2)+ 0.04]		=	2.5			(27)
Floor			86.4	x	0.1	=	8.64			(28)
Walls Type1	48.6	18.02	30.58	x	0.16	=	4.89			(29)
Walls Type2	14.31	1.89	12.42	x	0.15	=	1.86			(29)
Total area of elements, m²			149.31							(31)
Party wall			43.75	x	0	=	0			(32)
Party ceiling			86.4							(32b)

** 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) =	38.67	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	6480	(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	14.76	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

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Total fabric heat loss	(33) + (36) =	53.43	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.56	21.31	21.07	19.84	19.6	18.37	18.37	18.12	18.86	19.6	20.09	20.58	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.99	74.75	74.5	73.27	73.03	71.8	71.8	71.56	72.29	73.03	73.52	74.01	

Average = $\text{Sum}(39)_{1\ldots12}$ /12= 73.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.86	0.85	0.85	0.83	0.83	0.83	0.84	0.85	0.85	0.86	

Average = $\text{Sum}(40)_{1\ldots12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = $\text{Sum}(44)_{1\ldots12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = $\text{Sum}(45)_{1\ldots12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.76	185.91	195.6	175.83	172.66	154.79	149.14	162.99	162.49	182.3	192.15	205.85	(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=	210.76	185.91	195.6	175.83	172.66	154.79	149.14	162.99	162.49	182.3	192.15	205.85	

Output from water heater (annual)$_{1…12}$ | 2150.48 | (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=	95.92	85.16	90.88	83.47	83.25	76.48	75.43	80.04	79.04	86.46	88.9	94.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.78	18.45	15.01	11.36	8.49	7.17	7.75	10.07	13.52	17.16	20.03	21.35	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	128.92	126.72	122.15	115.93	111.9	106.22	101.39	107.57	109.77	116.21	123.47	126.73	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	443.59	441.48	427.39	404.59	381.37	359.02	344.52	350.62	362.34	385.35	411.8	431.73	(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	5.28	x	10.63	x	0.4	x	0.7	=	10.89	(74)
North	0.9x	0.77	x	2.64	x	10.63	x	0.4	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	5.28	x	20.32	x	0.4	x	0.7	=	20.82	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.4	x	0.7	=	10.41	(74)
North	0.9x	0.77	x	5.28	x	34.53	x	0.4	x	0.7	=	35.38	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.4	x	0.7	=	17.69	(74)
North	0.9x	0.77	x	5.28	x	55.46	x	0.4	x	0.7	=	56.83	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.4	x	0.7	=	28.41	(74)
North	0.9x	0.77	x	5.28	x	74.72	x	0.4	x	0.7	=	76.55	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.4	x	0.7	=	38.27	(74)
North	0.9x	0.77	x	5.28	x	79.99	x	0.4	x	0.7	=	81.95	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.4	x	0.7	=	40.97	(74)
North	0.9x	0.77	x	5.28	x	74.68	x	0.4	x	0.7	=	76.51	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.4	x	0.7	=	38.25	(74)
North	0.9x	0.77	x	5.28	x	59.25	x	0.4	x	0.7	=	60.7	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.4	x	0.7	=	30.35	(74)
North	0.9x	0.77	x	5.28	x	41.52	x	0.4	x	0.7	=	42.54	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.4	x	0.7	=	21.27	(74)
North	0.9x	0.77	x	5.28	x	24.19	x	0.4	x	0.7	=	24.78	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.4	x	0.7	=	12.39	(74)
North	0.9x	0.77	x	5.28	x	13.12	x	0.4	x	0.7	=	13.44	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.4	x	0.7	=	6.72	(74)
North	0.9x	0.77	x	5.28	x	8.86	x	0.4	x	0.7	=	9.08	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.4	x	0.7	=	4.54	(74)
South	0.9x	0.77	x	5.28	x	46.75	x	0.4	x	0.7	=	47.9	(78)
South	0.9x	0.77	x	2.64	x	46.75	x	0.4	x	0.7	=	23.95	(78)
South	0.9x	0.77	x	2.18	x	46.75	x	0.4	x	0.7	=	19.78	(78)
South	0.9x	0.77	x	5.28	x	76.57	x	0.4	x	0.7	=	78.45	(78)
South	0.9x	0.77	x	2.64	x	76.57	x	0.4	x	0.7	=	39.22	(78)
South	0.9x	0.77	x	2.18	x	76.57	x	0.4	x	0.7	=	32.39	(78)
South	0.9x	0.77	x	5.28	x	97.53	x	0.4	x	0.7	=	99.93	(78)
South	0.9x	0.77	x	2.64	x	97.53	x	0.4	x	0.7	=	49.96	(78)
South	0.9x	0.77	x	2.18	x	97.53	x	0.4	x	0.7	=	41.26	(78)
South	0.9x	0.77	x	5.28	x	110.23	x	0.4	x	0.7	=	112.94	(78)
South	0.9x	0.77	x	2.64	x	110.23	x	0.4	x	0.7	=	56.47	(78)
South	0.9x	0.77	x	2.18	x	110.23	x	0.4	x	0.7	=	46.63	(78)
South	0.9x	0.77	x	5.28	x	114.87	x	0.4	x	0.7	=	117.69	(78)
South	0.9x	0.77	x	2.64	x	114.87	x	0.4	x	0.7	=	58.84	(78)
South	0.9x	0.77	x	2.18	x	114.87	x	0.4	x	0.7	=	48.59	(78)

South	0.9x	0.77	x	5.28	x	110.55	x	0.4	x	0.7	=	113.26	(78)
South	0.9x	0.77	x	2.64	x	110.55	x	0.4	x	0.7	=	56.63	(78)
South	0.9x	0.77	x	2.18	x	110.55	x	0.4	x	0.7	=	46.76	(78)
South	0.9x	0.77	x	5.28	x	108.01	x	0.4	x	0.7	=	110.66	(78)
South	0.9x	0.77	x	2.64	x	108.01	x	0.4	x	0.7	=	55.33	(78)
South	0.9x	0.77	x	2.18	x	108.01	x	0.4	x	0.7	=	45.69	(78)
South	0.9x	0.77	x	5.28	x	104.89	x	0.4	x	0.7	=	107.47	(78)
South	0.9x	0.77	x	2.64	x	104.89	x	0.4	x	0.7	=	53.73	(78)
South	0.9x	0.77	x	2.18	x	104.89	x	0.4	x	0.7	=	44.37	(78)
South	0.9x	0.77	x	5.28	x	101.89	x	0.4	x	0.7	=	104.39	(78)
South	0.9x	0.77	x	2.64	x	101.89	x	0.4	x	0.7	=	52.19	(78)
South	0.9x	0.77	x	2.18	x	101.89	x	0.4	x	0.7	=	43.1	(78)
South	0.9x	0.77	x	5.28	x	82.59	x	0.4	x	0.7	=	84.61	(78)
South	0.9x	0.77	x	2.64	x	82.59	x	0.4	x	0.7	=	42.31	(78)
South	0.9x	0.77	x	2.18	x	82.59	x	0.4	x	0.7	=	34.93	(78)
South	0.9x	0.77	x	5.28	x	55.42	x	0.4	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	2.64	x	55.42	x	0.4	x	0.7	=	28.39	(78)
South	0.9x	0.77	x	2.18	x	55.42	x	0.4	x	0.7	=	23.44	(78)
South	0.9x	0.77	x	5.28	x	40.4	x	0.4	x	0.7	=	41.39	(78)
South	0.9x	0.77	x	2.64	x	40.4	x	0.4	x	0.7	=	20.69	(78)
South	0.9x	0.77	x	2.18	x	40.4	x	0.4	x	0.7	=	17.09	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	107.97	181.29	244.21	301.28	339.95	339.57	326.44	296.62	263.48	199.03	128.77	92.8	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	551.56	622.77	671.6	705.87	721.31	698.59	670.96	647.24	625.81	584.37	540.57	524.52	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.64	0.47	0.51	0.75	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.33	20.52	20.75	20.91	20.99	21	21	20.97	20.77	20.44	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.2	20.2	20.21	20.21	20.23	20.23	20.23	20.22	20.21	20.21	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.79	0.57	0.39	0.42	0.68	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.12	19.31	19.59	19.92	20.13	20.22	20.23	20.23	20.2	19.95	19.49	19.09	(90)

fLA = Living area ÷ (4) = | 0.23 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.37	19.55	19.8	20.11	20.31	20.4	20.41	20.41	20.38	20.14	19.71	19.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.37	19.55	19.8	20.11	20.31	20.4	20.41	20.41	20.38	20.14	19.71	19.34	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.8	0.59	0.41	0.44	0.7	0.93	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	548.54	615.2	652.35	650.78	577.34	410.61	272.87	286.05	437.02	543.11	533.46	522.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1129.99	1095.05	991.07	821.34	629.12	416.33	273.32	286.79	453.79	696.64	927.08	1120.84	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	432.6	322.46	252.01	122.8	38.53	0	0	0	0	114.23	283.41	445.27	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2011.31	(98)
Space heating requirement in kWh/m²/year		23.28	(99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2011.31	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2111.88	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2150.48	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2258.01	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.7	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)

Electricity for pumps and fans within dwelling (Table 4f):					
mechanical ventilation - balanced, extract or positive input from outside				177.88	(330a)
warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			177.88	(331)
Energy for lighting (calculated in Appendix L)				366.92	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.7	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	986.31	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22.68	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1008.99	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1008.99	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	92.32	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	190.43	(379)
Total CO2, kg/year	sum of (376)…(382) =				1291.74	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.95	(384)
EI rating (section 14)					86.83	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: W2-01

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	94.3	(1a) x	2.7	(2a) =	254.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	254.61	(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)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			6.48	x1/[1/(1.2)+ 0.04]		=	7.42			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Floor			94.3	x	0.06	=	5.658			(28)
Walls Type1	66.42	19.68	46.74	x	0.16	=	7.48			(29)
Walls Type2	5.67	1.89	3.78	x	0.15	=	0.57			(29)
Total area of elements, m²			166.39							(31)
Party wall			42.75	x	0	=	0			(32)
Party ceiling			94.3							(32b)

** 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) = 38.88 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7072.5 (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 14.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 53.63 (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=	23.53	23.26	23	21.66	21.39	20.05	20.05	19.78	20.59	21.39	21.92	22.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.16	76.89	76.63	75.29	75.02	73.68	73.68	73.41	74.21	75.02	75.55	76.09	

Average = Sum(39)$_{1…12}$ /12= 75.22 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	0.81

Average = Sum(40)$_{1...12}$ /12= 0.8 (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 2.68 (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 97.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.64	103.72	99.81	95.9	91.98	88.07	88.07	91.98	95.9	99.81	103.72	107.64

Total = Sum(44)$_{1...12}$ = 1174.24 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.62	139.61	144.06	125.6	120.51	103.99	96.37	110.58	111.9	130.41	142.35	154.59

Total = Sum(45)$_{1...12}$ = 1539.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.94	20.94	21.61	18.84	18.08	15.6	14.45	16.59	16.79	19.56	21.35	23.19	(46)

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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	214.9	189.54	199.34	179.09	175.79	157.49	151.64	165.86	165.4	185.69	195.85	209.86	(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=	214.9	189.54	199.34	179.09	175.79	157.49	151.64	165.86	165.4	185.69	195.85	209.86

Output from water heater (annual)$_{1...12}$ 2190.45 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.3	86.36	92.12	84.56	84.29	77.37	76.26	80.99	80	87.58	90.13	95.62	(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=	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	22.07	19.6	15.94	12.07	9.02	7.62	8.23	10.7	14.36	18.23	21.28	22.68	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	246.77	249.33	242.88	229.14	211.8	195.5	184.61	182.05	188.51	202.24	219.58	235.88	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	(71)
Water heating gains (Table 5)													
(72)m=	130.77	128.51	123.82	117.44	113.3	107.46	102.5	108.86	111.11	117.72	125.18	128.52	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	462.82	460.65	445.84	421.85	397.32	373.78	358.55	364.81	377.18	401.4	429.24	450.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	6.48	x	19.64	x	0.4	x	0.7	=	24.7	(80)
West	0.9x	0.77	x	2.64	x	19.64	x	0.4	x	0.7	=	50.31	(80)
West	0.9x	0.77	x	6.48	x	38.42	x	0.4	x	0.7	=	48.31	(80)
West	0.9x	0.77	x	2.64	x	38.42	x	0.4	x	0.7	=	98.41	(80)
West	0.9x	0.77	x	6.48	x	63.27	x	0.4	x	0.7	=	79.56	(80)

West	0.9x	0.77	x	2.64	x	63.27	x	0.4	x	0.7	=	162.06	(80)
West	0.9x	0.77	x	6.48	x	92.28	x	0.4	x	0.7	=	116.03	(80)
West	0.9x	0.77	x	2.64	x	92.28	x	0.4	x	0.7	=	236.36	(80)
West	0.9x	0.77	x	6.48	x	113.09	x	0.4	x	0.7	=	142.2	(80)
West	0.9x	0.77	x	2.64	x	113.09	x	0.4	x	0.7	=	289.67	(80)
West	0.9x	0.77	x	6.48	x	115.77	x	0.4	x	0.7	=	145.57	(80)
West	0.9x	0.77	x	2.64	x	115.77	x	0.4	x	0.7	=	296.53	(80)
West	0.9x	0.77	x	6.48	x	110.22	x	0.4	x	0.7	=	138.59	(80)
West	0.9x	0.77	x	2.64	x	110.22	x	0.4	x	0.7	=	282.31	(80)
West	0.9x	0.77	x	6.48	x	94.68	x	0.4	x	0.7	=	119.04	(80)
West	0.9x	0.77	x	2.64	x	94.68	x	0.4	x	0.7	=	242.5	(80)
West	0.9x	0.77	x	6.48	x	73.59	x	0.4	x	0.7	=	92.53	(80)
West	0.9x	0.77	x	2.64	x	73.59	x	0.4	x	0.7	=	188.49	(80)
West	0.9x	0.77	x	6.48	x	45.59	x	0.4	x	0.7	=	57.32	(80)
West	0.9x	0.77	x	2.64	x	45.59	x	0.4	x	0.7	=	116.77	(80)
West	0.9x	0.77	x	6.48	x	24.49	x	0.4	x	0.7	=	30.79	(80)
West	0.9x	0.77	x	2.64	x	24.49	x	0.4	x	0.7	=	62.72	(80)
West	0.9x	0.77	x	6.48	x	16.15	x	0.4	x	0.7	=	20.31	(80)
West	0.9x	0.77	x	2.64	x	16.15	x	0.4	x	0.7	=	41.37	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	75	146.72	241.62	352.39	431.87	442.09	420.89	361.54	281.02	174.09	93.52	61.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	537.82	607.37	687.46	774.24	829.19	815.88	779.44	726.35	658.2	575.49	522.76	511.97	(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	0.98	0.93	0.79	0.57	0.42	0.46	0.74	0.96	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.33	20.54	20.8	20.95	21	21	21	20.98	20.76	20.44	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.25	20.26	20.27	20.27	20.27	20.26	20.26	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.74	0.51	0.35	0.39	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.16	19.35	19.65	20.02	20.21	20.27	20.27	20.27	20.25	19.98	19.51	19.14	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.72	19.99	20.32	20.49	20.54	20.55	20.55	20.52	20.28	19.87	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.56	19.72	19.99	20.32	20.49	20.54	20.55	20.55	20.52	20.28	19.87	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.91	0.75	0.53	0.37	0.42	0.7	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	536.23	603.09	671.8	706.53	625.65	435.25	290.7	304.18	461.26	546.26	518.96	510.85	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1177.41	1139.62	1033.73	859.59	659.7	438	290.89	304.61	476.77	725.95	964.52	1167.27	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	477.04	360.55	269.28	110.21	25.33	0	0	0	0	133.69	320.81	488.38	

	Total per year (kWh/year) = Sum(98)1...5,9...12 =	2185.28	(98)
Space heating requirement in kWh/m²/year		23.17	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2185.28	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	2294.54	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2190.45	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2299.97	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.95	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		205.79	(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) =		205.79	(331)
Energy for lighting (calculated in Appendix L)			389.76	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.7	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1037.01	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	23.85	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1060.85	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1060.85	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	106.8	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	202.29	(379)
Total CO2, kg/year	sum of (376)…(382) =				1369.94	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.53	(384)
EI rating (section 14)					86.82	(385)

FHP

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.12

Property Address: W3-12

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.8	(1a) x	2.7	(2a) =	139.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	139.86	(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		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) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Walls Type1	18.36	7.92	10.44	x	0.16	=	1.67			(29)
Walls Type2	18.36	1.89	16.47	x	0.15	=	2.47			(29)
Total area of elements, m²			36.72							(31)
Party wall			37.5	x	0	=	0			(32)
Party floor			51.8							(32a)
Party ceiling			51.8							(32b)

** 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) = 15.85 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.23 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.08 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.26	12.13	12	11.32	11.19	10.52	10.52	10.39	10.79	11.19	11.46	11.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	32.35	32.21	32.08	31.41	31.27	30.6	30.6	30.47	30.87	31.27	31.54	31.81

Average = $Sum(39)_{1\ldots12}$ /12= 31.37 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.62	0.62	0.62	0.61	0.6	0.59	0.59	0.59	0.6	0.6	0.61	0.61

Average = Sum(40)$_{1…12}$ /12= 0.61 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.74 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.6 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	83.16	80.14	77.11	74.09	71.06	68.04	68.04	71.06	74.09	77.11	80.14	83.16

Total = Sum(44)$_{1…12}$ = 907.2 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	123.32	107.86	111.3	97.04	93.11	80.35	74.45	85.43	86.45	100.75	109.98	119.43

Total = Sum(45)$_{1…12}$ = 1189.49 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.5	16.18	16.7	14.56	13.97	12.05	11.17	12.82	12.97	15.11	16.5	17.91	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	178.6	157.79	166.58	150.53	148.39	133.84	129.73	140.71	139.95	156.03	163.48	174.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	178.6	157.79	166.58	150.53	148.39	133.84	129.73	140.71	139.95	156.03	163.48	174.71	

Output from water heater (annual)$_{1...12}$ 1840.33 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.23	75.81	81.23	75.06	75.18	69.51	68.98	72.63	71.54	77.72	79.36	83.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.26	12.66	10.3	7.8	5.83	4.92	5.32	6.91	9.28	11.78	13.75	14.66	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	151.91	153.48	149.51	141.05	130.38	120.35	113.64	112.07	116.04	124.5	135.17	145.2	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	(71)
Water heating gains (Table 5)													
(72)m=	114.55	112.81	109.18	104.25	101.05	96.54	92.71	97.62	99.36	104.47	110.23	112.81	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	329.87	328.1	318.14	302.25	286.4	270.96	260.82	265.75	273.83	289.89	308.29	321.82	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.28	x	19.64	x	0.4	x	0.7	=	20.12	(76)
East	0.9x	0.77	x	2.64	x	19.64	x	0.4	x	0.7	=	10.06	(76)
East	0.9x	0.77	x	5.28	x	38.42	x	0.4	x	0.7	=	39.36	(76)
East	0.9x	0.77	x	2.64	x	38.42	x	0.4	x	0.7	=	19.68	(76)
East	0.9x	0.77	x	5.28	x	63.27	x	0.4	x	0.7	=	64.83	(76)

East	0.9x	0.77	x	2.64	x	63.27	x	0.4	x	0.7	=	32.41	(76)
East	0.9x	0.77	x	5.28	x	92.28	x	0.4	x	0.7	=	94.54	(76)
East	0.9x	0.77	x	2.64	x	92.28	x	0.4	x	0.7	=	47.27	(76)
East	0.9x	0.77	x	5.28	x	113.09	x	0.4	x	0.7	=	115.87	(76)
East	0.9x	0.77	x	2.64	x	113.09	x	0.4	x	0.7	=	57.93	(76)
East	0.9x	0.77	x	5.28	x	115.77	x	0.4	x	0.7	=	118.61	(76)
East	0.9x	0.77	x	2.64	x	115.77	x	0.4	x	0.7	=	59.31	(76)
East	0.9x	0.77	x	5.28	x	110.22	x	0.4	x	0.7	=	112.92	(76)
East	0.9x	0.77	x	2.64	x	110.22	x	0.4	x	0.7	=	56.46	(76)
East	0.9x	0.77	x	5.28	x	94.68	x	0.4	x	0.7	=	97	(76)
East	0.9x	0.77	x	2.64	x	94.68	x	0.4	x	0.7	=	48.5	(76)
East	0.9x	0.77	x	5.28	x	73.59	x	0.4	x	0.7	=	75.39	(76)
East	0.9x	0.77	x	2.64	x	73.59	x	0.4	x	0.7	=	37.7	(76)
East	0.9x	0.77	x	5.28	x	45.59	x	0.4	x	0.7	=	46.71	(76)
East	0.9x	0.77	x	2.64	x	45.59	x	0.4	x	0.7	=	23.35	(76)
East	0.9x	0.77	x	5.28	x	24.49	x	0.4	x	0.7	=	25.09	(76)
East	0.9x	0.77	x	2.64	x	24.49	x	0.4	x	0.7	=	12.54	(76)
East	0.9x	0.77	x	5.28	x	16.15	x	0.4	x	0.7	=	16.55	(76)
East	0.9x	0.77	x	2.64	x	16.15	x	0.4	x	0.7	=	8.27	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.18	59.04	97.24	141.82	173.8	177.92	169.38	145.5	113.09	70.06	37.63	24.82	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	360.05	387.15	415.38	444.06	460.2	448.87	430.2	411.24	386.92	359.95	345.93	346.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.81	0.63	0.44	0.31	0.34	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.63	20.72	20.85	20.96	21	21	21	21	21	20.96	20.79	20.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.41	20.41	20.41	20.42	20.43	20.44	20.44	20.44	20.43	20.43	20.42	20.42	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.27	0.3	0.5	0.81	0.96	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.92	20.05	20.23	20.39	20.42	20.44	20.44	20.44	20.43	20.38	20.16	19.91	(90)

fLA = Living area ÷ (4) = | 0.45 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.24	20.35	20.51	20.65	20.68	20.69	20.69	20.69	20.69	20.64	20.45	20.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	20.24	20.35	20.51	20.65	20.68	20.69	20.69	20.69	20.69	20.64	20.45	20.23	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.8	0.61	0.42	0.29	0.32	0.52	0.83	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	354.57	375.78	384.67	353.79	279.37	186.38	125.23	130.81	203.05	297.32	332.51	342.42	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	515.64	497.7	449.37	368.92	280.89	186.43	125.23	130.81	203.4	314.08	421.01	509.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	119.84	81.93	48.13	10.89	1.14	0	0	0	0	12.48	63.72	124.57	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 462.69 (98)

Space heating requirement in kWh/m²/year 8.93 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community 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		462.69	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	485.83	(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		1840.33	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1932.34	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	24.18	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		106.64	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			106.64	(331)
Energy for lighting (calculated in Appendix L)				251.82	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			95.7	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22 =	545.79	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	12.55	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	558.34	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			558.34	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	55.35	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	130.69	(379)
Total CO2, kg/year	sum of (376)…(382) =			744.39	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.37	(384)
EI rating (section 14)				89.7	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: W4-09

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Windows Type 3			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 4			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Walls Type1	48.6	18.48	30.12	x	0.16	=	4.82			(29)
Walls Type2	14.31	1.89	12.42	x	0.15	=	1.86			(29)
Roof	18.7	0	18.7	x	0.2	=	3.74			(30)
Total area of elements, m²			81.61							(31)
Party wall			43.75	x	0	=	0			(32)
Party floor			86.4							(32a)
Party ceiling			67.7							(32b)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.22 (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 15.69 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss	(33) + (36) =	49.91 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.56	21.31	21.07	19.84	19.6	18.37	18.37	18.12	18.86	19.6	20.09	20.58	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.47	71.23	70.98	69.76	69.51	68.28	68.28	68.04	68.77	69.51	70	70.49	

Average = Sum(39)$_{1...12}$ /12= 69.69 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.82	0.82	0.81	0.8	0.79	0.79	0.79	0.8	0.8	0.81	0.82	

Average = Sum(40)$_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.76	185.91	195.6	175.83	172.66	154.79	149.14	162.99	162.49	182.3	192.15	205.85	(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=	210.76	185.91	195.6	175.83	172.66	154.79	149.14	162.99	162.49	182.3	192.15	205.85	

Output from water heater (annual)1…12 — 2150.48 (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=	95.92	85.16	90.88	83.47	83.25	76.48	75.43	80.04	79.04	86.46	88.9	94.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.74	18.42	14.98	11.34	8.48	7.16	7.73	10.05	13.49	17.13	20	21.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	128.92	126.72	122.15	115.93	111.9	106.22	101.39	107.57	109.77	116.21	123.47	126.73	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	443.56	441.45	427.36	404.58	381.35	359.01	344.5	350.6	362.31	385.32	411.77	431.69	(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	5.28	x	10.63	x	0.4	x	0.7	=	10.89	(74)
North	0.9x	0.77	x	2.64	x	10.63	x	0.4	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	5.28	x	20.32	x	0.4	x	0.7	=	20.82	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.4	x	0.7	=	10.41	(74)
North	0.9x	0.77	x	5.28	x	34.53	x	0.4	x	0.7	=	35.38	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.4	x	0.7	=	17.69	(74)
North	0.9x	0.77	x	5.28	x	55.46	x	0.4	x	0.7	=	56.83	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.4	x	0.7	=	28.41	(74)
North	0.9x	0.77	x	5.28	x	74.72	x	0.4	x	0.7	=	76.55	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.4	x	0.7	=	38.27	(74)
North	0.9x	0.77	x	5.28	x	79.99	x	0.4	x	0.7	=	81.95	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.4	x	0.7	=	40.97	(74)
North	0.9x	0.77	x	5.28	x	74.68	x	0.4	x	0.7	=	76.51	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.4	x	0.7	=	38.25	(74)
North	0.9x	0.77	x	5.28	x	59.25	x	0.4	x	0.7	=	60.7	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.4	x	0.7	=	30.35	(74)
North	0.9x	0.77	x	5.28	x	41.52	x	0.4	x	0.7	=	42.54	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.4	x	0.7	=	21.27	(74)
North	0.9x	0.77	x	5.28	x	24.19	x	0.4	x	0.7	=	24.78	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.4	x	0.7	=	12.39	(74)
North	0.9x	0.77	x	5.28	x	13.12	x	0.4	x	0.7	=	13.44	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.4	x	0.7	=	6.72	(74)
North	0.9x	0.77	x	5.28	x	8.86	x	0.4	x	0.7	=	9.08	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.4	x	0.7	=	4.54	(74)
South	0.9x	0.77	x	5.28	x	46.75	x	0.4	x	0.7	=	47.9	(78)
South	0.9x	0.77	x	2.64	x	46.75	x	0.4	x	0.7	=	47.9	(78)
South	0.9x	0.77	x	5.28	x	76.57	x	0.4	x	0.7	=	78.45	(78)
South	0.9x	0.77	x	2.64	x	76.57	x	0.4	x	0.7	=	78.45	(78)
South	0.9x	0.77	x	5.28	x	97.53	x	0.4	x	0.7	=	99.93	(78)
South	0.9x	0.77	x	2.64	x	97.53	x	0.4	x	0.7	=	99.93	(78)
South	0.9x	0.77	x	5.28	x	110.23	x	0.4	x	0.7	=	112.94	(78)
South	0.9x	0.77	x	2.64	x	110.23	x	0.4	x	0.7	=	112.94	(78)
South	0.9x	0.77	x	5.28	x	114.87	x	0.4	x	0.7	=	117.69	(78)
South	0.9x	0.77	x	2.64	x	114.87	x	0.4	x	0.7	=	117.69	(78)
South	0.9x	0.77	x	5.28	x	110.55	x	0.4	x	0.7	=	113.26	(78)
South	0.9x	0.77	x	2.64	x	110.55	x	0.4	x	0.7	=	113.26	(78)
South	0.9x	0.77	x	5.28	x	108.01	x	0.4	x	0.7	=	110.66	(78)
South	0.9x	0.77	x	2.64	x	108.01	x	0.4	x	0.7	=	110.66	(78)
South	0.9x	0.77	x	5.28	x	104.89	x	0.4	x	0.7	=	107.47	(78)

South	0.9x	0.77	x	2.64	x	104.89	x	0.4	x	0.7	=	107.47	(78)
South	0.9x	0.77	x	5.28	x	101.89	x	0.4	x	0.7	=	104.39	(78)
South	0.9x	0.77	x	2.64	x	101.89	x	0.4	x	0.7	=	104.39	(78)
South	0.9x	0.77	x	5.28	x	82.59	x	0.4	x	0.7	=	84.61	(78)
South	0.9x	0.77	x	2.64	x	82.59	x	0.4	x	0.7	=	84.61	(78)
South	0.9x	0.77	x	5.28	x	55.42	x	0.4	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	2.64	x	55.42	x	0.4	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	5.28	x	40.4	x	0.4	x	0.7	=	41.39	(78)
South	0.9x	0.77	x	2.64	x	40.4	x	0.4	x	0.7	=	41.39	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	112.14	188.12	252.92	311.11	350.2	349.44	336.09	305.99	272.57	206.4	133.71	96.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	555.7	629.57	680.28	715.69	731.55	708.45	680.59	656.59	634.89	591.72	545.48	528.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.61	0.44	0.48	0.72	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.4	20.58	20.79	20.94	20.99	21	21	20.98	20.81	20.5	20.24	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.25	20.26	20.26	20.26	20.26	20.25	20.24	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.77	0.54	0.37	0.4	0.65	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.24	19.44	19.7	20.01	20.19	20.26	20.26	20.26	20.24	20.03	19.6	19.22	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.66	19.91	20.19	20.37	20.43	20.43	20.44	20.41	20.21	19.81	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.66	19.91	20.19	20.37	20.43	20.43	20.44	20.41	20.21	19.81	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.77	0.56	0.38	0.42	0.67	0.92	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	552.39	620.91	657.62	650.17	565.59	394.64	261.56	274.17	423.34	542.93	537.39	525.75	(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=	1084.85	1051.43	951.63	787.7	602.37	398.02	261.79	274.57	434.2	668.29	889.57	1075.31	(97)

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	396.14	289.31	218.74	99.02	27.37	0	0	0	0	93.27	253.57	408.87

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1786.3 (98)

Space heating requirement in kWh/m²/year 20.67 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1786.3	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1875.62	(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		2150.48	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2258.01	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.34	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		188.55	(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) =	188.55	(331)
Energy for lighting (calculated in Appendix L)		366.31	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.7	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	932.98	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	21.45	(372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	954.43	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			954.43	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	97.86	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	190.12	(379)
Total CO2, kg/year	sum of (376)…(382) =			1242.41	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.38	(384)
EI rating (section 14)				87.33	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.12

Property Address: W5-12

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.8	(1a) x	2.7	(2a) =	139.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	139.86	(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

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Walls Type1	18.36	7.92	10.44	x	0.16	=	1.67			(29)
Walls Type2	18.36	1.89	16.47	x	0.15	=	2.47			(29)
Roof	51.8	0	51.8	x	0.12	=	6.22			(30)
Total area of elements, m²			88.52							(31)
Party wall			37.5	x	0	=	0			(32)
Party floor			51.8							(32a)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.07 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.37 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.43 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.26	12.13	12	11.32	11.19	10.52	10.52	10.39	10.79	11.19	11.46	11.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	45.7	45.56	45.43	44.76	44.62	43.95	43.95	43.82	44.22	44.62	44.89	45.16	

Average = Sum(39)$_{1…12}$ /12= 44.73 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.88	0.88	0.88	0.86	0.86	0.85	0.85	0.85	0.85	0.86	0.87	0.87

Average = Sum(40)$_{1…12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.74 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 75.6 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	83.16	80.14	77.11	74.09	71.06	68.04	68.04	71.06	74.09	77.11	80.14	83.16	
Total = Sum(44)$_{1…12}$ =												907.2	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	123.32	107.86	111.3	97.04	93.11	80.35	74.45	85.43	86.45	100.75	109.98	119.43	
Total = Sum(45)$_{1…12}$ =												1189.49	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.5	16.18	16.7	14.56	13.97	12.05	11.17	12.82	12.97	15.11	16.5	17.91	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	178.6	157.79	166.58	150.53	148.39	133.84	129.73	140.71	139.95	156.03	163.48	174.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	178.6	157.79	166.58	150.53	148.39	133.84	129.73	140.71	139.95	156.03	163.48	174.71	

Output from water heater (annual)$_{1...12}$ 1840.33 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.23	75.81	81.23	75.06	75.18	69.51	68.98	72.63	71.54	77.72	79.36	83.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.26	12.66	10.3	7.8	5.83	4.92	5.32	6.91	9.28	11.78	13.75	14.66	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	151.91	153.48	149.51	141.05	130.38	120.35	113.64	112.07	116.04	124.5	135.17	145.2	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	(71)
Water heating gains (Table 5)													
(72)m=	114.55	112.81	109.18	104.25	101.05	96.54	92.71	97.62	99.36	104.47	110.23	112.81	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	329.87	328.1	318.14	302.25	286.4	270.96	260.82	265.75	273.83	289.89	308.29	321.82	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.28	x	19.64	x	0.4	x	0.7	=	20.12	(76)
East	0.9x	0.77	x	2.64	x	19.64	x	0.4	x	0.7	=	10.06	(76)
East	0.9x	0.77	x	5.28	x	38.42	x	0.4	x	0.7	=	39.36	(76)
East	0.9x	0.77	x	2.64	x	38.42	x	0.4	x	0.7	=	19.68	(76)
East	0.9x	0.77	x	5.28	x	63.27	x	0.4	x	0.7	=	64.83	(76)

East	0.9x	0.77	x	2.64	x	63.27	x	0.4	x	0.7	=	32.41	(76)
East	0.9x	0.77	x	5.28	x	92.28	x	0.4	x	0.7	=	94.54	(76)
East	0.9x	0.77	x	2.64	x	92.28	x	0.4	x	0.7	=	47.27	(76)
East	0.9x	0.77	x	5.28	x	113.09	x	0.4	x	0.7	=	115.87	(76)
East	0.9x	0.77	x	2.64	x	113.09	x	0.4	x	0.7	=	57.93	(76)
East	0.9x	0.77	x	5.28	x	115.77	x	0.4	x	0.7	=	118.61	(76)
East	0.9x	0.77	x	2.64	x	115.77	x	0.4	x	0.7	=	59.31	(76)
East	0.9x	0.77	x	5.28	x	110.22	x	0.4	x	0.7	=	112.92	(76)
East	0.9x	0.77	x	2.64	x	110.22	x	0.4	x	0.7	=	56.46	(76)
East	0.9x	0.77	x	5.28	x	94.68	x	0.4	x	0.7	=	97	(76)
East	0.9x	0.77	x	2.64	x	94.68	x	0.4	x	0.7	=	48.5	(76)
East	0.9x	0.77	x	5.28	x	73.59	x	0.4	x	0.7	=	75.39	(76)
East	0.9x	0.77	x	2.64	x	73.59	x	0.4	x	0.7	=	37.7	(76)
East	0.9x	0.77	x	5.28	x	45.59	x	0.4	x	0.7	=	46.71	(76)
East	0.9x	0.77	x	2.64	x	45.59	x	0.4	x	0.7	=	23.35	(76)
East	0.9x	0.77	x	5.28	x	24.49	x	0.4	x	0.7	=	25.09	(76)
East	0.9x	0.77	x	2.64	x	24.49	x	0.4	x	0.7	=	12.54	(76)
East	0.9x	0.77	x	5.28	x	16.15	x	0.4	x	0.7	=	16.55	(76)
East	0.9x	0.77	x	2.64	x	16.15	x	0.4	x	0.7	=	8.27	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.18	59.04	97.24	141.82	173.8	177.92	169.38	145.5	113.09	70.06	37.63	24.82	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	360.05	387.15	415.38	444.06	460.2	448.87	430.2	411.24	386.92	359.95	345.93	346.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.61	0.45	0.49	0.74	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.33	20.52	20.76	20.92	20.99	21	21	20.97	20.76	20.46	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.19	20.2	20.2	20.21	20.21	20.21	20.21	20.2	20.2	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.77	0.54	0.37	0.41	0.68	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.16	19.31	19.58	19.92	20.13	20.2	20.21	20.21	20.18	19.93	19.5	19.14	(90)

fLA = Living area ÷ (4) = | 0.45 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.64	19.77	20	20.3	20.49	20.56	20.57	20.57	20.54	20.31	19.94	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.64	19.77	20	20.3	20.49	20.56	20.57	20.57	20.54	20.31	19.94	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.79	0.58	0.4	0.44	0.71	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	357.3	382.08	403.06	406.83	361.97	258.51	174.06	182.09	272.99	334.88	340.36	344.5	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	701	677.59	613.43	510.11	392.16	261.94	174.36	182.62	284.67	433.29	576.27	696.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	255.71	198.59	156.52	74.36	22.46	0	0	0	0	73.22	169.85	261.85	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1212.56	(98)
Space heating requirement in kWh/m²/year	23.41	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1212.56	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1273.19	(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		1840.33	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1932.34	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	32.06	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		106.64	(330a)

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		106.64	(331)
Energy for lighting (calculated in Appendix L)			251.82	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.7	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	723.51	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	16.64	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	740.14	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				740.14	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	55.35	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	130.69	(379)
Total CO2, kg/year	sum of (376)…(382) =				926.19	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.88	(384)
EI rating (section 14)					87.18	(385)

Be Green DER

FHP

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.12

Property Address: E0-01

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71	(1a) x	2.7	(2a) =	191.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	191.7	(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		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14	(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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			7.58	x1/[1/(1.2)+ 0.04]		=	8.68			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 3			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 4			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Floor			71	x	0.12	=	8.52			(28)
Walls Type1	65.34	21.18	44.16	x	0.16	=	7.07			(29)
Walls Type2	4.32	1.89	2.43	x	0.15	=	0.37			(29)
Walls Type3	7.29	0	7.29	x	0.16	=	1.17			(29)
Roof	6	0	6	x	0.12	=	0.72			(30)
Total area of elements, m²			153.95							(31)
Party wall			19.17	x	0	=	0			(32)
Party ceiling			65							(32b)

** 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) = 44.74 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 19.84 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 64.58 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	18.62	18.4	18.19	17.09	16.87	15.77	15.77	15.55	16.21	16.87	17.31	17.75	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.2	82.98	82.77	81.67	81.45	80.35	80.35	80.13	80.79	81.45	81.89	82.33	

Average = $Sum(39)_{1...12}$ /12= 81.61 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.17	1.15	1.15	1.13	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 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.12 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

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=	96.93	93.4	89.88	86.35	82.83	79.3	79.3	82.83	86.35	89.88	93.4	96.93	

Total = $Sum(44)_{1...12}$ = 1057.39 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.74	125.72	129.73	113.1	108.52	93.65	86.78	99.58	100.77	117.44	128.19	139.21	

Total = $Sum(45)_{1...12}$ = 1386.41 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.56	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.88	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	199.02	175.64	185.01	166.59	163.8	147.14	142.05	154.86	154.26	172.71	181.68	194.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	199.02	175.64	185.01	166.59	163.8	147.14	142.05	154.86	154.26	172.71	181.68	194.48	

Output from water heater (annual)$_{1…12}$ 2037.25 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.02	81.74	87.36	80.4	80.31	73.93	73.07	77.33	76.3	83.27	85.42	90.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	113.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.8	15.81	12.85	9.73	7.27	6.14	6.64	8.63	11.58	14.7	17.16	18.29	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.62	201.69	196.47	185.36	171.33	158.15	149.34	147.27	152.49	163.6	177.63	190.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	34.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	-90.81	(71)

Water heating gains (Table 5)

(72)m=	123.68	121.64	117.41	111.67	107.94	102.68	98.22	103.94	105.97	111.92	118.64	121.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.14	396.19	383.79	363.81	343.59	324.02	311.25	316.89	327.09	347.27	370.47	387.8	(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	2.72	x	10.63	x	0.4	x	0.7	=	11.22	(74)
North	0.9x	0.77	x	2.72	x	20.32	x	0.4	x	0.7	=	21.45	(74)
North	0.9x	0.77	x	2.72	x	34.53	x	0.4	x	0.7	=	36.45	(74)
North	0.9x	0.77	x	2.72	x	55.46	x	0.4	x	0.7	=	58.55	(74)
North	0.9x	0.77	x	2.72	x	74.72	x	0.4	x	0.7	=	78.87	(74)
North	0.9x	0.77	x	2.72	x	79.99	x	0.4	x	0.7	=	84.43	(74)
North	0.9x	0.77	x	2.72	x	74.68	x	0.4	x	0.7	=	78.83	(74)
North	0.9x	0.77	x	2.72	x	59.25	x	0.4	x	0.7	=	62.54	(74)
North	0.9x	0.77	x	2.72	x	41.52	x	0.4	x	0.7	=	43.82	(74)
North	0.9x	0.77	x	2.72	x	24.19	x	0.4	x	0.7	=	25.53	(74)
North	0.9x	0.77	x	2.72	x	13.12	x	0.4	x	0.7	=	13.85	(74)
North	0.9x	0.77	x	2.72	x	8.86	x	0.4	x	0.7	=	9.36	(74)
South	0.9x	0.77	x	7.58	x	46.75	x	0.4	x	0.7	=	68.76	(78)
South	0.9x	0.77	x	2.72	x	46.75	x	0.4	x	0.7	=	49.35	(78)
South	0.9x	0.77	x	7.58	x	76.57	x	0.4	x	0.7	=	112.62	(78)
South	0.9x	0.77	x	2.72	x	76.57	x	0.4	x	0.7	=	80.82	(78)
South	0.9x	0.77	x	7.58	x	97.53	x	0.4	x	0.7	=	143.46	(78)
South	0.9x	0.77	x	2.72	x	97.53	x	0.4	x	0.7	=	102.95	(78)
South	0.9x	0.77	x	7.58	x	110.23	x	0.4	x	0.7	=	162.14	(78)
South	0.9x	0.77	x	2.72	x	110.23	x	0.4	x	0.7	=	116.36	(78)
South	0.9x	0.77	x	7.58	x	114.87	x	0.4	x	0.7	=	168.96	(78)
South	0.9x	0.77	x	2.72	x	114.87	x	0.4	x	0.7	=	121.26	(78)
South	0.9x	0.77	x	7.58	x	110.55	x	0.4	x	0.7	=	162.6	(78)
South	0.9x	0.77	x	2.72	x	110.55	x	0.4	x	0.7	=	116.69	(78)
South	0.9x	0.77	x	7.58	x	108.01	x	0.4	x	0.7	=	158.87	(78)
South	0.9x	0.77	x	2.72	x	108.01	x	0.4	x	0.7	=	114.01	(78)
South	0.9x	0.77	x	7.58	x	104.89	x	0.4	x	0.7	=	154.28	(78)
South	0.9x	0.77	x	2.72	x	104.89	x	0.4	x	0.7	=	110.72	(78)
South	0.9x	0.77	x	7.58	x	101.89	x	0.4	x	0.7	=	149.86	(78)
South	0.9x	0.77	x	2.72	x	101.89	x	0.4	x	0.7	=	107.55	(78)
South	0.9x	0.77	x	7.58	x	82.59	x	0.4	x	0.7	=	121.47	(78)
South	0.9x	0.77	x	2.72	x	82.59	x	0.4	x	0.7	=	87.18	(78)
South	0.9x	0.77	x	7.58	x	55.42	x	0.4	x	0.7	=	81.51	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.4	x	0.7	=	58.5	(78)
South	0.9x	0.77	x	7.58	x	40.4	x	0.4	x	0.7	=	59.42	(78)
South	0.9x	0.77	x	2.72	x	40.4	x	0.4	x	0.7	=	42.64	(78)
West	0.9x	0.77	x	2.72	x	19.64	x	0.4	x	0.7	=	10.37	(80)
West	0.9x	0.77	x	2.72	x	38.42	x	0.4	x	0.7	=	20.28	(80)
West	0.9x	0.77	x	2.72	x	63.27	x	0.4	x	0.7	=	33.39	(80)

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West	0.9x	0.77	x	2.72	x	92.28	x	0.4	x	0.7	=	48.7	(80)
West	0.9x	0.77	x	2.72	x	113.09	x	0.4	x	0.7	=	59.69	(80)
West	0.9x	0.77	x	2.72	x	115.77	x	0.4	x	0.7	=	61.1	(80)
West	0.9x	0.77	x	2.72	x	110.22	x	0.4	x	0.7	=	58.17	(80)
West	0.9x	0.77	x	2.72	x	94.68	x	0.4	x	0.7	=	49.97	(80)
West	0.9x	0.77	x	2.72	x	73.59	x	0.4	x	0.7	=	38.84	(80)
West	0.9x	0.77	x	2.72	x	45.59	x	0.4	x	0.7	=	24.06	(80)
West	0.9x	0.77	x	2.72	x	24.49	x	0.4	x	0.7	=	12.93	(80)
West	0.9x	0.77	x	2.72	x	16.15	x	0.4	x	0.7	=	8.52	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	139.7	235.17	316.25	385.75	428.77	424.82	409.88	377.51	340.07	258.24	166.78	119.94	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	537.85	631.36	700.05	749.56	772.36	748.85	721.13	694.4	667.16	605.51	537.25	507.75	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.83	0.65	0.48	0.52	0.75	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.87	20.06	20.31	20.61	20.84	20.96	20.99	20.99	20.93	20.63	20.2	19.84	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.95	19.95	19.96	19.96	19.98	19.98	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=	0.99	0.98	0.96	0.9	0.77	0.56	0.37	0.41	0.67	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.46	18.73	19.1	19.52	19.81	19.95	19.97	19.97	19.92	19.56	18.94	18.42	(90)

fLA = Living area ÷ (4) = 0.37 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.98	19.22	19.54	19.92	20.19	20.32	20.35	20.35	20.29	19.95	19.4	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.98	19.22	19.54	19.92	20.19	20.32	20.35	20.35	20.29	19.95	19.4	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.79	0.59	0.41	0.45	0.7	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	532.62	618.21	669.14	674.69	606.34	444.25	298.98	313.08	464.69	553.35	526.28	503.92	(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=	1221.32	1188.24	1079.42	899.88	691.53	459.88	301.04	316.22	499.77	761.61	1007.31	1213.57	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	512.39	383.06	305.25	162.14	63.38	0	0	0	0	154.95	346.34	527.98

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2455.5 (98)

Space heating requirement in kWh/m²/year 34.58 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2455.5	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1890.73	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	810.31	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2037.25	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1568.68	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	672.29	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	49.42	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):			
mechanical ventilation - balanced, extract or positive input from outside		154.94	(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) =	154.94	(331)
Energy for lighting (calculated in Appendix L)		314.29	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

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CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	610.69	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	334.98	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	25.65	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	971.32	(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) =				971.32	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	80.41	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	163.12	(379)
Total CO2, kg/year	sum of (376)…(382) =				1214.85	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.11	(384)
EI rating (section 14)					85.97	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.12

Property Address: E1-18

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50	(1a) x	2.7	(2a) =	135	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	135	(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

FHP

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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) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.42	x1/[1/(1.2)+ 0.04]		=	6.21			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 3			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Walls Type1	22.95	10.86	12.09	x	0.16	=	1.93			(29)
Walls Type2	20.79	1.89	18.9	x	0.15	=	2.84			(29)
Total area of elements, m²			43.74							(31)
Party wall			35.37	x	0	=	0			(32)
Party floor			50							(32a)
Party ceiling			50							(32b)

** 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) = 19.86 (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 6.55 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 26.41 (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=	11.84	11.71	11.58	10.93	10.8	10.15	10.15	10.03	10.41	10.8	11.06	11.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	38.25	38.12	37.99	37.34	37.21	36.57	36.57	36.44	36.82	37.21	37.47	37.73	

Average = Sum(39)$_{1…12}$ /12= 37.31 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.76	0.76	0.76	0.75	0.74	0.73	0.73	0.73	0.74	0.74	0.75	0.75	

Average = Sum(40)$_{1…12}$ /12= 0.75 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	81.77	78.8	75.83	72.85	69.88	66.91	66.91	69.88	72.85	75.83	78.8	81.77	

Total = Sum(44)$_{1…12}$ = 892.08 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.27	106.06	109.45	95.42	91.56	79.01	73.21	84.01	85.01	99.08	108.15	117.44	

Total = Sum(45)$_{1…12}$ = 1169.66 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.55	155.99	164.72	148.91	146.83	132.5	128.49	139.29	138.51	154.35	161.64	172.72	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.55	155.99	164.72	148.91	146.83	132.5	128.49	139.29	138.51	154.35	161.64	172.72

Output from water heater (annual)$_{1…12}$ | 1820.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.54	75.21	80.61	74.52	74.66	69.06	68.56	72.15	71.06	77.16	78.75	83.27	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.14	11.67	9.49	7.18	5.37	4.53	4.9	6.37	8.55	10.85	12.67	13.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.23	148.76	144.91	136.72	126.37	116.64	110.15	108.62	112.47	120.67	131.01	140.74	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	(71)

Water heating gains (Table 5)

(72)m=	113.63	111.92	108.35	103.5	100.35	95.92	92.16	96.98	98.7	103.71	109.38	111.92	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	322.36	320.7	311.1	295.75	280.44	265.45	255.55	260.32	268.07	283.59	301.41	314.51	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.72	x	46.75	x	0.4	x	0.7	=	24.68	(78)
South	0.9x	0.77	x	2.72	x	76.57	x	0.4	x	0.7	=	40.41	(78)

South	0.9x	0.77	x	2.72	x	97.53	x	0.4	x	0.7	=	51.48	(78)
South	0.9x	0.77	x	2.72	x	110.23	x	0.4	x	0.7	=	58.18	(78)
South	0.9x	0.77	x	2.72	x	114.87	x	0.4	x	0.7	=	60.63	(78)
South	0.9x	0.77	x	2.72	x	110.55	x	0.4	x	0.7	=	58.35	(78)
South	0.9x	0.77	x	2.72	x	108.01	x	0.4	x	0.7	=	57.01	(78)
South	0.9x	0.77	x	2.72	x	104.89	x	0.4	x	0.7	=	55.36	(78)
South	0.9x	0.77	x	2.72	x	101.89	x	0.4	x	0.7	=	53.77	(78)
South	0.9x	0.77	x	2.72	x	82.59	x	0.4	x	0.7	=	43.59	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.4	x	0.7	=	29.25	(78)
South	0.9x	0.77	x	2.72	x	40.4	x	0.4	x	0.7	=	21.32	(78)
West	0.9x	0.77	x	5.42	x	19.64	x	0.4	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.72	x	19.64	x	0.4	x	0.7	=	10.37	(80)
West	0.9x	0.77	x	5.42	x	38.42	x	0.4	x	0.7	=	40.41	(80)
West	0.9x	0.77	x	2.72	x	38.42	x	0.4	x	0.7	=	20.28	(80)
West	0.9x	0.77	x	5.42	x	63.27	x	0.4	x	0.7	=	66.54	(80)
West	0.9x	0.77	x	2.72	x	63.27	x	0.4	x	0.7	=	33.39	(80)
West	0.9x	0.77	x	5.42	x	92.28	x	0.4	x	0.7	=	97.05	(80)
West	0.9x	0.77	x	2.72	x	92.28	x	0.4	x	0.7	=	48.7	(80)
West	0.9x	0.77	x	5.42	x	113.09	x	0.4	x	0.7	=	118.94	(80)
West	0.9x	0.77	x	2.72	x	113.09	x	0.4	x	0.7	=	59.69	(80)
West	0.9x	0.77	x	5.42	x	115.77	x	0.4	x	0.7	=	121.76	(80)
West	0.9x	0.77	x	2.72	x	115.77	x	0.4	x	0.7	=	61.1	(80)
West	0.9x	0.77	x	5.42	x	110.22	x	0.4	x	0.7	=	115.92	(80)
West	0.9x	0.77	x	2.72	x	110.22	x	0.4	x	0.7	=	58.17	(80)
West	0.9x	0.77	x	5.42	x	94.68	x	0.4	x	0.7	=	99.57	(80)
West	0.9x	0.77	x	2.72	x	94.68	x	0.4	x	0.7	=	49.97	(80)
West	0.9x	0.77	x	5.42	x	73.59	x	0.4	x	0.7	=	77.39	(80)
West	0.9x	0.77	x	2.72	x	73.59	x	0.4	x	0.7	=	38.84	(80)
West	0.9x	0.77	x	5.42	x	45.59	x	0.4	x	0.7	=	47.95	(80)
West	0.9x	0.77	x	2.72	x	45.59	x	0.4	x	0.7	=	24.06	(80)
West	0.9x	0.77	x	5.42	x	24.49	x	0.4	x	0.7	=	25.76	(80)
West	0.9x	0.77	x	2.72	x	24.49	x	0.4	x	0.7	=	12.93	(80)
West	0.9x	0.77	x	5.42	x	16.15	x	0.4	x	0.7	=	16.99	(80)
West	0.9x	0.77	x	2.72	x	16.15	x	0.4	x	0.7	=	8.52	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.7	101.1	151.42	203.94	239.26	241.2	231.1	204.9	170.01	115.6	67.93	46.83	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	378.05	421.79	462.52	499.69	519.7	506.66	486.65	465.22	438.07	399.18	369.34	361.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.83	0.65	0.46	0.33	0.36	0.58	0.86	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.47	20.59	20.76	20.92	20.99	21	21	21	21	20.91	20.67	20.44	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.28	20.29	20.29	20.3	20.3	20.31	20.31	20.32	20.31	20.3	20.3	20.29	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.8	0.61	0.41	0.28	0.31	0.52	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.58	19.76	20	20.22	20.29	20.31	20.31	20.32	20.31	20.21	19.89	19.55	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20	20.16	20.36	20.55	20.62	20.64	20.64	20.64	20.63	20.55	20.26	19.97	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20	20.16	20.36	20.55	20.62	20.64	20.64	20.64	20.63	20.55	20.26	19.97	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.81	0.63	0.44	0.3	0.33	0.55	0.84	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	372.56	408.87	428.05	404.53	327.13	220.5	147.66	154.45	239.18	336.38	356.49	357.24	(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=	600.47	581.52	526.66	435.16	331.97	220.78	147.68	154.48	240.57	370.12	493.14	595.19	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	169.56	116.02	73.37	22.05	3.6	0	0	0	0	25.1	98.39	177.03	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 685.12 (98)

Space heating requirement in kWh/m²/year 13.7 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)

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Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		685.12	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	527.54	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	226.09	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1820.5	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1401.78	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	600.76	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	27.56	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		109.11	(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) =	109.11	(331)
Energy for lighting (calculated in Appendix L)		232	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	340.59	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	186.82	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	14.3	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	541.71	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				541.71	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	56.63	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	120.41	(379)
Total CO2, kg/year	sum of (376)…(382) =				718.75	(383)

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Dwelling CO2 Emission Rate	(383) ÷ (4) =	14.37	(384)
EI rating (section 14)		89.86	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.12

Property Address: E2-07

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.3	(1a) x	2.7	(2a) =	135.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	135.81	(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

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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) =	76.5	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			8.16	x1/[1/(1.2)+ 0.04]		=	9.34			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Walls Type1	15.93	10.88	5.05	x	0.16	=	0.81			(29)
Walls Type2	25.11	1.89	23.22	x	0.15	=	3.49			(29)
Walls Type3	13.77	0	13.77	x	0.14	=	1.93			(29)
Total area of elements, m²			54.81							(31)
Party wall			23.49	x	0	=	0			(32)
Party floor			50.3							(32a)
Party ceiling			50.3							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	21.33	(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		7.88	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	29.21	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	11.91	11.78	11.65	11	10.87	10.22	10.22	10.09	10.48	10.87	11.13	11.39	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	41.12	40.99	40.86	40.2	40.07	39.42	39.42	39.29	39.68	40.07	40.33	40.59	

Average = Sum(39)$_{1…12}$ /12= 40.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.82	0.81	0.81	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	0.81	

Average = Sum(40)$_{1…12}$ /12= 0.8 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.55 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82	79.02	76.04	73.06	70.08	67.09	67.09	70.08	73.06	76.04	79.02	82	

Total = Sum(44)$_{1…12}$ = 894.6 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.61	106.36	109.76	95.69	91.81	79.23	73.42	84.25	85.25	99.35	108.45	117.77	

Total = Sum(45)$_{1…12}$ = 1172.96 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.24	15.95	16.46	14.35	13.77	11.88	11.01	12.64	12.79	14.9	16.27	17.67	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	176.89	156.29	165.03	149.18	147.09	132.72	128.69	139.52	138.75	154.63	161.95	173.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	176.89	156.29	165.03	149.18	147.09	132.72	128.69	139.52	138.75	154.63	161.95	173.05

Output from water heater (annual)$_{1...12}$	1823.8	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.66	75.31	80.72	74.61	74.75	69.14	68.63	72.23	71.14	77.26	78.86	83.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	84.95	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.21	11.73	9.54	7.22	5.4	4.56	4.93	6.4	8.59	10.91	12.73	13.58	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.01	149.55	145.68	137.44	127.04	117.26	110.73	109.2	113.07	121.31	131.71	141.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	-67.96	(71)

Water heating gains (Table 5)

(72)m=	113.79	112.06	108.49	103.63	100.47	96.03	92.25	97.09	98.81	103.84	109.52	112.07	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	323.49	321.83	312.19	296.77	281.39	266.33	256.39	261.17	268.95	284.54	302.45	315.61	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	8.16	x	19.64	x	0.4	x	0.7	=	31.1	(76)
East	0.9x	0.77	x	2.72	x	19.64	x	0.4	x	0.7	=	10.37	(76)

East	0.9x	0.77	x	8.16	x	38.42	x	0.4	x	0.7	=	60.83	(76)
East	0.9x	0.77	x	2.72	x	38.42	x	0.4	x	0.7	=	20.28	(76)
East	0.9x	0.77	x	8.16	x	63.27	x	0.4	x	0.7	=	100.18	(76)
East	0.9x	0.77	x	2.72	x	63.27	x	0.4	x	0.7	=	33.39	(76)
East	0.9x	0.77	x	8.16	x	92.28	x	0.4	x	0.7	=	146.11	(76)
East	0.9x	0.77	x	2.72	x	92.28	x	0.4	x	0.7	=	48.7	(76)
East	0.9x	0.77	x	8.16	x	113.09	x	0.4	x	0.7	=	179.07	(76)
East	0.9x	0.77	x	2.72	x	113.09	x	0.4	x	0.7	=	59.69	(76)
East	0.9x	0.77	x	8.16	x	115.77	x	0.4	x	0.7	=	183.31	(76)
East	0.9x	0.77	x	2.72	x	115.77	x	0.4	x	0.7	=	61.1	(76)
East	0.9x	0.77	x	8.16	x	110.22	x	0.4	x	0.7	=	174.52	(76)
East	0.9x	0.77	x	2.72	x	110.22	x	0.4	x	0.7	=	58.17	(76)
East	0.9x	0.77	x	8.16	x	94.68	x	0.4	x	0.7	=	149.91	(76)
East	0.9x	0.77	x	2.72	x	94.68	x	0.4	x	0.7	=	49.97	(76)
East	0.9x	0.77	x	8.16	x	73.59	x	0.4	x	0.7	=	116.52	(76)
East	0.9x	0.77	x	2.72	x	73.59	x	0.4	x	0.7	=	38.84	(76)
East	0.9x	0.77	x	8.16	x	45.59	x	0.4	x	0.7	=	72.18	(76)
East	0.9x	0.77	x	2.72	x	45.59	x	0.4	x	0.7	=	24.06	(76)
East	0.9x	0.77	x	8.16	x	24.49	x	0.4	x	0.7	=	38.78	(76)
East	0.9x	0.77	x	2.72	x	24.49	x	0.4	x	0.7	=	12.93	(76)
East	0.9x	0.77	x	8.16	x	16.15	x	0.4	x	0.7	=	25.57	(76)
East	0.9x	0.77	x	2.72	x	16.15	x	0.4	x	0.7	=	8.52	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	41.46	81.11	133.58	194.82	238.76	244.41	232.69	199.88	155.36	96.25	51.7	34.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364.96	402.94	445.77	491.59	520.15	510.74	489.08	461.05	424.31	380.79	354.15	349.71	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) — 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.87	0.69	0.49	0.35	0.39	0.63	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.36	20.48	20.67	20.88	20.98	21	21	21	20.99	20.86	20.58	20.33	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.25	20.26	20.27	20.27	20.27	20.26	20.26	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.84	0.65	0.44	0.3	0.33	0.57	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.38	19.56	19.84	20.12	20.24	20.27	20.27	20.27	20.26	20.1	19.71	19.36	(90)

fLA = Living area ÷ (4) = 0.59 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.95	20.1	20.33	20.57	20.67	20.7	20.7	20.7	20.69	20.55	20.22	19.93	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.95	20.1	20.33	20.57	20.67	20.7	20.7	20.7	20.69	20.55	20.22	19.93	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.85	0.67	0.47	0.33	0.37	0.61	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	361.3	394.91	422.83	418.01	349.97	239.6	161.46	168.77	257.69	339.27	346.08	346.95	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	643.61	622.91	564.88	469.05	359.46	240.3	161.51	168.87	261.37	398.58	529.17	638.62	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	210.04	153.21	105.68	36.75	7.06	0	0	0	0	44.12	131.83	217	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 905.7 (98)

Space heating requirement in kWh/m²/year 18.01 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		905.7	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	697.39	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	298.88	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1823.8	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1404.32	(310a)

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Water heat from heat source 2	(64) x (303b) x (305) x (306) =	601.85	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	30.02	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		109.77	(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) =	109.77	(331)
Energy for lighting (calculated in Appendix L)		233.27	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	371.02	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	203.51	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	15.58	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	590.11	(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) =				590.11	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	56.97	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	121.07	(379)
Total CO2, kg/year	sum of (376)…(382) =				768.15	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				15.27	(384)
EI rating (section 14)					89.2	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.5.12

Property Address: E5-03

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74.5	(1a) x	2.7	(2a) =	201.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	201.15	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.42	x1/[1/(1.2)+ 0.04]		=	6.21			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 3			5.42	x1/[1/(1.2)+ 0.04]		=	6.21			(27)
Walls Type1	46.17	24.4	21.77	x	0.16	=	3.48			(29)
Walls Type2	11.07	1.89	9.18	x	0.15	=	1.38			(29)
Roof	74.5	0	74.5	x	0.12	=	8.94			(30)
Total area of elements, m²			131.74							(31)
Party wall			35.64	x	0	=	0			(32)
Party floor			74.5							(32a)

** 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) = 44.39 (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 20.56 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 64.95 (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=	18.59	18.38	18.17	17.11	16.9	15.84	15.84	15.63	16.26	16.9	17.32	17.74	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.54	83.32	83.11	82.05	81.84	80.78	80.78	80.57	81.21	81.84	82.27	82.69	

Average = $\text{Sum}(39)_{1\ldots12}$ /12= 82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.12	1.12	1.12	1.1	1.1	1.08	1.08	1.08	1.09	1.1	1.1	1.11	

Average = $\text{Sum}(40)_{1\ldots12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.35 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 90.02 (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=	99.02	95.42	91.82	88.22	84.62	81.02	81.02	84.62	88.22	91.82	95.42	99.02	

Total = $\text{Sum}(44)_{1\ldots12}$ = 1080.22 (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=	146.84	128.43	132.53	115.54	110.87	95.67	88.65	101.73	102.94	119.97	130.96	142.21	

Total = $\text{Sum}(45)_{1\ldots12}$ = 1416.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.03	19.26	19.88	17.33	16.63	14.35	13.3	15.26	15.44	18	19.64	21.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3												0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	202.12	178.36	187.81	169.04	166.14	149.16	143.93	157	156.44	175.25	184.45	197.49	

Output from water heater (annual)$_{1...12}$ 2067.18 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.05	82.65	88.29	81.21	81.08	74.6	73.7	78.05	77.02	84.11	86.34	91.51	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	117.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.5	16.44	13.37	10.12	7.56	6.39	6.9	8.97	12.04	15.29	17.84	19.02	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	207.56	209.72	204.29	192.74	178.15	164.44	155.28	153.13	158.56	170.11	184.7	198.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	34.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	-94.01	(71)

Water heating gains (Table 5)

(72)m=	125.06	122.98	118.67	112.8	108.98	103.62	99.06	104.9	106.98	113.05	119.91	122.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	409.39	407.39	394.58	373.9	352.95	332.7	319.49	325.25	335.83	356.7	380.71	398.67	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	2.72	x	46.75	x	0.4	x	0.7	=	24.68	(78)
South	0.9x	0.77	x	5.42	x	46.75	x	0.4	x	0.7	=	98.34	(78)

South	0.9x	0.77	x	2.72	x	76.57	x	0.4	x	0.7	=	40.41	(78)
South	0.9x	0.77	x	5.42	x	76.57	x	0.4	x	0.7	=	161.05	(78)
South	0.9x	0.77	x	2.72	x	97.53	x	0.4	x	0.7	=	51.48	(78)
South	0.9x	0.77	x	5.42	x	97.53	x	0.4	x	0.7	=	205.15	(78)
South	0.9x	0.77	x	2.72	x	110.23	x	0.4	x	0.7	=	58.18	(78)
South	0.9x	0.77	x	5.42	x	110.23	x	0.4	x	0.7	=	231.87	(78)
South	0.9x	0.77	x	2.72	x	114.87	x	0.4	x	0.7	=	60.63	(78)
South	0.9x	0.77	x	5.42	x	114.87	x	0.4	x	0.7	=	241.62	(78)
South	0.9x	0.77	x	2.72	x	110.55	x	0.4	x	0.7	=	58.35	(78)
South	0.9x	0.77	x	5.42	x	110.55	x	0.4	x	0.7	=	232.53	(78)
South	0.9x	0.77	x	2.72	x	108.01	x	0.4	x	0.7	=	57.01	(78)
South	0.9x	0.77	x	5.42	x	108.01	x	0.4	x	0.7	=	227.19	(78)
South	0.9x	0.77	x	2.72	x	104.89	x	0.4	x	0.7	=	55.36	(78)
South	0.9x	0.77	x	5.42	x	104.89	x	0.4	x	0.7	=	220.63	(78)
South	0.9x	0.77	x	2.72	x	101.89	x	0.4	x	0.7	=	53.77	(78)
South	0.9x	0.77	x	5.42	x	101.89	x	0.4	x	0.7	=	214.31	(78)
South	0.9x	0.77	x	2.72	x	82.59	x	0.4	x	0.7	=	43.59	(78)
South	0.9x	0.77	x	5.42	x	82.59	x	0.4	x	0.7	=	173.71	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.4	x	0.7	=	29.25	(78)
South	0.9x	0.77	x	5.42	x	55.42	x	0.4	x	0.7	=	116.56	(78)
South	0.9x	0.77	x	2.72	x	40.4	x	0.4	x	0.7	=	21.32	(78)
South	0.9x	0.77	x	5.42	x	40.4	x	0.4	x	0.7	=	84.97	(78)
West	0.9x	0.77	x	5.42	x	19.64	x	0.4	x	0.7	=	41.31	(80)
West	0.9x	0.77	x	5.42	x	38.42	x	0.4	x	0.7	=	80.81	(80)
West	0.9x	0.77	x	5.42	x	63.27	x	0.4	x	0.7	=	133.09	(80)
West	0.9x	0.77	x	5.42	x	92.28	x	0.4	x	0.7	=	194.1	(80)
West	0.9x	0.77	x	5.42	x	113.09	x	0.4	x	0.7	=	237.88	(80)
West	0.9x	0.77	x	5.42	x	115.77	x	0.4	x	0.7	=	243.51	(80)
West	0.9x	0.77	x	5.42	x	110.22	x	0.4	x	0.7	=	231.83	(80)
West	0.9x	0.77	x	5.42	x	94.68	x	0.4	x	0.7	=	199.14	(80)
West	0.9x	0.77	x	5.42	x	73.59	x	0.4	x	0.7	=	154.79	(80)
West	0.9x	0.77	x	5.42	x	45.59	x	0.4	x	0.7	=	95.89	(80)
West	0.9x	0.77	x	5.42	x	24.49	x	0.4	x	0.7	=	51.51	(80)
West	0.9x	0.77	x	5.42	x	16.15	x	0.4	x	0.7	=	33.97	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	164.32	282.28	389.72	484.15	540.13	534.38	516.03	475.14	422.87	313.19	197.32	140.27	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	573.71	689.67	784.29	858.05	893.08	867.08	835.52	800.39	758.69	669.89	578.03	538.94	(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	0.98	0.96	0.89	0.77	0.58	0.42	0.46	0.69	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.95	20.16	20.43	20.71	20.9	20.98	21	21	20.96	20.7	20.27	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.99	19.99	20	20	20.01	20.01	20.02	20.01	20	20	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.86	0.71	0.5	0.33	0.36	0.61	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.91	19.28	19.68	19.91	20	20.01	20.01	19.98	19.68	19.08	18.56	(90)

fLA = Living area ÷ (4) = 0.36 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.09	19.36	19.69	20.05	20.27	20.35	20.37	20.37	20.33	20.05	19.51	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.09	19.36	19.69	20.05	20.27	20.35	20.37	20.37	20.33	20.05	19.51	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.94	0.86	0.72	0.53	0.36	0.4	0.64	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	567.65	672.32	738.75	741.82	646.35	456.66	303.35	318.15	484.03	598.08	564.54	534.63	(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=	1235.69	1204.56	1096.64	915.12	701.26	464.9	304.3	319.66	505.86	773.25	1020.6	1227.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	497.02	357.66	266.27	124.77	40.86	0	0	0	0	130.33	328.37	515.71	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2260.99 (98)

Space heating requirement in kWh/m²/year 30.35 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)

DER WorkSheet: New dwelling design stage

Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2260.99	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1740.97	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	746.13	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2067.18	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1591.73	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	682.17	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	47.61	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		162.58	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	162.58	(331)
Energy for lighting (calculated in Appendix L)		326.8	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	588.32	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	322.71	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	24.71	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	935.74	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				935.74	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	84.38	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	169.61	(379)
Total CO2, kg/year	sum of (376)…(382) =				1189.73	(383)

Dwelling CO2 Emission Rate	(383) ÷ (4) =	15.97	(384)
EI rating (section 14)		86.66	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.12

Property Address: EB1-04

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72.7	(1a) x	2.7	(2a) =	196.29	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	196.29	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 2			2.72	x1/[1/(1.2)+ 0.04]		=	3.11			(27)
Windows Type 3			5.42	x1/[1/(1.2)+ 0.04]		=	6.21			(27)
Windows Type 4			2.18	x1/[1/(1.2)+ 0.04]		=	2.5			(27)
Windows Type 5			2.18	x1/[1/(1.2)+ 0.04]		=	2.5			(27)
Floor			72.7	x	0.12	=	8.723999			(28)
Walls	43.2	19.29	23.91	x	0.16	=	3.83			(29)
Total area of elements, m²			115.9							(31)
Party wall			49.14	x	0	=	0			(32)
Party ceiling			72.7							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.12 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.08 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.2 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	18.14	17.93	17.73	16.7	16.49	15.46	15.46	15.25	15.87	16.49	16.9	17.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.34	68.13	67.93	66.89	66.69	65.66	65.66	65.45	66.07	66.69	67.1	67.51	

Average = Sum(39)$_{1...12}$ /12= 66.84 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.93	

Average = Sum(40)$_{1...12}$ /12= 0.92 (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 2.31 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.06 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.96	94.4	90.84	87.28	83.72	80.15	80.15	83.72	87.28	90.84	94.4	97.96

Total = Sum(44)$_{1...12}$ = 1068.71 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.28	127.06	131.12	114.31	109.68	94.65	87.71	100.64	101.85	118.69	129.56	140.69

Total = Sum(45)$_{1...12}$ = 1401.24 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.79	19.06	19.67	17.15	16.45	14.2	13.16	15.1	15.28	17.8	19.43	21.1	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.56	176.99	186.39	167.8	164.96	148.14	142.98	155.92	155.34	173.97	183.05	195.97	(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=	200.56	176.99	186.39	167.8	164.96	148.14	142.98	155.92	155.34	173.97	183.05	195.97

Output from water heater (annual)$_{1…12}$ — 2052.08 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.53	82.19	87.82	80.8	80.69	74.27	73.38	77.69	76.66	83.69	85.87	91	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	115.49	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.14	16.11	13.11	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	203.51	205.63	200.3	188.98	174.67	161.23	152.25	150.14	155.46	166.79	181.09	194.54	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	34.55	(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=	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	-92.39	(71)

Water heating gains (Table 5)

(72)m=	124.36	122.31	118.03	112.23	108.46	103.15	98.63	104.42	106.47	112.48	119.27	122.32	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	403.67	401.7	389.09	368.77	348.19	328.29	315.3	321	331.38	351.91	375.5	393.15	(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	2.72	x	10.63	x	0.4	x	0.7	=	5.61	(74)
North	0.9x	0.77	x	2.18	x	10.63	x	0.4	x	0.7	=	4.5	(74)
North	0.9x	0.77	x	2.72	x	20.32	x	0.4	x	0.7	=	10.73	(74)
North	0.9x	0.77	x	2.18	x	20.32	x	0.4	x	0.7	=	8.6	(74)
North	0.9x	0.77	x	2.72	x	34.53	x	0.4	x	0.7	=	18.22	(74)
North	0.9x	0.77	x	2.18	x	34.53	x	0.4	x	0.7	=	14.61	(74)
North	0.9x	0.77	x	2.72	x	55.46	x	0.4	x	0.7	=	29.27	(74)
North	0.9x	0.77	x	2.18	x	55.46	x	0.4	x	0.7	=	23.46	(74)
North	0.9x	0.77	x	2.72	x	74.72	x	0.4	x	0.7	=	39.43	(74)
North	0.9x	0.77	x	2.18	x	74.72	x	0.4	x	0.7	=	31.61	(74)
North	0.9x	0.77	x	2.72	x	79.99	x	0.4	x	0.7	=	42.22	(74)
North	0.9x	0.77	x	2.18	x	79.99	x	0.4	x	0.7	=	33.83	(74)
North	0.9x	0.77	x	2.72	x	74.68	x	0.4	x	0.7	=	39.41	(74)
North	0.9x	0.77	x	2.18	x	74.68	x	0.4	x	0.7	=	31.59	(74)
North	0.9x	0.77	x	2.72	x	59.25	x	0.4	x	0.7	=	31.27	(74)
North	0.9x	0.77	x	2.18	x	59.25	x	0.4	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	2.72	x	41.52	x	0.4	x	0.7	=	21.91	(74)
North	0.9x	0.77	x	2.18	x	41.52	x	0.4	x	0.7	=	17.56	(74)
North	0.9x	0.77	x	2.72	x	24.19	x	0.4	x	0.7	=	12.77	(74)
North	0.9x	0.77	x	2.18	x	24.19	x	0.4	x	0.7	=	10.23	(74)
North	0.9x	0.77	x	2.72	x	13.12	x	0.4	x	0.7	=	6.92	(74)
North	0.9x	0.77	x	2.18	x	13.12	x	0.4	x	0.7	=	5.55	(74)
North	0.9x	0.77	x	2.72	x	8.86	x	0.4	x	0.7	=	4.68	(74)
North	0.9x	0.77	x	2.18	x	8.86	x	0.4	x	0.7	=	3.75	(74)
South	0.9x	0.77	x	2.72	x	46.75	x	0.4	x	0.7	=	24.68	(78)
South	0.9x	0.77	x	5.42	x	46.75	x	0.4	x	0.7	=	49.17	(78)
South	0.9x	0.77	x	2.18	x	46.75	x	0.4	x	0.7	=	39.55	(78)
South	0.9x	0.77	x	2.72	x	76.57	x	0.4	x	0.7	=	40.41	(78)
South	0.9x	0.77	x	5.42	x	76.57	x	0.4	x	0.7	=	80.53	(78)
South	0.9x	0.77	x	2.18	x	76.57	x	0.4	x	0.7	=	64.78	(78)
South	0.9x	0.77	x	2.72	x	97.53	x	0.4	x	0.7	=	51.48	(78)
South	0.9x	0.77	x	5.42	x	97.53	x	0.4	x	0.7	=	102.58	(78)
South	0.9x	0.77	x	2.18	x	97.53	x	0.4	x	0.7	=	82.52	(78)
South	0.9x	0.77	x	2.72	x	110.23	x	0.4	x	0.7	=	58.18	(78)
South	0.9x	0.77	x	5.42	x	110.23	x	0.4	x	0.7	=	115.93	(78)
South	0.9x	0.77	x	2.18	x	110.23	x	0.4	x	0.7	=	93.26	(78)
South	0.9x	0.77	x	2.72	x	114.87	x	0.4	x	0.7	=	60.63	(78)
South	0.9x	0.77	x	5.42	x	114.87	x	0.4	x	0.7	=	120.81	(78)
South	0.9x	0.77	x	2.18	x	114.87	x	0.4	x	0.7	=	97.18	(78)
South	0.9x	0.77	x	2.72	x	110.55	x	0.4	x	0.7	=	58.35	(78)
South	0.9x	0.77	x	5.42	x	110.55	x	0.4	x	0.7	=	116.26	(78)

South	0.9x	0.77	x	2.18	x	110.55	x	0.4	x	0.7	=	93.53	(78)
South	0.9x	0.77	x	2.72	x	108.01	x	0.4	x	0.7	=	57.01	(78)
South	0.9x	0.77	x	5.42	x	108.01	x	0.4	x	0.7	=	113.6	(78)
South	0.9x	0.77	x	2.18	x	108.01	x	0.4	x	0.7	=	91.38	(78)
South	0.9x	0.77	x	2.72	x	104.89	x	0.4	x	0.7	=	55.36	(78)
South	0.9x	0.77	x	5.42	x	104.89	x	0.4	x	0.7	=	110.32	(78)
South	0.9x	0.77	x	2.18	x	104.89	x	0.4	x	0.7	=	88.74	(78)
South	0.9x	0.77	x	2.72	x	101.89	x	0.4	x	0.7	=	53.77	(78)
South	0.9x	0.77	x	5.42	x	101.89	x	0.4	x	0.7	=	107.15	(78)
South	0.9x	0.77	x	2.18	x	101.89	x	0.4	x	0.7	=	86.2	(78)
South	0.9x	0.77	x	2.72	x	82.59	x	0.4	x	0.7	=	43.59	(78)
South	0.9x	0.77	x	5.42	x	82.59	x	0.4	x	0.7	=	86.86	(78)
South	0.9x	0.77	x	2.18	x	82.59	x	0.4	x	0.7	=	69.87	(78)
South	0.9x	0.77	x	2.72	x	55.42	x	0.4	x	0.7	=	29.25	(78)
South	0.9x	0.77	x	5.42	x	55.42	x	0.4	x	0.7	=	58.28	(78)
South	0.9x	0.77	x	2.18	x	55.42	x	0.4	x	0.7	=	46.88	(78)
South	0.9x	0.77	x	2.72	x	40.4	x	0.4	x	0.7	=	21.32	(78)
South	0.9x	0.77	x	5.42	x	40.4	x	0.4	x	0.7	=	42.49	(78)
South	0.9x	0.77	x	2.18	x	40.4	x	0.4	x	0.7	=	34.18	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	123.51	205.04	269.4	320.11	349.66	344.18	332.99	310.75	286.6	223.31	146.89	106.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	527.18	606.73	658.49	688.88	697.85	672.47	648.29	631.75	617.98	575.22	522.39	499.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.8	0.61	0.44	0.47	0.7	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.17	20.33	20.53	20.76	20.92	20.99	21	21	20.97	20.78	20.44	20.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.14	20.14	20.15	20.15	20.16	20.16	20.17	20.16	20.15	20.15	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.75	0.54	0.36	0.39	0.63	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=	19.03	19.27	19.56	19.88	20.08	20.16	20.16	20.17	20.14	19.91	19.43	19	(90)

fLA = Living area ÷ (4) = 0.5 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.61	19.8	20.05	20.32	20.5	20.57	20.58	20.58	20.56	20.35	19.94	19.57	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.61	19.8	20.05	20.32	20.5	20.57	20.58	20.58	20.56	20.35	19.94	19.57	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.77	0.57	0.4	0.43	0.67	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	522.63	594.93	630.2	618.71	540.4	386.08	260.91	272.91	411.73	520.55	511.93	496.28	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1045.95	1015.2	920.18	764.02	586.85	392.22	261.51	273.82	426.61	650.22	861.35	1037.96	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	389.35	282.43	215.74	104.63	34.55	0	0	0	0	96.47	251.59	403.01	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1777.77 (98)

Space heating requirement in kWh/m²/year 24.45 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1777.77	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1368.88	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	586.66	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2052.08	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1580.1	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	677.19	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.13	(313)

DER WorkSheet: New dwelling design stage

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		158.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	158.65	(331)
Energy for lighting (calculated in Appendix L)		320.42	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	520.59	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	285.56	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	21.86	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	828.01	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				828.01	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	82.34	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	166.3	(379)
Total CO2, kg/year	sum of (376)…(382) =				1076.64	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.81	(384)
EI rating (section 14)					87.74	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: W1-03

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Windows Type 3			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 4			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Windows Type 5			2.18	x1/[1/(1.2)+ 0.04]		=	2.5			(27)
Floor			86.4	x	0.1	=	8.64			(28)
Walls Type1	48.6	18.02	30.58	x	0.16	=	4.89			(29)
Walls Type2	14.31	1.89	12.42	x	0.15	=	1.86			(29)
Total area of elements, m²			149.31							(31)
Party wall			43.75	x	0	=	0			(32)
Party ceiling			86.4							(32b)

** 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) =	38.67	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	6480	(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	14.76	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 53.43 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.56	21.31	21.07	19.84	19.6	18.37	18.37	18.12	18.86	19.6	20.09	20.58	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.99	74.75	74.5	73.27	73.03	71.8	71.8	71.56	72.29	73.03	73.52	74.01	

Average = Sum(39)$_{1\ldots12}$ /12= 73.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.86	0.85	0.85	0.83	0.83	0.83	0.84	0.85	0.85	0.86	

Average = Sum(40)$_{1\ldots12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (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=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = Sum(44)$_{1\ldots12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = Sum(45)$_{1\ldots12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.76	185.91	195.6	175.83	172.66	154.79	149.14	162.99	162.49	182.3	192.15	205.85	(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=	210.76	185.91	195.6	175.83	172.66	154.79	149.14	162.99	162.49	182.3	192.15	205.85	

Output from water heater (annual)1…12 | 2150.48 | (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=	95.92	85.16	90.88	83.47	83.25	76.48	75.43	80.04	79.04	86.46	88.9	94.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.78	18.45	15.01	11.36	8.49	7.17	7.75	10.07	13.52	17.16	20.03	21.35	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	128.92	126.72	122.15	115.93	111.9	106.22	101.39	107.57	109.77	116.21	123.47	126.73	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	443.59	441.48	427.39	404.59	381.37	359.02	344.52	350.62	362.34	385.35	411.8	431.73	(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	5.28	x	10.63	x	0.4	x	0.7	=	10.89	(74)
North	0.9x	0.77	x	2.64	x	10.63	x	0.4	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	5.28	x	20.32	x	0.4	x	0.7	=	20.82	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.4	x	0.7	=	10.41	(74)
North	0.9x	0.77	x	5.28	x	34.53	x	0.4	x	0.7	=	35.38	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.4	x	0.7	=	17.69	(74)
North	0.9x	0.77	x	5.28	x	55.46	x	0.4	x	0.7	=	56.83	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.4	x	0.7	=	28.41	(74)
North	0.9x	0.77	x	5.28	x	74.72	x	0.4	x	0.7	=	76.55	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.4	x	0.7	=	38.27	(74)
North	0.9x	0.77	x	5.28	x	79.99	x	0.4	x	0.7	=	81.95	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.4	x	0.7	=	40.97	(74)
North	0.9x	0.77	x	5.28	x	74.68	x	0.4	x	0.7	=	76.51	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.4	x	0.7	=	38.25	(74)
North	0.9x	0.77	x	5.28	x	59.25	x	0.4	x	0.7	=	60.7	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.4	x	0.7	=	30.35	(74)
North	0.9x	0.77	x	5.28	x	41.52	x	0.4	x	0.7	=	42.54	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.4	x	0.7	=	21.27	(74)
North	0.9x	0.77	x	5.28	x	24.19	x	0.4	x	0.7	=	24.78	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.4	x	0.7	=	12.39	(74)
North	0.9x	0.77	x	5.28	x	13.12	x	0.4	x	0.7	=	13.44	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.4	x	0.7	=	6.72	(74)
North	0.9x	0.77	x	5.28	x	8.86	x	0.4	x	0.7	=	9.08	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.4	x	0.7	=	4.54	(74)
South	0.9x	0.77	x	5.28	x	46.75	x	0.4	x	0.7	=	47.9	(78)
South	0.9x	0.77	x	2.64	x	46.75	x	0.4	x	0.7	=	23.95	(78)
South	0.9x	0.77	x	2.18	x	46.75	x	0.4	x	0.7	=	19.78	(78)
South	0.9x	0.77	x	5.28	x	76.57	x	0.4	x	0.7	=	78.45	(78)
South	0.9x	0.77	x	2.64	x	76.57	x	0.4	x	0.7	=	39.22	(78)
South	0.9x	0.77	x	2.18	x	76.57	x	0.4	x	0.7	=	32.39	(78)
South	0.9x	0.77	x	5.28	x	97.53	x	0.4	x	0.7	=	99.93	(78)
South	0.9x	0.77	x	2.64	x	97.53	x	0.4	x	0.7	=	49.96	(78)
South	0.9x	0.77	x	2.18	x	97.53	x	0.4	x	0.7	=	41.26	(78)
South	0.9x	0.77	x	5.28	x	110.23	x	0.4	x	0.7	=	112.94	(78)
South	0.9x	0.77	x	2.64	x	110.23	x	0.4	x	0.7	=	56.47	(78)
South	0.9x	0.77	x	2.18	x	110.23	x	0.4	x	0.7	=	46.63	(78)
South	0.9x	0.77	x	5.28	x	114.87	x	0.4	x	0.7	=	117.69	(78)
South	0.9x	0.77	x	2.64	x	114.87	x	0.4	x	0.7	=	58.84	(78)
South	0.9x	0.77	x	2.18	x	114.87	x	0.4	x	0.7	=	48.59	(78)

South	0.9x	0.77	x	5.28	x	110.55	x	0.4	x	0.7	=	113.26	(78)
South	0.9x	0.77	x	2.64	x	110.55	x	0.4	x	0.7	=	56.63	(78)
South	0.9x	0.77	x	2.18	x	110.55	x	0.4	x	0.7	=	46.76	(78)
South	0.9x	0.77	x	5.28	x	108.01	x	0.4	x	0.7	=	110.66	(78)
South	0.9x	0.77	x	2.64	x	108.01	x	0.4	x	0.7	=	55.33	(78)
South	0.9x	0.77	x	2.18	x	108.01	x	0.4	x	0.7	=	45.69	(78)
South	0.9x	0.77	x	5.28	x	104.89	x	0.4	x	0.7	=	107.47	(78)
South	0.9x	0.77	x	2.64	x	104.89	x	0.4	x	0.7	=	53.73	(78)
South	0.9x	0.77	x	2.18	x	104.89	x	0.4	x	0.7	=	44.37	(78)
South	0.9x	0.77	x	5.28	x	101.89	x	0.4	x	0.7	=	104.39	(78)
South	0.9x	0.77	x	2.64	x	101.89	x	0.4	x	0.7	=	52.19	(78)
South	0.9x	0.77	x	2.18	x	101.89	x	0.4	x	0.7	=	43.1	(78)
South	0.9x	0.77	x	5.28	x	82.59	x	0.4	x	0.7	=	84.61	(78)
South	0.9x	0.77	x	2.64	x	82.59	x	0.4	x	0.7	=	42.31	(78)
South	0.9x	0.77	x	2.18	x	82.59	x	0.4	x	0.7	=	34.93	(78)
South	0.9x	0.77	x	5.28	x	55.42	x	0.4	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	2.64	x	55.42	x	0.4	x	0.7	=	28.39	(78)
South	0.9x	0.77	x	2.18	x	55.42	x	0.4	x	0.7	=	23.44	(78)
South	0.9x	0.77	x	5.28	x	40.4	x	0.4	x	0.7	=	41.39	(78)
South	0.9x	0.77	x	2.64	x	40.4	x	0.4	x	0.7	=	20.69	(78)
South	0.9x	0.77	x	2.18	x	40.4	x	0.4	x	0.7	=	17.09	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	107.97	181.29	244.21	301.28	339.95	339.57	326.44	296.62	263.48	199.03	128.77	92.8	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	551.56	622.77	671.6	705.87	721.31	698.59	670.96	647.24	625.81	584.37	540.57	524.52	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.64	0.47	0.51	0.75	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.33	20.52	20.75	20.91	20.99	21	21	20.97	20.77	20.44	20.17	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.2	20.2	20.21	20.21	20.23	20.23	20.23	20.22	20.21	20.21	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.79	0.57	0.39	0.42	0.68	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.12	19.31	19.59	19.92	20.13	20.22	20.23	20.23	20.2	19.95	19.49	19.09	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.37	19.55	19.8	20.11	20.31	20.4	20.41	20.41	20.38	20.14	19.71	19.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.37	19.55	19.8	20.11	20.31	20.4	20.41	20.41	20.38	20.14	19.71	19.34	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.8	0.59	0.41	0.44	0.7	0.93	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	548.54	615.2	652.35	650.78	577.34	410.61	272.87	286.05	437.02	543.11	533.46	522.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1129.99	1095.05	991.07	821.34	629.12	416.33	273.32	286.79	453.79	696.64	927.08	1120.84	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	432.6	322.46	252.01	122.8	38.53	0	0	0	0	114.23	283.41	445.27	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2011.31	(98)
Space heating requirement in kWh/m²/year	23.28	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2011.31	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1548.71	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	663.73	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2150.48	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1655.87	(310a)

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Water heat from heat source 2	(64) x (303b) x (305) x (306) =	709.66	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	45.78	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		177.88	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	177.88	(331)
Energy for lighting (calculated in Appendix L)		366.92	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	565.71	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	310.31	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	23.76	(372)
Total CO2 associated with community systems	(363)...(366) + (368)...(372)			=	899.77	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				899.77	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	92.32	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	190.43	(379)
Total CO2, kg/year	sum of (376)…(382) =				1182.52	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.69	(384)
EI rating (section 14)					87.94	(385)

FHP

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.5.12

Property Address: W2-01

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	94.3	(1a) x	2.7	(2a) =	254.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	94.3	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	254.61	(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) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			6.48	x1/[1/(1.2)+ 0.04]		=	7.42			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Floor			94.3	x	0.06	=	5.658			(28)
Walls Type1	66.42	19.68	46.74	x	0.16	=	7.48			(29)
Walls Type2	5.67	1.89	3.78	x	0.15	=	0.57			(29)
Total area of elements, m²			166.39							(31)
Party wall			42.75	x	0	=	0			(32)
Party ceiling			94.3							(32b)

** 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) = 38.88 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7072.5 (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 14.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 53.63 (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=	23.53	23.26	23	21.66	21.39	20.05	20.05	19.78	20.59	21.39	21.92	22.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.16	76.89	76.63	75.29	75.02	73.68	73.68	73.41	74.21	75.02	75.55	76.09	

Average = Sum(39)$_{1…12}$ /12= 75.22 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.82	0.82	0.81	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	0.81

Average = $Sum(40)_{1...12}$ /12= 0.8 (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 — 2.68 (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 — 97.85 (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=	107.64	103.72	99.81	95.9	91.98	88.07	88.07	91.98	95.9	99.81	103.72	107.64

Total = $Sum(44)_{1...12}$ = 1174.24 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.62	139.61	144.06	125.6	120.51	103.99	96.37	110.58	111.9	130.41	142.35	154.59

Total = $Sum(45)_{1...12}$ = 1539.61 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.94	20.94	21.61	18.84	18.08	15.6	14.45	16.59	16.79	19.56	21.35	23.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	214.9	189.54	199.34	179.09	175.79	157.49	151.64	165.86	165.4	185.69	195.85	209.86	(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=	214.9	189.54	199.34	179.09	175.79	157.49	151.64	165.86	165.4	185.69	195.85	209.86	

Output from water heater (annual)$_{1…12}$ 2190.45 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.3	86.36	92.12	84.56	84.29	77.37	76.26	80.99	80	87.58	90.13	95.62	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	134.01	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.07	19.6	15.94	12.07	9.02	7.62	8.23	10.7	14.36	18.23	21.28	22.68	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	246.77	249.33	242.88	229.14	211.8	195.5	184.61	182.05	188.51	202.24	219.58	235.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	36.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	-107.21	(71)

Water heating gains (Table 5)

(72)m=	130.77	128.51	123.82	117.44	113.3	107.46	102.5	108.86	111.11	117.72	125.18	128.52	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	462.82	460.65	445.84	421.85	397.32	373.78	358.55	364.81	377.18	401.4	429.24	450.29	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	6.48	x	19.64	x	0.4	x	0.7	=	24.7	(80)
West	0.9x	0.77	x	2.64	x	19.64	x	0.4	x	0.7	=	50.31	(80)
West	0.9x	0.77	x	6.48	x	38.42	x	0.4	x	0.7	=	48.31	(80)
West	0.9x	0.77	x	2.64	x	38.42	x	0.4	x	0.7	=	98.41	(80)
West	0.9x	0.77	x	6.48	x	63.27	x	0.4	x	0.7	=	79.56	(80)

West	0.9x	0.77	x	2.64	x	63.27	x	0.4	x	0.7	=	162.06	(80)
West	0.9x	0.77	x	6.48	x	92.28	x	0.4	x	0.7	=	116.03	(80)
West	0.9x	0.77	x	2.64	x	92.28	x	0.4	x	0.7	=	236.36	(80)
West	0.9x	0.77	x	6.48	x	113.09	x	0.4	x	0.7	=	142.2	(80)
West	0.9x	0.77	x	2.64	x	113.09	x	0.4	x	0.7	=	289.67	(80)
West	0.9x	0.77	x	6.48	x	115.77	x	0.4	x	0.7	=	145.57	(80)
West	0.9x	0.77	x	2.64	x	115.77	x	0.4	x	0.7	=	296.53	(80)
West	0.9x	0.77	x	6.48	x	110.22	x	0.4	x	0.7	=	138.59	(80)
West	0.9x	0.77	x	2.64	x	110.22	x	0.4	x	0.7	=	282.31	(80)
West	0.9x	0.77	x	6.48	x	94.68	x	0.4	x	0.7	=	119.04	(80)
West	0.9x	0.77	x	2.64	x	94.68	x	0.4	x	0.7	=	242.5	(80)
West	0.9x	0.77	x	6.48	x	73.59	x	0.4	x	0.7	=	92.53	(80)
West	0.9x	0.77	x	2.64	x	73.59	x	0.4	x	0.7	=	188.49	(80)
West	0.9x	0.77	x	6.48	x	45.59	x	0.4	x	0.7	=	57.32	(80)
West	0.9x	0.77	x	2.64	x	45.59	x	0.4	x	0.7	=	116.77	(80)
West	0.9x	0.77	x	6.48	x	24.49	x	0.4	x	0.7	=	30.79	(80)
West	0.9x	0.77	x	2.64	x	24.49	x	0.4	x	0.7	=	62.72	(80)
West	0.9x	0.77	x	6.48	x	16.15	x	0.4	x	0.7	=	20.31	(80)
West	0.9x	0.77	x	2.64	x	16.15	x	0.4	x	0.7	=	41.37	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	75	146.72	241.62	352.39	431.87	442.09	420.89	361.54	281.02	174.09	93.52	61.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	537.82	607.37	687.46	774.24	829.19	815.88	779.44	726.35	658.2	575.49	522.76	511.97	(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	0.98	0.93	0.79	0.57	0.42	0.46	0.74	0.96	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.2	20.33	20.54	20.8	20.95	21	21	21	20.98	20.76	20.44	20.19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.24	20.24	20.24	20.25	20.26	20.27	20.27	20.27	20.26	20.26	20.25	20.25	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.74	0.51	0.35	0.39	0.68	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.16	19.35	19.65	20.02	20.21	20.27	20.27	20.27	20.25	19.98	19.51	19.14	(90)

fLA = Living area ÷ (4) = | 0.38 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.56	19.72	19.99	20.32	20.49	20.54	20.55	20.55	20.52	20.28	19.87	19.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.56	19.72	19.99	20.32	20.49	20.54	20.55	20.55	20.52	20.28	19.87	19.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.91	0.75	0.53	0.37	0.42	0.7	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	536.23	603.09	671.8	706.53	625.65	435.25	290.7	304.18	461.26	546.26	518.96	510.85	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1177.41	1139.62	1033.73	859.59	659.7	438	290.89	304.61	476.77	725.95	964.52	1167.27	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	477.04	360.55	269.28	110.21	25.33	0	0	0	0	133.69	320.81	488.38	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2185.28	(98)
Space heating requirement in kWh/m²/year	23.17	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		2185.28	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1682.66	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	721.14	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2190.45	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1686.65	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	722.85	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	48.13	(313)

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Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		205.79	(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) =	205.79	(331)
Energy for lighting (calculated in Appendix L)		389.76	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	594.79	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	326.26	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	24.98	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	946.02	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				946.02	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	106.8	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	202.29	(379)
Total CO2, kg/year	sum of (376)…(382) =				1255.12	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.31	(384)
EI rating (section 14)					87.93	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: W3-12

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.8	(1a) x	2.7	(2a) =	139.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	139.86	(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) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Walls Type1	18.36	7.92	10.44	x	0.16	=	1.67			(29)
Walls Type2	18.36	1.89	16.47	x	0.15	=	2.47			(29)
Total area of elements, m²			36.72							(31)
Party wall			37.5	x	0	=	0			(32)
Party floor			51.8							(32a)
Party ceiling			51.8							(32b)

** 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) = 15.85 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.23 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 20.08 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.26	12.13	12	11.32	11.19	10.52	10.52	10.39	10.79	11.19	11.46	11.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	32.35	32.21	32.08	31.41	31.27	30.6	30.6	30.47	30.87	31.27	31.54	31.81	

Average = Sum(39)$_{1…12}$ /12= 31.37 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.62	0.62	0.62	0.61	0.6	0.59	0.59	0.59	0.6	0.6	0.61	0.61

Average = Sum(40)$_{1...12}$ /12= 0.61 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.74 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.6 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	83.16	80.14	77.11	74.09	71.06	68.04	68.04	71.06	74.09	77.11	80.14	83.16	
										Total = Sum(44)$_{1...12}$ =		907.2	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	123.32	107.86	111.3	97.04	93.11	80.35	74.45	85.43	86.45	100.75	109.98	119.43	
										Total = Sum(45)$_{1...12}$ =		1189.49	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.5	16.18	16.7	14.56	13.97	12.05	11.17	12.82	12.97	15.11	16.5	17.91	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H													
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	178.6	157.79	166.58	150.53	148.39	133.84	129.73	140.71	139.95	156.03	163.48	174.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	178.6	157.79	166.58	150.53	148.39	133.84	129.73	140.71	139.95	156.03	163.48	174.71	

Output from water heater (annual)$_{1...12}$ 1840.33 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.23	75.81	81.23	75.06	75.18	69.51	68.98	72.63	71.54	77.72	79.36	83.93	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.26	12.66	10.3	7.8	5.83	4.92	5.32	6.91	9.28	11.78	13.75	14.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	151.91	153.48	149.51	141.05	130.38	120.35	113.64	112.07	116.04	124.5	135.17	145.2	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	(71)

Water heating gains (Table 5)

(72)m=	114.55	112.81	109.18	104.25	101.05	96.54	92.71	97.62	99.36	104.47	110.23	112.81	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	329.87	328.1	318.14	302.25	286.4	270.96	260.82	265.75	273.83	289.89	308.29	321.82	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.28	x	19.64	x	0.4	x	0.7	=	20.12	(76)
East	0.9x	0.77	x	2.64	x	19.64	x	0.4	x	0.7	=	10.06	(76)
East	0.9x	0.77	x	5.28	x	38.42	x	0.4	x	0.7	=	39.36	(76)
East	0.9x	0.77	x	2.64	x	38.42	x	0.4	x	0.7	=	19.68	(76)
East	0.9x	0.77	x	5.28	x	63.27	x	0.4	x	0.7	=	64.83	(76)

East	0.9x	0.77	x	2.64	x	63.27	x	0.4	x	0.7	=	32.41	(76)
East	0.9x	0.77	x	5.28	x	92.28	x	0.4	x	0.7	=	94.54	(76)
East	0.9x	0.77	x	2.64	x	92.28	x	0.4	x	0.7	=	47.27	(76)
East	0.9x	0.77	x	5.28	x	113.09	x	0.4	x	0.7	=	115.87	(76)
East	0.9x	0.77	x	2.64	x	113.09	x	0.4	x	0.7	=	57.93	(76)
East	0.9x	0.77	x	5.28	x	115.77	x	0.4	x	0.7	=	118.61	(76)
East	0.9x	0.77	x	2.64	x	115.77	x	0.4	x	0.7	=	59.31	(76)
East	0.9x	0.77	x	5.28	x	110.22	x	0.4	x	0.7	=	112.92	(76)
East	0.9x	0.77	x	2.64	x	110.22	x	0.4	x	0.7	=	56.46	(76)
East	0.9x	0.77	x	5.28	x	94.68	x	0.4	x	0.7	=	97	(76)
East	0.9x	0.77	x	2.64	x	94.68	x	0.4	x	0.7	=	48.5	(76)
East	0.9x	0.77	x	5.28	x	73.59	x	0.4	x	0.7	=	75.39	(76)
East	0.9x	0.77	x	2.64	x	73.59	x	0.4	x	0.7	=	37.7	(76)
East	0.9x	0.77	x	5.28	x	45.59	x	0.4	x	0.7	=	46.71	(76)
East	0.9x	0.77	x	2.64	x	45.59	x	0.4	x	0.7	=	23.35	(76)
East	0.9x	0.77	x	5.28	x	24.49	x	0.4	x	0.7	=	25.09	(76)
East	0.9x	0.77	x	2.64	x	24.49	x	0.4	x	0.7	=	12.54	(76)
East	0.9x	0.77	x	5.28	x	16.15	x	0.4	x	0.7	=	16.55	(76)
East	0.9x	0.77	x	2.64	x	16.15	x	0.4	x	0.7	=	8.27	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.18	59.04	97.24	141.82	173.8	177.92	169.38	145.5	113.09	70.06	37.63	24.82	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	360.05	387.15	415.38	444.06	460.2	448.87	430.2	411.24	386.92	359.95	345.93	346.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.81	0.63	0.44	0.31	0.34	0.55	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.63	20.72	20.85	20.96	21	21	21	21	21	20.96	20.79	20.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.41	20.41	20.41	20.42	20.43	20.44	20.44	20.44	20.43	20.43	20.42	20.42	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.27	0.3	0.5	0.81	0.96	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.92	20.05	20.23	20.39	20.42	20.44	20.44	20.44	20.43	20.38	20.16	19.91	(90)

fLA = Living area ÷ (4) = | 0.45 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.24	20.35	20.51	20.65	20.68	20.69	20.69	20.69	20.69	20.64	20.45	20.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	20.24	20.35	20.51	20.65	20.68	20.69	20.69	20.69	20.69	20.64	20.45	20.23	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.8	0.61	0.42	0.29	0.32	0.52	0.83	0.96	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	354.57	375.78	384.67	353.79	279.37	186.38	125.23	130.81	203.05	297.32	332.51	342.42	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	515.64	497.7	449.37	368.92	280.89	186.43	125.23	130.81	203.4	314.08	421.01	509.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	119.84	81.93	48.13	10.89	1.14	0	0	0	0	12.48	63.72	124.57	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 462.69 (98)

Space heating requirement in kWh/m²/year 8.93 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		462.69	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	356.27	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	152.69	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1840.33	
If DHW from community scheme:			
Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1417.05	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	607.31	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	25.33	(313)

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Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =		0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside			106.64	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		106.64	(331)
Energy for lighting (calculated in Appendix L)			251.82	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	= 313.05	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	= 171.71	(368)
Electrical energy for heat distribution	[(313) x	0.52	= 13.15	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		= 497.91	(373)
CO2 associated with space heating (secondary)	(309) x	0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		497.91	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	= 55.35	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	= 130.69	(379)
Total CO2, kg/year	sum of (376)…(382) =		683.95	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =		13.2	(384)
EI rating (section 14)			90.53	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: W4-09

Address : , 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4	(1a) x	2.7	(2a) =	233.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	86.4	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	233.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.13	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x 1.4	= 2.646			(26)
Windows Type 1			5.28	x1/[1/(1.2)+ 0.04]	= 6.05			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]	= 3.02			(27)
Windows Type 3			5.28	x1/[1/(1.2)+ 0.04]	= 6.05			(27)
Windows Type 4			2.64	x1/[1/(1.2)+ 0.04]	= 3.02			(27)
Walls Type1	48.6	18.48	30.12	x 0.16	= 4.82			(29)
Walls Type2	14.31	1.89	12.42	x 0.15	= 1.86			(29)
Roof	18.7	0	18.7	x 0.2	= 3.74			(30)
Total area of elements, m²			81.61					(31)
Party wall			43.75	x 0	= 0			(32)
Party floor			86.4					(32a)
Party ceiling			67.7					(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	34.22	(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	15.69	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

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Total fabric heat loss	(33) + (36) =	49.91	(37)
Ventilation heat loss calculated monthly	(38)m = 0.33 × (25)m x (5)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.56	21.31	21.07	19.84	19.6	18.37	18.37	18.12	18.86	19.6	20.09	20.58	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.47	71.23	70.98	69.76	69.51	68.28	68.28	68.04	68.77	69.51	70	70.49	

Average = $Sum(39)_{1...12}$ /12= 69.69 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.82	0.82	0.81	0.8	0.79	0.79	0.79	0.8	0.8	0.81	0.82	

Average = $Sum(40)_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	104.84	101.03	97.22	93.41	89.59	85.78	85.78	89.59	93.41	97.22	101.03	104.84	

Total = $Sum(44)_{1...12}$ = 1143.75 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	155.48	135.98	140.32	122.34	117.39	101.3	93.86	107.71	109	127.03	138.66	150.57	

Total = $Sum(45)_{1...12}$ = 1499.64 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.32	20.4	21.05	18.35	17.61	15.19	14.08	16.16	16.35	19.05	20.8	22.59	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	110	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
If community heating see section 4.3			
Volume factor from Table 2a		1.03	(52)
Temperature factor from Table 2b		0.6	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	1.03	(54)
Enter (50) or (54) in (55)		1.03	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.76	185.91	195.6	175.83	172.66	154.79	149.14	162.99	162.49	182.3	192.15	205.85	(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=	210.76	185.91	195.6	175.83	172.66	154.79	149.14	162.99	162.49	182.3	192.15	205.85	

Output from water heater (annual)$_{1...12}$ | 2150.48 | (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=	95.92	85.16	90.88	83.47	83.25	76.48	75.43	80.04	79.04	86.46	88.9	94.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	128.66	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.74	18.42	14.98	11.34	8.48	7.16	7.73	10.05	13.49	17.13	20	21.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	232.3	234.71	228.63	215.7	199.38	184.03	173.79	171.37	177.45	190.38	206.7	222.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	35.87	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	-102.93	(71)

Water heating gains (Table 5)

(72)m=	128.92	126.72	122.15	115.93	111.9	106.22	101.39	107.57	109.77	116.21	123.47	126.73	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	443.56	441.45	427.36	404.58	381.35	359.01	344.5	350.6	362.31	385.32	411.77	431.69	(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	5.28	x	10.63	x	0.4	x	0.7	=	10.89	(74)
North	0.9x	0.77	x	2.64	x	10.63	x	0.4	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	5.28	x	20.32	x	0.4	x	0.7	=	20.82	(74)
North	0.9x	0.77	x	2.64	x	20.32	x	0.4	x	0.7	=	10.41	(74)
North	0.9x	0.77	x	5.28	x	34.53	x	0.4	x	0.7	=	35.38	(74)
North	0.9x	0.77	x	2.64	x	34.53	x	0.4	x	0.7	=	17.69	(74)
North	0.9x	0.77	x	5.28	x	55.46	x	0.4	x	0.7	=	56.83	(74)
North	0.9x	0.77	x	2.64	x	55.46	x	0.4	x	0.7	=	28.41	(74)
North	0.9x	0.77	x	5.28	x	74.72	x	0.4	x	0.7	=	76.55	(74)
North	0.9x	0.77	x	2.64	x	74.72	x	0.4	x	0.7	=	38.27	(74)
North	0.9x	0.77	x	5.28	x	79.99	x	0.4	x	0.7	=	81.95	(74)
North	0.9x	0.77	x	2.64	x	79.99	x	0.4	x	0.7	=	40.97	(74)
North	0.9x	0.77	x	5.28	x	74.68	x	0.4	x	0.7	=	76.51	(74)
North	0.9x	0.77	x	2.64	x	74.68	x	0.4	x	0.7	=	38.25	(74)
North	0.9x	0.77	x	5.28	x	59.25	x	0.4	x	0.7	=	60.7	(74)
North	0.9x	0.77	x	2.64	x	59.25	x	0.4	x	0.7	=	30.35	(74)
North	0.9x	0.77	x	5.28	x	41.52	x	0.4	x	0.7	=	42.54	(74)
North	0.9x	0.77	x	2.64	x	41.52	x	0.4	x	0.7	=	21.27	(74)
North	0.9x	0.77	x	5.28	x	24.19	x	0.4	x	0.7	=	24.78	(74)
North	0.9x	0.77	x	2.64	x	24.19	x	0.4	x	0.7	=	12.39	(74)
North	0.9x	0.77	x	5.28	x	13.12	x	0.4	x	0.7	=	13.44	(74)
North	0.9x	0.77	x	2.64	x	13.12	x	0.4	x	0.7	=	6.72	(74)
North	0.9x	0.77	x	5.28	x	8.86	x	0.4	x	0.7	=	9.08	(74)
North	0.9x	0.77	x	2.64	x	8.86	x	0.4	x	0.7	=	4.54	(74)
South	0.9x	0.77	x	5.28	x	46.75	x	0.4	x	0.7	=	47.9	(78)
South	0.9x	0.77	x	2.64	x	46.75	x	0.4	x	0.7	=	47.9	(78)
South	0.9x	0.77	x	5.28	x	76.57	x	0.4	x	0.7	=	78.45	(78)
South	0.9x	0.77	x	2.64	x	76.57	x	0.4	x	0.7	=	78.45	(78)
South	0.9x	0.77	x	5.28	x	97.53	x	0.4	x	0.7	=	99.93	(78)
South	0.9x	0.77	x	2.64	x	97.53	x	0.4	x	0.7	=	99.93	(78)
South	0.9x	0.77	x	5.28	x	110.23	x	0.4	x	0.7	=	112.94	(78)
South	0.9x	0.77	x	2.64	x	110.23	x	0.4	x	0.7	=	112.94	(78)
South	0.9x	0.77	x	5.28	x	114.87	x	0.4	x	0.7	=	117.69	(78)
South	0.9x	0.77	x	2.64	x	114.87	x	0.4	x	0.7	=	117.69	(78)
South	0.9x	0.77	x	5.28	x	110.55	x	0.4	x	0.7	=	113.26	(78)
South	0.9x	0.77	x	2.64	x	110.55	x	0.4	x	0.7	=	113.26	(78)
South	0.9x	0.77	x	5.28	x	108.01	x	0.4	x	0.7	=	110.66	(78)
South	0.9x	0.77	x	2.64	x	108.01	x	0.4	x	0.7	=	110.66	(78)
South	0.9x	0.77	x	5.28	x	104.89	x	0.4	x	0.7	=	107.47	(78)

South	0.9x	0.77	x	2.64	x	104.89	x	0.4	x	0.7	=	107.47	(78)
South	0.9x	0.77	x	5.28	x	101.89	x	0.4	x	0.7	=	104.39	(78)
South	0.9x	0.77	x	2.64	x	101.89	x	0.4	x	0.7	=	104.39	(78)
South	0.9x	0.77	x	5.28	x	82.59	x	0.4	x	0.7	=	84.61	(78)
South	0.9x	0.77	x	2.64	x	82.59	x	0.4	x	0.7	=	84.61	(78)
South	0.9x	0.77	x	5.28	x	55.42	x	0.4	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	2.64	x	55.42	x	0.4	x	0.7	=	56.78	(78)
South	0.9x	0.77	x	5.28	x	40.4	x	0.4	x	0.7	=	41.39	(78)
South	0.9x	0.77	x	2.64	x	40.4	x	0.4	x	0.7	=	41.39	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	112.14	188.12	252.92	311.11	350.2	349.44	336.09	305.99	272.57	206.4	133.71	96.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	555.7	629.57	680.28	715.69	731.55	708.45	680.59	656.59	634.89	591.72	545.48	528.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.61	0.44	0.48	0.72	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.26	20.4	20.58	20.79	20.94	20.99	21	21	20.98	20.81	20.5	20.24	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.23	20.23	20.23	20.25	20.25	20.26	20.26	20.26	20.26	20.25	20.24	20.24	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.77	0.54	0.37	0.4	0.65	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.24	19.44	19.7	20.01	20.19	20.26	20.26	20.26	20.24	20.03	19.6	19.22	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.48	19.66	19.91	20.19	20.37	20.43	20.43	20.44	20.41	20.21	19.81	19.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.48	19.66	19.91	20.19	20.37	20.43	20.43	20.44	20.41	20.21	19.81	19.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.77	0.56	0.38	0.42	0.67	0.92	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	552.39	620.91	657.62	650.17	565.59	394.64	261.56	274.17	423.34	542.93	537.39	525.75	(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=	1084.85	1051.43	951.63	787.7	602.37	398.02	261.79	274.57	434.2	668.29	889.57	1075.31	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	396.14	289.31	218.74	99.02	27.37	0	0	0	0	93.27	253.57	408.87

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1786.3	(98)
Space heating requirement in kWh/m²/year	20.67	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1786.3	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1375.45	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	589.48	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2150.48	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1655.87	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	709.66	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	43.3	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		188.55	(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) =	188.55	(331)
Energy for lighting (calculated in Appendix L)		366.31	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

DER WorkSheet: New dwelling design stage

CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	=	535.12	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	293.53	(368)
Electrical energy for heat distribution	[(313) x	0.52	=	22.48	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	851.13	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			851.13	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	97.86	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	190.12	(379)
Total CO2, kg/year	sum of (376)…(382) =			1139.1	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			13.18	(384)
EI rating (section 14)				88.38	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.12

Property Address: W5-12

Address :	, 156 West End Lane, Camden, London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.8	(1a) x	2.7	(2a) =	139.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	139.86	(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

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	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) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	1.4	=	2.646			(26)
Windows Type 1			5.28	x1/[1/(1.2)+ 0.04]		=	6.05			(27)
Windows Type 2			2.64	x1/[1/(1.2)+ 0.04]		=	3.02			(27)
Walls Type1	18.36	7.92	10.44	x	0.16	=	1.67			(29)
Walls Type2	18.36	1.89	16.47	x	0.15	=	2.47			(29)
Roof	51.8	0	51.8	x	0.12	=	6.22			(30)
Total area of elements, m²			88.52							(31)
Party wall			37.5	x	0	=	0			(32)
Party floor			51.8							(32a)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.07 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.37 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.43 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.26	12.13	12	11.32	11.19	10.52	10.52	10.39	10.79	11.19	11.46	11.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	45.7	45.56	45.43	44.76	44.62	43.95	43.95	43.82	44.22	44.62	44.89	45.16	

Average = $Sum(39)_{1...12}$ /12= 44.7? (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(40)m=	0.88	0.88	0.88	0.86	0.86	0.85	0.85	0.85	0.85	0.86	0.87	0.87		
											Average = Sum(40)$_{1…12}$ /12=		0.86	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.74 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 75.6 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

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		
(44)m=	83.16	80.14	77.11	74.09	71.06	68.04	68.04	71.06	74.09	77.11	80.14	83.16		
											Total = Sum(44)$_{1…12}$ =		907.2	(44)
(45)m=	123.32	107.86	111.3	97.04	93.11	80.35	74.45	85.43	86.45	100.75	109.98	119.43		
											Total = Sum(45)$_{1…12}$ =		1189.49	(45)
(46)m=	18.5	16.18	16.7	14.56	13.97	12.05	11.17	12.82	12.97	15.11	16.5	17.91		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	178.6	157.79	166.58	150.53	148.39	133.84	129.73	140.71	139.95	156.03	163.48	174.71	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	178.6	157.79	166.58	150.53	148.39	133.84	129.73	140.71	139.95	156.03	163.48	174.71	

Output from water heater (annual)$_{1...12}$ 1840.33 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.23	75.81	81.23	75.06	75.18	69.51	68.98	72.63	71.54	77.72	79.36	83.93	(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=	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	87.16	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.26	12.66	10.3	7.8	5.83	4.92	5.32	6.91	9.28	11.78	13.75	14.66	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	151.91	153.48	149.51	141.05	130.38	120.35	113.64	112.07	116.04	124.5	135.17	145.2	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	31.72	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	-69.73	(71)
Water heating gains (Table 5)													
(72)m=	114.55	112.81	109.18	104.25	101.05	96.54	92.71	97.62	99.36	104.47	110.23	112.81	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	329.87	328.1	318.14	302.25	286.4	270.96	260.82	265.75	273.83	289.89	308.29	321.82	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.28	x	19.64	x	0.4	x	0.7	=	20.12	(76)
East	0.9x	0.77	x	2.64	x	19.64	x	0.4	x	0.7	=	10.06	(76)
East	0.9x	0.77	x	5.28	x	38.42	x	0.4	x	0.7	=	39.36	(76)
East	0.9x	0.77	x	2.64	x	38.42	x	0.4	x	0.7	=	19.68	(76)
East	0.9x	0.77	x	5.28	x	63.27	x	0.4	x	0.7	=	64.83	(76)

East	0.9x	0.77	x	2.64	x	63.27	x	0.4	x	0.7	=	32.41	(76)
East	0.9x	0.77	x	5.28	x	92.28	x	0.4	x	0.7	=	94.54	(76)
East	0.9x	0.77	x	2.64	x	92.28	x	0.4	x	0.7	=	47.27	(76)
East	0.9x	0.77	x	5.28	x	113.09	x	0.4	x	0.7	=	115.87	(76)
East	0.9x	0.77	x	2.64	x	113.09	x	0.4	x	0.7	=	57.93	(76)
East	0.9x	0.77	x	5.28	x	115.77	x	0.4	x	0.7	=	118.61	(76)
East	0.9x	0.77	x	2.64	x	115.77	x	0.4	x	0.7	=	59.31	(76)
East	0.9x	0.77	x	5.28	x	110.22	x	0.4	x	0.7	=	112.92	(76)
East	0.9x	0.77	x	2.64	x	110.22	x	0.4	x	0.7	=	56.46	(76)
East	0.9x	0.77	x	5.28	x	94.68	x	0.4	x	0.7	=	97	(76)
East	0.9x	0.77	x	2.64	x	94.68	x	0.4	x	0.7	=	48.5	(76)
East	0.9x	0.77	x	5.28	x	73.59	x	0.4	x	0.7	=	75.39	(76)
East	0.9x	0.77	x	2.64	x	73.59	x	0.4	x	0.7	=	37.7	(76)
East	0.9x	0.77	x	5.28	x	45.59	x	0.4	x	0.7	=	46.71	(76)
East	0.9x	0.77	x	2.64	x	45.59	x	0.4	x	0.7	=	23.35	(76)
East	0.9x	0.77	x	5.28	x	24.49	x	0.4	x	0.7	=	25.09	(76)
East	0.9x	0.77	x	2.64	x	24.49	x	0.4	x	0.7	=	12.54	(76)
East	0.9x	0.77	x	5.28	x	16.15	x	0.4	x	0.7	=	16.55	(76)
East	0.9x	0.77	x	2.64	x	16.15	x	0.4	x	0.7	=	8.27	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.18	59.04	97.24	141.82	173.8	177.92	169.38	145.5	113.09	70.06	37.63	24.82	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	360.05	387.15	415.38	444.06	460.2	448.87	430.2	411.24	386.92	359.95	345.93	346.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.61	0.45	0.49	0.74	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.23	20.33	20.52	20.76	20.92	20.99	21	21	20.97	20.76	20.46	20.21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.19	20.2	20.2	20.21	20.21	20.21	20.21	20.2	20.2	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.77	0.54	0.37	0.41	0.68	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.16	19.31	19.58	19.92	20.13	20.2	20.21	20.21	20.18	19.93	19.5	19.14	(90)

fLA = Living area ÷ (4) = | 0.45 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.64	19.77	20	20.3	20.49	20.56	20.57	20.57	20.54	20.31	19.94	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.64	19.77	20	20.3	20.49	20.56	20.57	20.57	20.54	20.31	19.94	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.79	0.58	0.4	0.44	0.71	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	357.3	382.08	403.06	406.83	361.97	258.51	174.06	182.09	272.99	334.88	340.36	344.5	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	701	677.59	613.43	510.11	392.16	261.94	174.36	182.62	284.67	433.29	576.27	696.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	255.71	198.59	156.52	74.36	22.46	0	0	0	0	73.22	169.85	261.85	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1212.56 (98)

Space heating requirement in kWh/m²/year 23.41 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		0.7	(303a)
Fraction of community heat from heat source 2		0.3	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	0.7	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.3	(304b)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1212.56	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	933.67	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	400.15	(307b)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1840.33	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	1417.05	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	607.31	(310b)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.58	(313)

DER WorkSheet: New dwelling design stage

Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		106.64	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	106.64	(331)
Energy for lighting (calculated in Appendix L)		251.82	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				294	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				95.6	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	414.98	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	227.63	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	17.43	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	660.03	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				660.03	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	55.35	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	130.69	(379)
Total CO2, kg/year	sum of (376)…(382) =				846.07	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				16.33	(384)
EI rating (section 14)					88.29	(385)

DRAFT

Appendix F – PV Specification

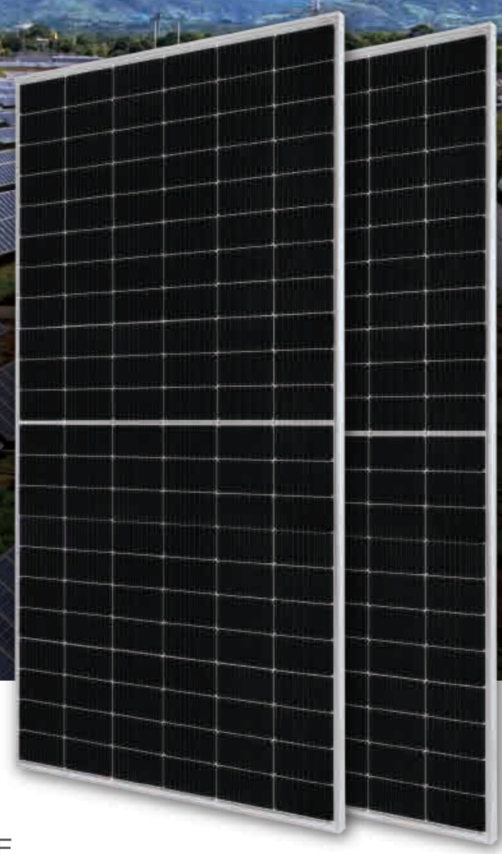
Preliminary

Harvest the Sunshine

DEEP BLUE 3.0

Mono

505W MBB Half-cell Module
JAM66S30 480-505/MR Series



Introduction

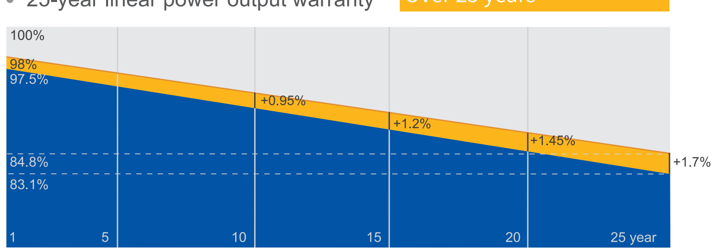
Assembled with 11BB PERC cells, the half-cell configuration of the modules offers the advantages of higher power output, better temperature-dependent performance, reduced shading effect on the energy generation, lower risk of hot spot, as well as enhanced tolerance for mechanical loading.

- Higher output power
- Lower LCOE
- Less shading and lower resistive loss
- Better mechanical loading tolerance

Superior Warranty

- 12-year product warranty
- 25-year linear power output warranty

0.55% Annual Degradation
Over 25 years



■ New linear power warranty ■ Standard module linear power warranty

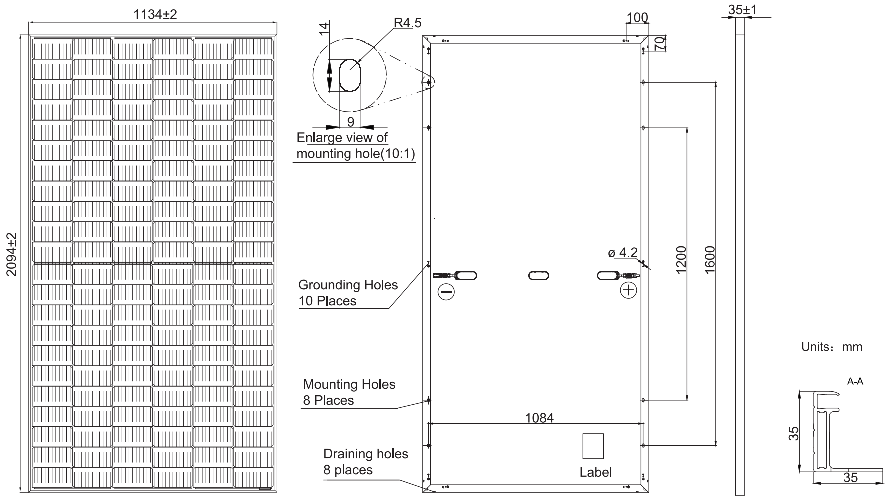
Comprehensive Certificates

- IEC 61215, IEC 61730,UL 61215, UL 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- ISO 45001: 2018 Occupational health and safety management systems
- IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules – Guidelines for increased confidence in PV module design qualification and type approval

JA SOLAR

JAM66S30 480-505/MR Series

MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono
Weight	26.3kg±3%
Dimensions	2094±2mm×1134±2mm×35±1mm
Cable Cross Section Size	4mm²（IEC）, 12 AWG(UL)
No. of cells	132(6×22）
Junction Box	IP68, 3 diodes
Connector	QC 4.10(1000V) QC 4.10-35(1500V）
Cable Length (Including Connector)	Portrait: 300mm(+)/400mm(-); Landscape: 1200mm(+)/1200mm(-)
Packaging Configuration	31pcs/Pallet, 682pcs/40ft Container

ELECTRICAL PARAMETERS AT STC

TYPE	JAM66S30 -480/MR	JAM66S30 -485/MR	JAM66S30 -490/MR	JAM66S30 -495/MR	JAM66S30 -500/MR	JAM66S30 -505/MR
Rated Maximum Power(Pmax) [W]	480	485	490	495	500	505
Open Circuit Voltage(Voc) [V]	45.07	45.20	45.33	45.46	45.59	45.72
Maximum Power Voltage(Vmp) [V]	37.62	37.81	37.99	38.17	38.35	38.53
Short Circuit Current(Isc) [A]	13.65	13.72	13.79	13.86	13.93	14.00
Maximum Power Current(Imp) [A]	12.76	12.83	12.90	12.97	13.04	13.11
Module Efficiency [%]	20.2	20.4	20.6	20.8	21.1	21.3
Power Tolerance	0~+5W					
Temperature Coefficient of Isc(α_Isc)	+0.045%/°C					
Temperature Coefficient of Voc(β_Voc)	-0.275%/°C					
Temperature Coefficient of Pmax(γ_Pmp)	-0.350%/°C					
STC	Irradiance 1000W/m², cell temperature 25°C, AM1.5G					

Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer.They only serve for comparison among different module types.

ELECTRICAL PARAMETERS AT NOCT

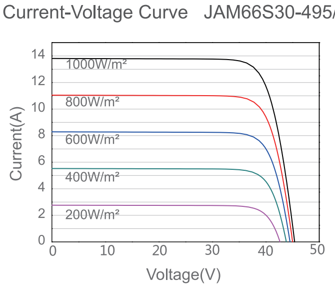
TYPE	JAM66S30 -480/MR	JAM66S30 -485/MR	JAM66S30 -490/MR	JAM66S30 -495/MR	JAM66S30 -500/MR	JAM66S30 -505/MR
Rated Max Power(Pmax) [W]	363	367	370	374	378	382
Open Circuit Voltage(Voc) [V]	42.15	42.30	42.43	42.58	42.72	42.86
Max Power Voltage(Vmp) [V]	35.54	35.67	35.76	35.84	35.93	36.02
Short Circuit Current(Isc) [A]	10.99	11.06	11.13	11.20	11.27	11.34
Max Power Current(Imp) [A]	10.21	10.28	10.36	10.44	10.52	10.60
NOCT	Irradiance 800W/m², ambient temperature 20°C,wind speed 1m/s, AM1.5G					

OPERATING CONDITIONS

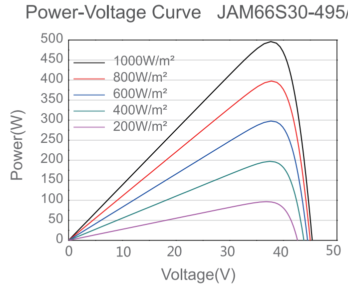
Maximum System Voltage	1000V/1500V DC
Operating Temperature	-40℃~+85℃
Maximum Series Fuse Rating	25A
Maximum Static Load,Front* Maximum Static Load,Back*	5400Pa(112lb/ft²) 2400Pa(50lb/ft²)
NOCT	45±2℃
Safety Class	Class Ⅱ
Fire Performance	UL Type 1

CHARACTERISTICS

Current-Voltage Curve JAM66S30-495/MR



Power-Voltage Curve JAM66S30-495/MR



Current-Voltage Curve JAM66S30-495/MR