Energy Statement

36 Lancaster Grove

For Nicholas Taylor and Associates

November 2016

XCO2 energy

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About us:
XCO2 Energy are a low-carbon consultancy working in the built environment. We are a multi-disciplinary company consisting of both architects and engineers, with specialists including CIBSE low carbon consultants, Code for Sustainable Homes, EcoHomes and BREEAM assessors and LEED accredited professionals.

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Executive Summary

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at 36 Lancaster Grove, based on the information provided by the design team.

The site is located between Lancaster Grove, Lambolle Place and Eton Ave within the London Borough of Camden, just north of Primrose Hill. The proposed scheme comprise the change of use, refurbishment and extension of the Grade II* Listed former Belsize Park Fire Station Building into 18 units of apartment accommodation. This includes 11 units which formed part of the approved application (Camden application reference 2016/0745/P and listed building consent 2016/1128/L), and 7 additional units in the reminder of the building at ground and first floor levels. For completeness, this report covers the energy assessment of all 18 units.

As the former Belsize Park Fire Station is a Listed Building located within the Belsize Park conservation area, all of the existing facades, roof, windows and floors will be retained and re-used as far as possible to maintain the character of the existing building.

In line with the 'GLA Guidance on preparing energy assessments' (April 2015) Sections 8.11-8.14, the existing building with it's current fabric and building services systems are used as the baseline condition for the scheme in this Energy Statement.

The methodology used to determine the CO_2 emissions is in accordance with the London Plan's three-step Energy Hierarchy (Policy 5.2) outlined below.

1. Be Lean - use less energy
The first step deals with the reduction in energy use, through the adoption of sustainable design and construction measures. In accordance with this strategy, this development will incorporate a range of energy efficiency measures including the provision of a new and highly efficiency communal space heating and hot water system, electrical rewiring to include provision of low energy lighting throughout the scheme, and insulation levels meeting Part L1B targets for the any new thermal elements. Insulation will also be provided between and below the rafters at the existing pitched roof. The improvements in the building systems and fabric have reduced regulated CO_2 emissions by 46.2% in comparison to the existing building, thus exceeding the requirements outlined by the Camden Council and London Plan 2015.

2. Be Clean - supply energy efficiently
The second strategy takes into account the efficient supply of energy, by prioritising decentralised energy generation. The feasibility study showed that no district heating network currently exists within close proximity of the site. Due to the nature of the development, a CHP unit would not be an economically viable option. Hence, a high efficiency centralised gas boiler will be installed to provide space heating and hot water to all apartments.

3. Be Green - use renewable energy
The third strategy covers the use of renewable technologies. The feasibility study analysed a number of renewable technologies for their suitability for the site. The analysis included a biomass heating system, ground-source heat pumps, air-source heat pumps, photovoltaic panels, solar thermal and wind turbines.

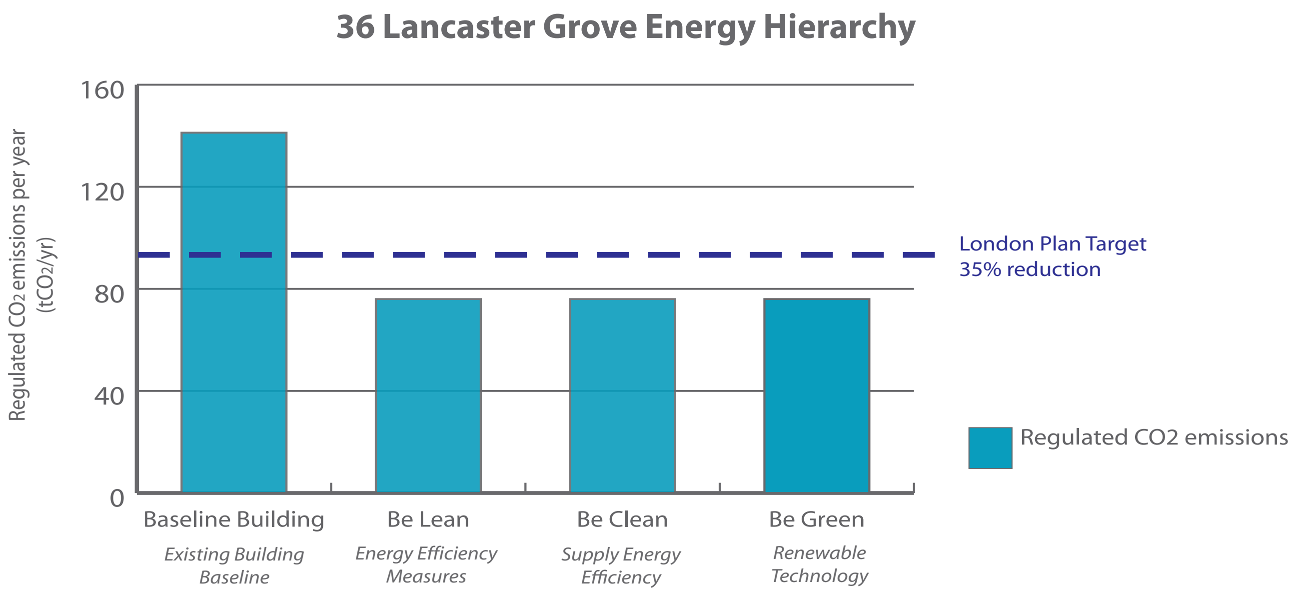
The analysis demonstrated that due to the conservation requirements of the existing Grade II listed building, it will not be feasible to install renewable technologies without considerable alterations to the former Belsize Park Fire Station.

In total, the development is expected to reduce regulated CO_2 emissions by 46.2% when compared to the existing baseline building. This meets the London Plan CO_2 reduction target of 35% set out for all major developments.

Conclusion

The graph below provides a summary of the regulated CO_2 savings at each stage of the London Plan Energy Hierarchy. The table below and on the following page detail the regulated and unregulated emissions at each stage of the hierarchy.

It can be seen on the graph below that the development at 36 Lancaster Grove will achieve a regulated CO_2 saving exceeding the required 35% beyond the existing baseline building.



CO_2 Emissions Breakdown from each stage of the energy hierarchy

	Carbon Dioxide Emissions (tonnes CO_2 per annum)	
	Regulated	Total
Existing building baseline	141.2	165.5
After energy demand reduction	76.0	100.3
After CHP	76.0	100.3
After renewable technologies	76.0	100.3

CO_2 Savings Breakdown from each stage of the energy hierarchy

	Regulated Carbon Dioxide Savings	
	Tonnes CO_2 / year	% over baseline
Savings from energy demand reduction	65.2	46.2%
Savings from CHP	0.0	0.0%
Savings from renewable energy	0.0	0.0%
Cumulative savings	65.2	46.2%

Introduction

The proposed Belsize Park Fire Station development located at Lancaster, is a five-storey high Grade II listed building. It is a change of use development from a fire station to domestic units.

The site is located between Lancaster Grove, Lambolle Place and Eton Ave within the London Borough of Camden, just north of Primrose Hill. The proposed scheme comprise the change of use, refurbishment and extension of the Grade II* Listed former Belsize Park Fire Station Building into 18 units of apartment accommodation. This includes 11 units which formed part of the approved application (Camden application reference 2016/0745/P and listed building consent 2016/1128/L), and 7 additional units in the reminder of the building at ground and first floor levels. For completeness, this report covers the energy assessment of all 18 units.

This document demonstrates how the proposed development addresses the relevant energy policies of the London Plan 2015 (Further Alterations to the London Plan) and the requirements of Camden Council as outlined in their Core Strategy 2010-2025.

In particular this report responds to the energy policies of section 5 in the London Plan, including:

- Policy 5.2 Minimising Carbon Dioxide Emissions
- Policy 5.3 Sustainable Design and Construction
- Policy 5.5 Decentralised Energy Networks
- Policy 5.6 Decentralised Energy in Development proposals
- Policy 5.7 Renewable Energy where feasible.

and the Policy CS13 of the Camden's Core Strategy 2010-2025, which states the following in relation to sustainable redevelopment in the local area:

Camden Core Strategy 2010-2025: CS13 - Tackling climate change through promoting high environmental standards

Reducing the effects of and adapting to climate change

The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

- *ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;*
- *promoting the efficient use of land and buildings;*
- *minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:*

1. *ensuring developments use less energy,*
2. *making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;*
3. *generating renewable energy on-site; and*

- *ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.*

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions

Local energy generation

The Council will promote local energy generation and networks by:

- *working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the* *vicinity of:*

1. *housing estates with community heating or the potential for community heating and other uses with large heating loads;*
2. *the growth areas of King's Cross; Euston; Tottenham Court Road; West Hampstead Interchange and Holborn;*
3. *schools to be redeveloped as part of Building Schools for the Future programme;*
4. *existing or approved combined heat and power/ local energy networks;*

and other locations where land ownership would facilitate their implementation.

- *protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road);*

Camden's carbon reduction measures

The Council will take a lead in tackling climate change by:

- *taking measures to reduce its own carbon emissions;*
- *triallng new energy efficient technologies, where feasible; and*
- *raising awareness on mitigation and adaptation measures*

Furthermore, the Camden Core Strategy recommends that:

Given the large proportion of development in the borough that relates to existing buildings, we will expect proportionate measures to be taken to improve their environmental sustainability, where possible.

The methodology employed in this Energy Statement to determine the potential CO_2 savings for this development, is in accordance with the three step Energy Hierarchy outlined in the London Plan:

- Be Lean - Improve the energy efficiency of the scheme
- Be Clean - Supply as much of the remaining energy requirement with low-carbon technologies such as combined heat and power (CHP)
- Be Green - Offset a proportion of the remaining carbon dioxide emissions by using renewable technologies.

It should be noted that due to the change-of-use and refurbishment nature of the proposed development, the baseline conditions for the development are calculated based on the existing fabric and services of the retained building.

Energy calculations were carried out using the SAP (Standard Assessment Procedure) methodology. This is in line with Building Regulations Part L 2013. The SAP sheets for the existing building baseline is presented in Appendix A, while those for the proposed development is presented in Appendix B.

Demand Reduction (Be Lean)

Passive Design Measures

Enhanced Building Fabric

The heat loss of different building elements is dependent upon their U-value. The lower the U-value, the better the level of insulation of a particular element. A building with low U-values has a reduced heating demand during the cooler months.

The extended portions of the development at 36 Lancaster Grove will incorporate insulation meeting building regulation Part L1B threshold U-values and high efficiency glazing where possible in order to reduce the demand for space heating (see tables below).

Insulation would be installed to between and below the rafters of the existing pitched roof of the building, to achieve a u-value of circa 0.28 W/m2.K. However, it must be noted that since the building is a Grade II* listed structure of heritage interest, alteration of the existing fabric elements (external walls, floors, roofs and such) will impact the original character of the building, no changes apart from addition of roof insulation will be made to the existing fabric elements.

Heating and hot water to the apartments will be supplied by a communal heating system with a centralised high efficiency gas boiler.

Air Tightness

Heat loss may also occur due to air infiltration. Although this cannot be eliminated altogether, good construction detailing and the use of best practice construction techniques can minimise the amount of air infiltration into a building.

Current Part L Building Regulations (2013) sets a maximum air permeability rate of $10m^3/m^2$ at 50Pa for new build dwellings. The development will achieve this air tightness as a minimum, through draught proofing and the application of best practice construction techniques.

Daylight

The development will aim to maintain the existing good sized windows to provide satisfactory levels of daylighting in all habitable spaces such as living rooms, as a way of improving the health and wellbeing of its occupants.

Active Design Measures

High Efficacy Lighting

The development intends to incorporate low energy lighting fittings throughout the dwellings and communal spaces. All light fittings will be specified as low energy lighting to minimise energy demand. Internal and external areas which are not frequently used will be fitted with occupant sensors, whereas daylit areas will be fitted with daylight sensors and timers.

Energy Demand

The table below shows a breakdown of energy demand for space conditioning and electricity. These figures indicate baseline and Lean demand after energy efficiency measures have been applied.

The table below demonstrates the energy savings achieved through energy efficiency measures (Lean stage of the Energy Hierarchy).

Breakdown of Energy Consumption and CO_2 Emissions

	Baseline Building			Lean		
	Energy (kWh/year)	CO_2 emissions ($kgCO_2$/year)	CO_2 ($kgCO_2/m^2$)	Energy (kWh/year)	CO_2 emissions ($kgCO_2$/year)	CO_2 ($kgCO_2/m^2$)
Hot Water	41,020	13,820	10.0	37,290	9,140	7.0
Space Heating	361,740	122,300	90.0	260,080	63,770	46.0
Cooling	0	0	0	0	0	0
Auxiliary	0	0	0	0	0	0
Lighting	10,150	5,270	4.0	5,970	3,100	2.0
Equipment (not incl. in Part L)	46,850	24,320	18.0	46,850	24,320	18.0
Total Part L	412,910	141,390	102.0	303,340	76,010	55.0
Total (incl. Equip)	459,760	165,710	120.0	350,190	100,330	73.0

CO_2 Emissions

The table below shows the regulated and unregulated carbon dioxide emissions for the baseline scheme and the emissions after the passive and active lean measures have been implemented. A saving exceeding the required 35% is expected from the regulated CO_2 emission over the existing building.

CO_2 Emissions Breakdown at Lean stage

	Carbon Dioxide emissions (tonnes CO_2 per annum)		
	Regulated	Unregulated	Total
Baseline building	141.2	24.3	165.5
After energy demand reduction (Lean)	76.0	24.3	100.3

	Carbon dioxide savings (tonnes CO_2 per annum)		Carbon dioxide savings from baseline (%)	
	Regulated	Total	Regulated	Total
Savings from energy demand reduction	65.2	65.2	46.2%	39.4%

Heating and Cooling Infrastructure (Be Clean)

Energy System Hierarchy

The energy system for the development has been selected in accordance with the London Plan decentralised energy hierarchy. The hierarchy listed in Policy 5.6 states that energy systems should consider:

1. Connection to existing heating and cooling networks
2. Site wide CHP network
3. Communal heating and cooling

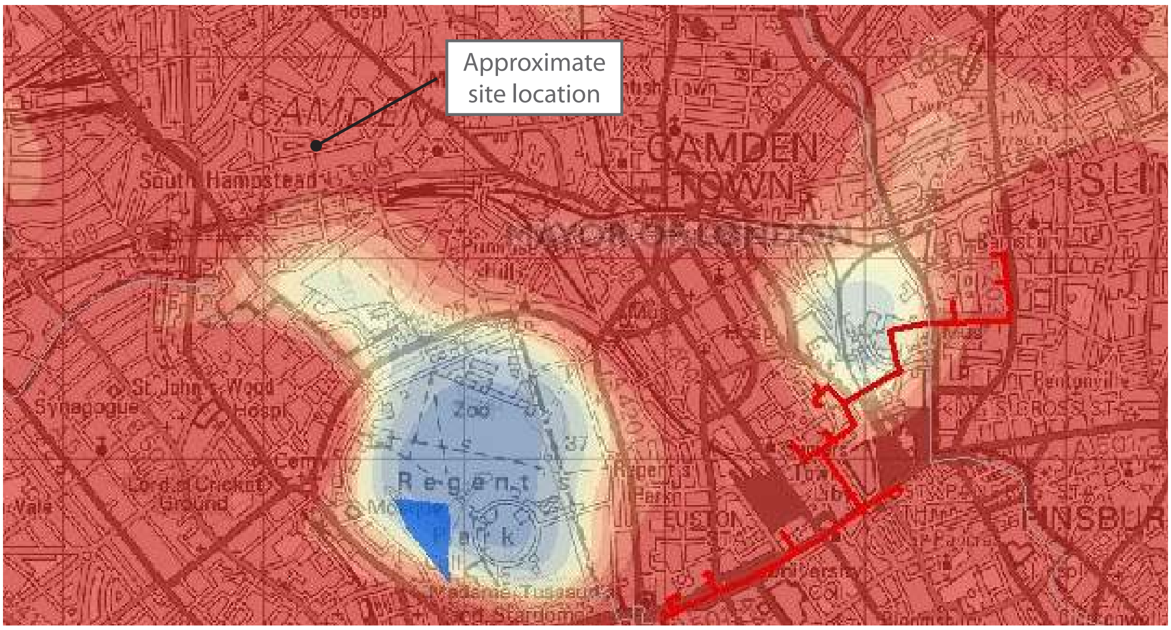
Local supply of heat and power minimise distribution losses, thereby achieving a greater efficiency and reducing CO_2 emissions, when compared to the individual systems.

In a communal energy system, energy in the form of heat, cooling, and/or electricity is generated from a central source and distributed via a network to surrounding residencies and commercial units.

Connection to Existing Low Carbon Heat Distribution Networks

The London Heat Map identifies existing and potential opportunities for decentralised energy projects in London. It builds on the 2005 London Community Heating Development Study. An excerpt from the London Heat Map below shows the energy demand for different areas. Darker shades of red signify areas where energy demand is high. The map also highlights any existing and proposed district heating network (DHN) within the vicinity of the development.

A review of the map shows that the closest existing or proposed heat networks approximately 1.4 miles to the south-east of the site. The scale of the development does not make it economically viable for connection with networks located at a distance from the site. For this reason connection to district heat networks are not currently considered feasible.



London Heat Map with proposed district heat network outlined in red

Combined Heat and Power (CHP)

CHP, or Co-generation is the production of electricity and useful heat from a single engine. Unlike conventional electricity generation, heat is re-used in a CHP system, primarily for hot water, thereby improving the overall energy conversion from 25-35% to around 80%.

Due to the type and size of the development, this technology would not be suitable for this site. The hot water load of the site would not be sufficient to justify the use of this technology.

Hence, this technology is deemed to be unsuitable for the development at 36 Lancaster Grove. The proposed development will be served by a communal heating network with a centralised gas boiler.

There will be no further reduction in CO_2 emissions at the Clean Stage.

An example of a CHP engine (courtesy of Baxi)

CO_2 Emissions Breakdown at Clean stage

	Carbon Dioxide emissions (tonnes CO_2 per annum)		
	Regulated	Unregulated	Total
Baseline building	141.2	24.3	165.5
After energy demand reduction (Lean)	76.0	24.3	100.3
After CHP (Clean)	76.0	24.3	100.3

	Carbon dioxide savings (tonnes CO_2 per annum)		Carbon dioxide savings from baseline (%)	
	Regulated	Total	Regulated	Total
Savings from energy demand reduction	65.2	65.2	46.2%	39.4%
Savings from clean technologies	0.0	0.0	0.0%	0.0%

Renewable Energy (Be Green)

Once the energy demand has been minimised, methods of generating low and zero carbon energy can be assessed. The renewable technologies to be considered for the development are:

- Biomass
- Photovoltaic panels
- Solar thermal panels
- Ground/water source heat pumps
- Air source heat pump
- Wind energy

The table below summarises the factors taken into account in determining the appropriate renewable technology for this project. This includes estimated lifetime, level of maintenance, and level of impact on external appearance. The final column indicates the feasibility of the technology in relation to the site conditions (10 being the most feasible and 0 being infeasible).

The analysis demonstrated that due to the conservation requirements of the existing Grade II* listed building, it will not be feasible to install renewable technologies without considerable construction and alterations to the former Belsize Park Fire Station building.

36 Lancaster Grove

	Comments	Lifetime	Maintenance	Impact on External Appearance	Site Feasibility
Biomass 	Not adopted -burning of wood pellets releases high NOx emissions and there are limitations for their storage and delivery within an urban location.	20yrs	High	High	1
PV 	Not adopted - PV panels mounted on the pitched roof would significantly alter the appearance and character of the Listed Building.	25yrs	Low	Med	3
Solar Thermal 	Not adopted - Solar thermal array mounted on the pitched roof would significantly alter the appearance and character of the Listed Building.	25yrs	Low	Med	3
GSHP 	Not adopted -the installation of ground loops require significant space, additional time at the beginning of the construction process and very high capital costs.	20yrs	Med	Low	1
ASHP 	Not adopted -ASHP evaporator units are located externally and produce noise which can be an issue in a residential location, especially at night.	20yrs	Med	Med	3
Wind 	Not adopted - Wind turbines located at the site will have a significant visual impact on the existing building within the Conservation Area.	25yrs	Med	High	1

CO_2 Emissions

The table below shows the regulated and unregulated carbon dioxide emissions for the baseline scheme and the emissions after the lean, clean and green measures have been implemented.

The proposed Energy Strategy outlined in this document achieved significant CO_2 savings for this development. The savings achieved through sustainable design measures alone are significant.

The figures below show a CO_2 reduction in regulated emissions exceeding the required 35% when compared to the building with its existing fabric and systems.

CO_2 Emissions Breakdown

	Carbon Dioxide emissions (tonnes CO_2 per annum)		
	Regulated	Unregulated	Total
Baseline building	141.2	24.3	165.5
After energy demand reduction (Lean)	76.0	24.3	100.3
After CHP (Clean)	76.0	24.3	100.3
After renewable technologies (Green)	76.0	24.3	100.3

CO_2 Savings Breakdown at all stages for the energy hierarchy

	Carbon dioxide savings (tonnes CO_2 per annum)		Carbon dioxide savings over baseline (%)	
	Regulated	Total	Regulated	Total
Savings from energy demand reduction	65.2	65.2	46.2%	39.4%
Savings from CHP	0.0	0.0	0.0%	0.0%
Savings from renewable energy	0.0	0.0	0.0%	0.0%
Cumulative savings	65.2	65.2	46.2%	39.4%

Conclusion

In line with the London Plan's three step energy hierarchy, the regulated CO_2 emission savings for this development will exceed 35% when energy efficiency measures are taken into account.

The tables on the following page provide a breakdown of the CO_2 savings made at each stage of the Energy Hierarchy. The reductions made through each step have been outlined below:

1. Be Lean - use less energy
The first step deals with the reduction in energy use, through the adoption of sustainable design and construction measures. In accordance with this strategy, this development will incorporate a range of energy efficiency measures including the provision of a new and highly efficiency communal space heating and hot water system, electrical rewiring to include provision of low energy lighting throughout the scheme, and insulation levels meeting Part L1B targets for the any new thermal elements.

Insulation will also be provided between and below the rafters at the existing pitched roof. The improvements in the building systems and fabric have reduced regulated CO_2 emissions by 46.2% in comparison to the existing building, thus exceeding the requirements outlined by the Camden Council and London Plan 2015.

2. Be Clean - supply energy efficiently
The second strategy takes into account the efficient supply of energy, by prioritising decentralised energy generation. The feasibility study showed that no district heating network currently exists within close proximity of the site. Due to the nature of the development, a CHP unit would not be an economically viable option. Hence, a high efficiency centralised gas boiler will be installed to provide space heating and hot water to all apartments.

3. Be Green - use renewable energy
The feasibility study analysed a number of renewable technologies for their suitability for the site. The analysis included a biomass heating system, ground-source heat pumps, air-source heat pumps, photo voltaic panels, solar thermal and wind turbines.

The analysis demonstrated that due to the conservation requirements of the existing Grade II* listed building, it will not be feasible to install renewable technologies without considerable alterations to the former Belsize Park Fire Station.

In total, the development is expected to reduce regulated CO_2 emissions by 46.2% when compared to the existing baseline building. This meets the London Plan CO_2 reduction target of 35% set out for all major developments.

CO_2 Emissions Breakdown at all stages for the energy hierarchy

	Carbon Dioxide emissions (tonnes CO_2 per annum)		
	Regulated	Unregulated	Total
Baseline building	141.2	24.3	165.5
After energy demand reduction (Lean)	76.0	24.3	100.3
After district heating system (Clean)	76.0	24.3	100.3
After renewable technologies (Green)	76.0	24.3	100.3

CO_2 Savings Breakdown at all stages for the energy hierarchy

	Carbon dioxide savings (tonnes CO_2 per annum)		Carbon dioxide savings over baseline (%)	
	Regulated	Total	Regulated	Total
Savings from energy demand reduction	65.2	65.2	46.2%	39.4%
Savings from district heating system	0.0	0.0	0.0%	0.0%
Savings from renewable energy	0.0	0.0	0.0%	0.0%
Cumulative savings	65.2	65.2	46.2%	39.4%

Appendix A - SAP outputs for the existing building baseline

The DER from the FSAP modelling of the proposed development with the existing fabric and building services systems were used to calculate the baseline CO_2 emissions of the existing building.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 1

Address : , london, NW3 4PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	33	(1a)	x	2.25	(2a)	=	74.25	(3a)
Ground floor	19	(1b)	x	1.65	(2b)	=	31.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	105.6	(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) =	0.19	(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		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.19	(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) =	1.1	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

1.4	1.38	1.35	1.21	1.18	1.05	1.05	1.02	1.1	1.18	1.24	1.29

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=	1.4	1.38	1.35	1.21	1.18	1.05	1.05	1.02	1.1	1.18	1.24	1.29	(24d)

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

(25)m=	1.4	1.38	1.35	1.21	1.18	1.05	1.05	1.02	1.1	1.18	1.24	1.29	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			7.3	x	1.4	=	10.22			(26)
Doors Type 2			4.3	x	1.4	=	6.02			(26)
Windows Type 1			1.6	x1/[1/(2.1)+ 0.04]		=	3.1			(27)
Windows Type 2			1.97	x1/[1/(2.1)+ 0.04]		=	3.82			(27)
Floor			34.3	x	0.22	=	7.546			(28)
Walls Type1	29.4	15.17	14.23	x	0.28	=	3.98			(29)
Walls Type2	44.1	0	44.1	x	0.28	=	12.35			(29)
Roof	19	0	19	x	0.16	=	3.04			(30)
Total area of elements, m²			126.8							(31)
Party wall			14.9	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.07 (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: High 450 (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 (36)

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

Total fabric heat loss	(33) + (36) =	70.07	(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=	48.88	47.92	46.97	42.17	41.21	36.42	36.42	35.46	38.34	41.21	43.13	45.05	(38)

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

(39)m=	118.96	118	117.04	112.25	111.29	106.5	106.5	105.54	108.41	111.29	113.21	115.12	

Average = Sum(39)$_{1...12}$ /12= 112.01 (39)

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

(40)m=	2.29	2.27	2.25	2.16	2.14	2.05	2.05	2.03	2.08	2.14	2.18	2.21	

Average = Sum(40)$_{1...12}$ /12= 2.15 (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 1.75 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.74 (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=	83.31	80.28	77.26	74.23	71.2	68.17	68.17	71.2	74.23	77.26	80.28	83.31	

Total = Sum(44)$_{1...12}$ = 908.89 (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=	123.55	108.06	111.51	97.22	93.28	80.49	74.59	85.59	86.62	100.94	110.19	119.65	

Total = Sum(45)$_{1...12}$ = 1191.69 (45)

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

(46)m=	18.53	16.21	16.73	14.58	13.99	12.07	11.19	12.84	12.99	15.14	16.53	17.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		160	(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=	178.83	157.99	166.79	150.71	148.56	133.99	129.87	140.87	140.11	156.22	163.68	174.93	(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=	178.83	157.99	166.79	150.71	148.56	133.99	129.87	140.87	140.11	156.22	163.68	174.93	

Output from water heater (annual)$_{1...12}$ 1842.53 (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=	59.69	52.74	55.69	50.33	49.63	44.77	43.41	47.07	46.81	52.17	54.65	58.4	(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=	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	(66)

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

(67)m=	28.32	25.16	20.46	15.49	11.58	9.77	10.56	13.73	18.43	23.4	27.31	29.11	(67)

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

(68)m=	152.43	154.01	150.02	141.54	130.83	120.76	114.03	112.45	116.44	124.92	135.63	145.7	(68)

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

(69)m=	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	(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=	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	(71)

Water heating gains (Table 5)

(72)m=	80.23	78.48	74.85	69.91	66.7	62.19	58.35	63.27	65.01	70.12	75.9	78.49	(72)

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

(73)m=	310.22	306.88	294.56	276.17	258.34	241.95	232.18	238.68	249.11	267.68	288.07	302.54	(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	1.97	x	10.63	x	0.76	x	0.7	=	7.72	(74)
North	0.9x	0.77	x	1.97	x	20.32	x	0.76	x	0.7	=	14.76	(74)
North	0.9x	0.77	x	1.97	x	34.53	x	0.76	x	0.7	=	25.08	(74)
North	0.9x	0.77	x	1.97	x	55.46	x	0.76	x	0.7	=	40.28	(74)
North	0.9x	0.77	x	1.97	x	74.72	x	0.76	x	0.7	=	54.27	(74)
North	0.9x	0.77	x	1.97	x	79.99	x	0.76	x	0.7	=	58.09	(74)
North	0.9x	0.77	x	1.97	x	74.68	x	0.76	x	0.7	=	54.24	(74)
North	0.9x	0.77	x	1.97	x	59.25	x	0.76	x	0.7	=	43.03	(74)
North	0.9x	0.77	x	1.97	x	41.52	x	0.76	x	0.7	=	30.15	(74)
North	0.9x	0.77	x	1.97	x	24.19	x	0.76	x	0.7	=	17.57	(74)
North	0.9x	0.77	x	1.97	x	13.12	x	0.76	x	0.7	=	9.53	(74)
North	0.9x	0.77	x	1.97	x	8.86	x	0.76	x	0.7	=	6.44	(74)
South	0.9x	0.77	x	1.6	x	46.75	x	0.76	x	0.7	=	27.58	(78)
South	0.9x	0.77	x	1.6	x	76.57	x	0.76	x	0.7	=	45.17	(78)
South	0.9x	0.77	x	1.6	x	97.53	x	0.76	x	0.7	=	57.53	(78)
South	0.9x	0.77	x	1.6	x	110.23	x	0.76	x	0.7	=	65.03	(78)
South	0.9x	0.77	x	1.6	x	114.87	x	0.76	x	0.7	=	67.76	(78)
South	0.9x	0.77	x	1.6	x	110.55	x	0.76	x	0.7	=	65.21	(78)
South	0.9x	0.77	x	1.6	x	108.01	x	0.76	x	0.7	=	63.71	(78)
South	0.9x	0.77	x	1.6	x	104.89	x	0.76	x	0.7	=	61.88	(78)
South	0.9x	0.77	x	1.6	x	101.89	x	0.76	x	0.7	=	60.1	(78)
South	0.9x	0.77	x	1.6	x	82.59	x	0.76	x	0.7	=	48.72	(78)
South	0.9x	0.77	x	1.6	x	55.42	x	0.76	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.6	x	40.4	x	0.76	x	0.7	=	23.83	(78)

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

(83)m=	35.3	59.92	82.61	105.31	122.03	123.3	117.95	104.91	90.25	66.28	42.22	30.27	(83)

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

(84)m=	345.52	366.81	377.18	381.48	380.37	365.26	350.13	343.59	339.37	333.96	330.29	332.8	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	1	1	0.98	0.93	0.94	0.99	1	1	1	(86)

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

(87)m=	19.39	19.49	19.7	20.03	20.35	20.67	20.86	20.84	20.59	20.18	19.77	19.42	(87)

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

(88)m=	19.86	19.87	19.87	19.92	19.93	19.98	19.98	19.99	19.96	19.93	19.91	19.89	(88)

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

(89)m=	1	1	1	1	0.99	0.96	0.85	0.87	0.98	1	1	1	(89)

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

(90)m=	18.38	18.49	18.7	19.07	19.39	19.75	19.91	19.91	19.65	19.23	18.8	18.44	(90)

fLA = Living area ÷ (4) = 0.66 (91)

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

(92)m=	19.04	19.15	19.36	19.7	20.02	20.36	20.54	20.52	20.27	19.86	19.44	19.08	(92)

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

(93)m=	19.04	19.15	19.36	19.7	20.02	20.36	20.54	20.52	20.27	19.86	19.44	19.08	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	1	1	0.99	0.97	0.9	0.92	0.98	1	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	345.37	366.57	376.76	380.53	377.47	354.11	315.25	315.19	333.63	333.05	330.05	332.69	(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=	1754.01	1681.57	1505.17	1212.46	926.12	613.51	419.07	434.87	668.86	1029.99	1396.61	1713.31	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1048.03	883.68	839.54	598.99	408.19	0	0	0	0	518.52	767.92	1027.18	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 6092.05 (98)

Space heating requirement in kWh/m²/year 117.15 (99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		6092.05	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	7036.32	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement 1842.53

If DHW from community scheme:

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Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2128.12	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	91.64	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		500.21	(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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	3045.42	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	47.56	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	3092.98	(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) =				3092.98	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	259.61	(379)
Total CO2, kg/year	sum of (376)…(382) =				3352.59	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				64.47	(384)
EI rating (section 14)					53.83	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 2

Address : , London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	55	(1a) x	2.17	(2a) =	119.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	119.35	(5)

2. Ventilation rate:

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

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(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		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.17	(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) =	0.99	(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

1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17

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=	1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17	(24d)

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

(25)m=	1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			9.03	x1/[1/(1.6)+ 0.04]		=	13.58			(27)
Windows Type 2			1.82	x1/[1/(4.8)+ 0.04]		=	7.33			(27)
Windows Type 3			0.87	x1/[1/(4.8)+ 0.04]		=	3.5			(27)
Floor			55	x	0.93	=	51.15			(28)
Walls Type1	28.9	10.85	18.05	x	2.1	=	37.9			(29)
Walls Type2	7.81	2.77	5.04	x	2.1	=	10.58			(29)
Total area of elements, m²			91.71							(31)
Party wall			27.9	x	0	=	0			(32)
Party wall			1.13	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 126.71 (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: High 450 (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 14.4 (36)

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

Total fabric heat loss (33) + (36) = 141.11 (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=	49.84	48.86	47.88	43	42.02	37.2	37.2	36.29	39.09	42.02	43.97	45.93	(38)

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

(39)m=	190.95	189.97	188.99	184.11	183.13	178.31	178.31	177.4	180.2	183.13	185.08	187.04	

Average = Sum(39)$_{1…12}$ /12= 183.88 (39)

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

(40)m=	3.47	3.45	3.44	3.35	3.33	3.24	3.24	3.23	3.28	3.33	3.37	3.4	

Average = Sum(40)$_{1…12}$ /12= 3.34 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.84 (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 77.84 (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=	85.62	82.51	79.39	76.28	73.17	70.05	70.05	73.17	76.28	79.39	82.51	85.62	

Total = Sum(44)$_{1…12}$ = 934.05 (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=	126.97	111.05	114.6	99.91	95.86	82.72	76.65	87.96	89.01	103.74	113.24	122.97	

Total = Sum(45)$_{1…12}$ = 1224.68 (45)

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

(46)m=	19.05	16.66	17.19	14.99	14.38	12.41	11.5	13.19	13.35	15.56	16.99	18.45	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24	(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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24	

Output from water heater (annual)1…12 | 1875.52 | (64)

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

(65)m=	60.83	53.73	56.71	51.23	50.48	45.51	44.1	47.86	47.61	53.1	55.66	59.5	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	24.29	21.57	17.54	13.28	9.93	8.38	9.06	11.77	15.8	20.06	23.42	24.96	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	160.19	161.85	157.66	148.74	137.49	126.91	119.84	118.18	122.36	131.28	142.54	153.12	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	(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=	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	(71)
Water heating gains (Table 5)													
(72)m=	81.76	79.96	76.23	71.15	67.86	63.22	59.27	64.32	66.12	71.37	77.31	79.97	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	316.79	313.94	301.99	283.74	265.83	249.06	238.73	244.83	254.85	273.28	293.82	308.61	(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)	
North	0.9x	0.77	x	1.82	x	10.63	x	0.85	x	0.7	=	7.98	(74)
North	0.9x	0.77	x	0.87	x	10.63	x	0.85	x	0.7	=	3.81	(74)

North	0.9x	0.77	x	1.82	x	20.32	x	0.85	x	0.7	=	15.25	(74)
North	0.9x	0.77	x	0.87	x	20.32	x	0.85	x	0.7	=	7.29	(74)
North	0.9x	0.77	x	1.82	x	34.53	x	0.85	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	0.87	x	34.53	x	0.85	x	0.7	=	12.39	(74)
North	0.9x	0.77	x	1.82	x	55.46	x	0.85	x	0.7	=	41.62	(74)
North	0.9x	0.77	x	0.87	x	55.46	x	0.85	x	0.7	=	19.9	(74)
North	0.9x	0.77	x	1.82	x	74.72	x	0.85	x	0.7	=	56.07	(74)
North	0.9x	0.77	x	0.87	x	74.72	x	0.85	x	0.7	=	26.8	(74)
North	0.9x	0.77	x	1.82	x	79.99	x	0.85	x	0.7	=	60.02	(74)
North	0.9x	0.77	x	0.87	x	79.99	x	0.85	x	0.7	=	28.69	(74)
North	0.9x	0.77	x	1.82	x	74.68	x	0.85	x	0.7	=	56.04	(74)
North	0.9x	0.77	x	0.87	x	74.68	x	0.85	x	0.7	=	26.79	(74)
North	0.9x	0.77	x	1.82	x	59.25	x	0.85	x	0.7	=	44.46	(74)
North	0.9x	0.77	x	0.87	x	59.25	x	0.85	x	0.7	=	21.25	(74)
North	0.9x	0.77	x	1.82	x	41.52	x	0.85	x	0.7	=	31.16	(74)
North	0.9x	0.77	x	0.87	x	41.52	x	0.85	x	0.7	=	14.89	(74)
North	0.9x	0.77	x	1.82	x	24.19	x	0.85	x	0.7	=	18.15	(74)
North	0.9x	0.77	x	0.87	x	24.19	x	0.85	x	0.7	=	8.68	(74)
North	0.9x	0.77	x	1.82	x	13.12	x	0.85	x	0.7	=	9.84	(74)
North	0.9x	0.77	x	0.87	x	13.12	x	0.85	x	0.7	=	4.71	(74)
North	0.9x	0.77	x	1.82	x	8.86	x	0.85	x	0.7	=	6.65	(74)
North	0.9x	0.77	x	0.87	x	8.86	x	0.85	x	0.7	=	3.18	(74)
South	0.9x	0.77	x	9.03	x	46.75	x	0.76	x	0.7	=	155.64	(78)
South	0.9x	0.77	x	9.03	x	76.57	x	0.76	x	0.7	=	254.91	(78)
South	0.9x	0.77	x	9.03	x	97.53	x	0.76	x	0.7	=	324.7	(78)
South	0.9x	0.77	x	9.03	x	110.23	x	0.76	x	0.7	=	366.99	(78)
South	0.9x	0.77	x	9.03	x	114.87	x	0.76	x	0.7	=	382.42	(78)
South	0.9x	0.77	x	9.03	x	110.55	x	0.76	x	0.7	=	368.03	(78)
South	0.9x	0.77	x	9.03	x	108.01	x	0.76	x	0.7	=	359.59	(78)
South	0.9x	0.77	x	9.03	x	104.89	x	0.76	x	0.7	=	349.21	(78)
South	0.9x	0.77	x	9.03	x	101.89	x	0.76	x	0.7	=	339.19	(78)
South	0.9x	0.77	x	9.03	x	82.59	x	0.76	x	0.7	=	274.94	(78)
South	0.9x	0.77	x	9.03	x	55.42	x	0.76	x	0.7	=	184.49	(78)
South	0.9x	0.77	x	9.03	x	40.4	x	0.76	x	0.7	=	134.49	(78)

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

(83)m=	167.44	277.44	363	428.51	465.3	456.75	442.42	414.92	385.24	301.77	199.04	144.32	(83)

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

(84)m=	484.23	591.39	665	712.24	731.13	705.81	681.14	659.76	640.09	575.05	492.86	452.93	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	1	1	0.99	0.99	0.97	0.92	0.83	0.86	0.95	0.99	1	1	(86)

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

(87)m=	18.75	18.95	19.27	19.72	20.16	20.58	20.82	20.79	20.46	19.88	19.25	18.75	(87)

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

(88)m=	19.26	19.27	19.28	19.33	19.34	19.38	19.38	19.39	19.36	19.34	19.32	19.3	(88)

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

(89)m=	1	1	0.99	0.98	0.95	0.85	0.64	0.69	0.9	0.98	1	1	(89)

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

(90)m=	17.29	17.49	17.82	18.3	18.74	19.16	19.33	19.32	19.05	18.46	17.83	17.32	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	18.09	18.29	18.61	19.08	19.52	19.94	20.15	20.13	19.83	19.24	18.61	18.1	(92)

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

(93)m=	18.09	18.29	18.61	19.08	19.52	19.94	20.15	20.13	19.83	19.24	18.61	18.1	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.98	0.95	0.88	0.75	0.78	0.92	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	482.98	588.26	658.13	696.95	695.46	621.84	511.73	516.37	589.56	564.37	490.53	452.03	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2633.88	2543.64	2289.38	1874.09	1432.54	952.89	632.32	661.17	1031.77	1582.17	2130.94	2600.63	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1600.27	1314.02	1213.65	847.54	548.38	0	0	0	0	757.24	1181.1	1598.55	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 9060.75 (98)

Space heating requirement in kWh/m²/year 164.74 (99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community 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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)

Space heating	**kWh/year**
Annual space heating requirement	9060.75

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	10465.17	(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		1875.52	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2166.23	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	126.31	(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		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		428.94	(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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	4197.51	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	65.56	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	4263.07	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				4263.07	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	222.62	(379)
Total CO2, kg/year	sum of (376)…(382) =				4485.69	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				81.56	(384)
EI rating (section 14)					43.08	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 3

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.17	(2a) =	110.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	110.67	(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)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.18	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.18	(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) =	0.92	(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

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

1.17	1.14	1.12	1.01	0.98	0.87	0.87	0.85	0.92	0.98	1.03	1.08

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=	1.17	1.14	1.12	1.01	0.98	0.88	0.88	0.86	0.92	0.98	1.03	1.08	(24d)

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

(25)m=	1.17	1.14	1.12	1.01	0.98	0.88	0.88	0.86	0.92	0.98	1.03	1.08	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			9.03	x1/[1/(1.6)+ 0.04]		=	13.58			(27)
Windows Type 2			2.89	x1/[1/(4.8)+ 0.04]		=	11.64			(27)
Floor			51	x	0.99	=	50.49			(28)
Walls Type1	16.14	9.03	7.11	x	2.1	=	14.93			(29)
Walls Type2	16.1	4.79	11.31	x	2.1	=	23.75			(29)
Total area of elements, m²			83.24							(31)
Party wall			33.3	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	117.05	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: High	450	(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		12.8	(36)

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

Total fabric heat loss	(33) + (36) =	129.85	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.61	41.77	40.94	36.76	35.93	32.06	32.06	31.34	33.55	35.93	37.6	39.27	(38)

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

(39)m=	172.46	171.62	170.79	166.61	165.78	161.91	161.91	161.19	163.4	165.78	167.44	169.12

Average = Sum(39)$_{1…12}$ /12= 166.5 (39)

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

(40)m=	3.38	3.37	3.35	3.27	3.25	3.17	3.17	3.16	3.2	3.25	3.28	3.32

Average = Sum(40)$_{1…12}$ /12= 3.26 (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 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	
										Total = Sum(44)$_{1…12}$ =		900.48	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55	
										Total = Sum(45)$_{1…12}$ =		1180.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

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

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

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

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

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

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)

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

(67)m=	22.71	20.17	16.4	12.42	9.28	7.84	8.47	11.01	14.77	18.76	21.89	23.34	(67)

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

(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)

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

(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)

Water heating gains (Table 5)

(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)

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

(73)m=	301.05	298.33	287.05	269.83	252.99	237.17	227.39	233.25	242.66	260.05	279.44	293.35	(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	2.89	x	10.63	x	0.85	x	0.7	=	12.67	(74)
North	0.9x	0.77	x	2.89	x	20.32	x	0.85	x	0.7	=	24.22	(74)
North	0.9x	0.77	x	2.89	x	34.53	x	0.85	x	0.7	=	41.15	(74)
North	0.9x	0.77	x	2.89	x	55.46	x	0.85	x	0.7	=	66.09	(74)
North	0.9x	0.77	x	2.89	x	74.72	x	0.85	x	0.7	=	89.03	(74)

North	0.9x	0.77	x	2.89	x	79.99	x	0.85	x	0.7	=	95.31	(74)
North	0.9x	0.77	x	2.89	x	74.68	x	0.85	x	0.7	=	88.99	(74)
North	0.9x	0.77	x	2.89	x	59.25	x	0.85	x	0.7	=	70.6	(74)
North	0.9x	0.77	x	2.89	x	41.52	x	0.85	x	0.7	=	49.47	(74)
North	0.9x	0.77	x	2.89	x	24.19	x	0.85	x	0.7	=	28.83	(74)
North	0.9x	0.77	x	2.89	x	13.12	x	0.85	x	0.7	=	15.63	(74)
North	0.9x	0.77	x	2.89	x	8.86	x	0.85	x	0.7	=	10.56	(74)
South	0.9x	0.77	x	9.03	x	46.75	x	0.76	x	0.7	=	155.64	(78)
South	0.9x	0.77	x	9.03	x	76.57	x	0.76	x	0.7	=	254.91	(78)
South	0.9x	0.77	x	9.03	x	97.53	x	0.76	x	0.7	=	324.7	(78)
South	0.9x	0.77	x	9.03	x	110.23	x	0.76	x	0.7	=	366.99	(78)
South	0.9x	0.77	x	9.03	x	114.87	x	0.76	x	0.7	=	382.42	(78)
South	0.9x	0.77	x	9.03	x	110.55	x	0.76	x	0.7	=	368.03	(78)
South	0.9x	0.77	x	9.03	x	108.01	x	0.76	x	0.7	=	359.59	(78)
South	0.9x	0.77	x	9.03	x	104.89	x	0.76	x	0.7	=	349.21	(78)
South	0.9x	0.77	x	9.03	x	101.89	x	0.76	x	0.7	=	339.19	(78)
South	0.9x	0.77	x	9.03	x	82.59	x	0.76	x	0.7	=	274.94	(78)
South	0.9x	0.77	x	9.03	x	55.42	x	0.76	x	0.7	=	184.49	(78)
South	0.9x	0.77	x	9.03	x	40.4	x	0.76	x	0.7	=	134.49	(78)

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

(83)m=	168.32	279.12	365.85	433.08	471.46	463.34	448.58	419.81	388.67	303.76	200.12	145.05	(83)

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

(84)m=	469.37	577.45	652.9	702.91	724.45	700.52	675.97	653.06	631.33	563.82	479.56	438.4	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.96	0.91	0.8	0.83	0.94	0.99	1	1	(86)

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

(87)m=	18.82	19.02	19.34	19.79	20.23	20.63	20.84	20.82	20.51	19.93	19.31	18.82	(87)

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

(88)m=	19.31	19.32	19.33	19.37	19.37	19.41	19.41	19.42	19.4	19.37	19.36	19.34	(88)

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

(89)m=	1	1	0.99	0.98	0.94	0.82	0.61	0.66	0.89	0.98	1	1	(89)

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

(90)m=	17.39	17.6	17.93	18.4	18.83	19.23	19.37	19.37	19.12	18.55	17.92	17.41	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	18.19	18.39	18.71	19.17	19.61	20.01	20.19	20.17	19.89	19.32	18.7	18.19	(92)

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

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(93)m=	18.19	18.39	18.71	19.17	19.61	20.01	20.19	20.17	19.89	19.32	18.7	18.19	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.94	0.86	0.72	0.76	0.91	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	468.03	573.98	645.06	685.03	682.48	603.48	487.47	493.33	573.38	551.64	476.99	437.44	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2394.85	2314.88	2085.85	1711.55	1310.84	875.22	581.23	607.94	946.16	1445.15	1941.59	2366.26	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1433.55	1169.89	1071.95	739.1	467.5	0	0	0	0	664.77	1054.51	1435.04	

	Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ =	8036.31	(98)
Space heating requirement in kWh/m²/year		157.57	(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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		8036.31	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	9281.94	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2115.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	113.97	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				401.03	(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			65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	3787.42	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	59.15	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	3846.57	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			3846.57	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	208.13	(379)
Total CO2, kg/year	sum of (376)…(382) =			4054.71	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			79.5	(384)
EI rating (section 14)				45.56	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 4

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.18	(2a) =	111.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		111.18	(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) =	0.18	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.18	(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) =	1	(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

1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18

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=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	(24d)

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

(25)m=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			9.03	x1/[1/(1.6)+ 0.04]		=	13.58			(27)
Windows Type 2			0.39	x1/[1/(4.8)+ 0.04]		=	1.57			(27)
Floor			51	x	0.97	=	49.47			(28)
Walls Type1	39.2	0.39	38.81	x	2.1	=	81.5			(29)
Walls Type2	10.99	10.93	0.06	x	2.1	=	0.13			(29)
Total area of elements, m²			101.19							(31)
Party wall			16.1	x	0	=	0			(32)

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 148.91 (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: High 450 (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 15.2 (36)

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

Total fabric heat loss (33) + (36) = 164.11 (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=	46.91	45.99	45.08	40.48	39.56	35	35	34.13	36.8	39.56	41.4	43.24	(38)

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

(39)m=	211.02	210.1	209.18	204.58	203.66	199.1	199.1	198.24	200.9	203.66	205.5	207.34	

Average = $Sum(39)_{1...12}$ /12= 204.37 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	4.14	4.12	4.1	4.01	3.99	3.9	3.9	3.89	3.94	3.99	4.03	4.07	

Average = Sum(40)$_{1…12}$ /12= 4.01 (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 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	

Total = Sum(44)$_{1…12}$ = 900.48 (44)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55	

Total = Sum(45)$_{1…12}$ = 1180.67 (45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

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

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

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

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.08	20.5	16.67	12.62	9.44	7.97	8.61	11.19	15.02	19.07	22.26	23.72	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)
Water heating gains (Table 5)													
(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	301.43	298.67	287.32	270.04	253.14	237.3	227.53	233.43	242.91	260.36	279.8	293.73	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.39	x	10.63	x	0.85	x	0.7	=	1.71	(74)
North	0.9x	0.77	x	0.39	x	20.32	x	0.85	x	0.7	=	3.27	(74)
North	0.9x	0.77	x	0.39	x	34.53	x	0.85	x	0.7	=	5.55	(74)
North	0.9x	0.77	x	0.39	x	55.46	x	0.85	x	0.7	=	8.92	(74)
North	0.9x	0.77	x	0.39	x	74.72	x	0.85	x	0.7	=	12.02	(74)

North	0.9x	0.77	x	0.39	x	79.99	x	0.85	x	0.7	=	12.86	(74)
North	0.9x	0.77	x	0.39	x	74.68	x	0.85	x	0.7	=	12.01	(74)
North	0.9x	0.77	x	0.39	x	59.25	x	0.85	x	0.7	=	9.53	(74)
North	0.9x	0.77	x	0.39	x	41.52	x	0.85	x	0.7	=	6.68	(74)
North	0.9x	0.77	x	0.39	x	24.19	x	0.85	x	0.7	=	3.89	(74)
North	0.9x	0.77	x	0.39	x	13.12	x	0.85	x	0.7	=	2.11	(74)
North	0.9x	0.77	x	0.39	x	8.86	x	0.85	x	0.7	=	1.43	(74)
South	0.9x	0.77	x	9.03	x	46.75	x	0.76	x	0.7	=	155.64	(78)
South	0.9x	0.77	x	9.03	x	76.57	x	0.76	x	0.7	=	254.91	(78)
South	0.9x	0.77	x	9.03	x	97.53	x	0.76	x	0.7	=	324.7	(78)
South	0.9x	0.77	x	9.03	x	110.23	x	0.76	x	0.7	=	366.99	(78)
South	0.9x	0.77	x	9.03	x	114.87	x	0.76	x	0.7	=	382.42	(78)
South	0.9x	0.77	x	9.03	x	110.55	x	0.76	x	0.7	=	368.03	(78)
South	0.9x	0.77	x	9.03	x	108.01	x	0.76	x	0.7	=	359.59	(78)
South	0.9x	0.77	x	9.03	x	104.89	x	0.76	x	0.7	=	349.21	(78)
South	0.9x	0.77	x	9.03	x	101.89	x	0.76	x	0.7	=	339.19	(78)
South	0.9x	0.77	x	9.03	x	82.59	x	0.76	x	0.7	=	274.94	(78)
South	0.9x	0.77	x	9.03	x	55.42	x	0.76	x	0.7	=	184.49	(78)
South	0.9x	0.77	x	9.03	x	40.4	x	0.76	x	0.7	=	134.49	(78)

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

(83)m=	157.35	258.17	330.26	375.91	394.44	380.89	371.6	358.74	345.87	278.83	186.6	135.92	(83)

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

(84)m=	458.78	556.84	617.58	645.94	647.58	618.2	599.13	592.17	588.78	539.19	466.4	429.65	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.99	0.98	0.94	0.88	0.89	0.96	0.99	1	1	(86)

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

(87)m=	18.41	18.6	18.95	19.43	19.92	20.4	20.7	20.67	20.29	19.64	18.96	18.4	(87)

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

(88)m=	18.93	18.94	18.95	18.99	19	19.05	19.05	19.06	19.03	19	18.99	18.97	(88)

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

(89)m=	1	0.99	0.99	0.98	0.96	0.87	0.68	0.71	0.91	0.98	0.99	1	(89)

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

(90)m=	16.71	16.91	17.26	17.77	18.26	18.75	18.98	18.97	18.64	17.99	17.3	16.73	(90)

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

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

(92)m=	17.51	17.71	18.06	18.55	19.04	19.53	19.79	19.77	19.42	18.77	18.08	17.52	(92)

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

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(93)m=	17.51	17.71	18.06	18.55	19.04	19.53	19.79	19.77	19.42	18.77	18.08	17.52	(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=	1	0.99	0.99	0.98	0.96	0.9	0.78	0.8	0.92	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457.11	553.06	610.21	631.85	618.93	555.19	467.2	475.12	543.64	527.84	463.46	428.4	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2787.46	2691.51	2417.34	1975.04	1495.61	981.87	635.17	668.14	1068.9	1664.17	2256.73	2761.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1733.78	1437.04	1344.51	967.1	652.25	0	0	0	0	845.43	1291.15	1735.6	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 10006.86 (98)

Space heating requirement in kWh/m²/year 196.21 (99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community 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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		10006.86	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	11557.93	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2115.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	136.73	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		407.66	(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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	4543.75	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	70.96	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	4614.71	(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) =				4614.71	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	211.57	(379)
Total CO2, kg/year	sum of (376)…(382) =				4826.29	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				94.63	(384)
EI rating (section 14)					38.37	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 5

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	128	(1a) x	4.08	(2a) =	522.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	128	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	522.24	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.06	(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			20	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			1.06	(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) =	0.9	(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

1.15	1.12	1.1	0.99	0.97	0.85	0.85	0.83	0.9	0.97	1.01	1.06

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=	1.15	1.12	1.1	0.99	0.97	0.86	0.86	0.85	0.9	0.97	1.01	1.06	(24d)

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

(25)m=	1.15	1.12	1.1	0.99	0.97	0.86	0.86	0.85	0.9	0.97	1.01	1.06	(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 Type 1			2.8	x	1.4	=	3.92			(26)
Doors Type 2			1.5	x	1.4	=	2.1			(26)
Windows Type 1			17.35	x1/[1/(4.8)+ 0.04]		=	69.87			(27)
Windows Type 2			2.48	x1/[1/(1.6)+ 0.04]		=	3.73			(27)
Windows Type 3			1.5	x1/[1/(4.8)+ 0.04]		=	6.04			(27)
Floor			128	x	0.79	=	101.12			(28)
Walls Type1	74.26	18.85	55.41	x	2.1	=	116.36			(29)
Walls Type2	46.4	5.28	41.12	x	0.28	=	11.51			(29)
Walls Type3	71.16	1.5	69.66	x	2.1	=	146.29			(29)
Walls Type4	5.34	0	5.34	x	0.3	=	1.6			(29)
Roof	17	0	17	x	0.1	=	1.7			(30)
Total area of elements, m²			342.16							(31)
Party wall			22.1	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 464.24 (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: High 450 (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 52 (36)

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

Total fabric heat loss (33) + (36) = 516.24 (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=	197.5	193.63	189.76	170.4	166.62	149	149	145.73	155.79	166.62	174.27	182.01	(38)

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

(39)m=	713.74	709.87	705.99	686.64	682.86	665.24	665.24	661.97	672.02	682.86	690.5	698.25	

Average = Sum(39)1…12 /12= 686.26 (39)

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

(40)m=	5.58	5.55	5.52	5.36	5.33	5.2	5.2	5.17	5.25	5.33	5.39	5.46

Average = Sum(40)1…12 /12= 5.36 (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 2.89 (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) + 36 102.83 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	113.11	109	104.88	100.77	96.66	92.55	92.55	96.66	100.77	104.88	109	113.11

Total = Sum(44)1…12 = 1233.94 (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=	167.74	146.71	151.39	131.98	126.64	109.28	101.27	116.2	117.59	137.04	149.59	162.45

Total = Sum(45)1…12 = 1617.89 (45)

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

(46)m=	25.16	22.01	22.71	19.8	19	16.39	15.19	17.43	17.64	20.56	22.44	24.37	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	223.02	196.63	206.67	185.48	181.92	162.78	156.54	171.48	171.09	192.32	203.09	217.72	(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=	223.02	196.63	206.67	185.48	181.92	162.78	156.54	171.48	171.09	192.32	203.09	217.72	

Output from water heater (annual)$_{1\ldots12}$ | 2268.73 | (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=	74.38	65.59	68.95	61.89	60.72	54.35	52.28	57.25	57.11	64.18	67.75	72.62	(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=	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	(66)

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

(67)m=	45.52	40.43	32.88	24.89	18.61	15.71	16.97	22.06	29.61	37.6	43.88	46.78	(67)

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

(68)m=	295.29	298.36	290.64	274.2	253.45	233.94	220.91	217.85	225.57	242.01	262.76	282.26	(68)

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

(69)m=	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	(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=	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	(71)

Water heating gains (Table 5)

(72)m=	99.98	97.6	92.67	85.96	81.61	75.48	70.27	76.95	79.32	86.26	94.1	97.61	(72)

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

(73)m=	507.13	502.73	482.53	451.4	420.01	391.48	374.5	383.2	400.85	432.21	467.08	493	(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	2.48	x	10.63	x	0.76	x	0.7	=	9.72	(74)
North	0.9x	0.77	x	2.48	x	20.32	x	0.76	x	0.7	=	18.58	(74)
North	0.9x	0.77	x	2.48	x	34.53	x	0.76	x	0.7	=	31.57	(74)
North	0.9x	0.77	x	2.48	x	55.46	x	0.76	x	0.7	=	50.71	(74)
North	0.9x	0.77	x	2.48	x	74.72	x	0.76	x	0.7	=	68.31	(74)
North	0.9x	0.77	x	2.48	x	79.99	x	0.76	x	0.7	=	73.13	(74)
North	0.9x	0.77	x	2.48	x	74.68	x	0.76	x	0.7	=	68.28	(74)
North	0.9x	0.77	x	2.48	x	59.25	x	0.76	x	0.7	=	54.17	(74)
North	0.9x	0.77	x	2.48	x	41.52	x	0.76	x	0.7	=	37.96	(74)
North	0.9x	0.77	x	2.48	x	24.19	x	0.76	x	0.7	=	22.12	(74)
North	0.9x	0.77	x	2.48	x	13.12	x	0.76	x	0.7	=	11.99	(74)
North	0.9x	0.77	x	2.48	x	8.86	x	0.76	x	0.7	=	8.1	(74)
South	0.9x	0.77	x	17.35	x	46.75	x	0.85	x	0.7	=	334.46	(78)
South	0.9x	0.77	x	17.35	x	76.57	x	0.85	x	0.7	=	547.77	(78)
South	0.9x	0.77	x	17.35	x	97.53	x	0.85	x	0.7	=	697.76	(78)
South	0.9x	0.77	x	17.35	x	110.23	x	0.85	x	0.7	=	788.62	(78)
South	0.9x	0.77	x	17.35	x	114.87	x	0.85	x	0.7	=	821.79	(78)
South	0.9x	0.77	x	17.35	x	110.55	x	0.85	x	0.7	=	790.86	(78)
South	0.9x	0.77	x	17.35	x	108.01	x	0.85	x	0.7	=	772.72	(78)
South	0.9x	0.77	x	17.35	x	104.89	x	0.85	x	0.7	=	750.42	(78)
South	0.9x	0.77	x	17.35	x	101.89	x	0.85	x	0.7	=	728.89	(78)
South	0.9x	0.77	x	17.35	x	82.59	x	0.85	x	0.7	=	590.82	(78)
South	0.9x	0.77	x	17.35	x	55.42	x	0.85	x	0.7	=	396.45	(78)
South	0.9x	0.77	x	17.35	x	40.4	x	0.85	x	0.7	=	289.01	(78)
West	0.9x	0.77	x	1.5	x	19.64	x	0.85	x	0.7	=	12.15	(80)
West	0.9x	0.77	x	1.5	x	38.42	x	0.85	x	0.7	=	23.76	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.85	x	0.7	=	39.13	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.85	x	0.7	=	57.08	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.85	x	0.7	=	69.95	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.85	x	0.7	=	71.6	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.85	x	0.7	=	68.17	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.85	x	0.7	=	58.56	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.85	x	0.7	=	45.52	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.85	x	0.7	=	28.2	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.85	x	0.7	=	15.15	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.85	x	0.7	=	9.99	(80)

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

(83)m=	356.33	590.11	768.46	896.41	960.05	935.6	909.17	863.14	812.37	641.13	423.6	307.1	(83)

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

(84)m=	863.47	1092.84	1250.99	1347.8	1380.06	1327.07	1283.67	1246.35	1213.21	1073.34	890.68	800.1	(84)

DER WorkSheet: New dwelling design stage

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.98	0.97	0.93	0.94	0.98	0.99	1	1	(86)

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

(87)m=	17.67	17.88	18.28	18.87	19.47	20.08	20.46	20.42	19.94	19.15	18.34	17.68	(87)

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

(88)m=	18.21	18.23	18.24	18.32	18.33	18.4	18.4	18.41	18.37	18.33	18.3	18.27	(88)

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

(89)m=	1	1	0.99	0.99	0.97	0.9	0.7	0.75	0.93	0.99	1	1	(89)

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

(90)m=	15.48	15.7	16.11	16.75	17.35	17.99	18.31	18.29	17.84	17.04	16.21	15.53	(90)

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

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

(92)m=	16.27	16.49	16.9	17.51	18.12	18.74	19.09	19.06	18.6	17.8	16.98	16.31	(92)

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

(93)m=	16.27	16.49	16.9	17.51	18.12	18.74	19.09	19.06	18.6	17.8	16.98	16.31	(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	0.99	0.98	0.96	0.92	0.81	0.83	0.94	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	860.91	1086.77	1238.76	1323.83	1330.27	1216.5	1035.48	1038.91	1142	1056.28	886.33	798.23	(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=	8546.27	8226.8	7339.05	5913.9	4382.29	2756.23	1653.59	1759.51	3021.12	4917.46	6823.99	8453.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	5717.9	4798.1	4538.62	3304.85	2270.7	0	0	0	0	2872.72	4275.12	5695.88	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 33473.89 | (98)

Space heating requirement in kWh/m²/year | 261.51 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301)

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

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

Fraction of heat from Community boilers | 1 | (303a)

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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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		33473.89	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	38662.34	(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		2268.73	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2620.38	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	412.83	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		803.82	(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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	13718.57	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	214.26	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	13932.82	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				13932.82	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	417.18	(379)
Total CO2, kg/year	sum of (376)…(382) =				14350.01	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				112.11	(384)
EI rating (section 14)					17.71	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	247	(1a) x	4.09	(2a) =	1010.23	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	247	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1010.23	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.04	(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		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.04	(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) =	0.96	(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

1.23	1.2	1.18	1.06	1.03	0.91	0.91	0.89	0.96	1.03	1.08	1.13

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=	1.23	1.2	1.18	1.06	1.03	0.92	0.92	0.9	0.96	1.03	1.08	1.13	(24d)

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

(25)m=	1.23	1.2	1.18	1.06	1.03	0.92	0.92	0.9	0.96	1.03	1.08	1.13	(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 Type 1			13.1	x	3	=	39.3			(26)
Doors Type 2			13.1	x	3	=	39.3			(26)
Doors Type 3			13.1	x	3	=	39.3			(26)
Doors Type 4			2.5	x	1.4	=	3.5			(26)
Windows Type 1			17.22	x1/[1/(4.8)+ 0.04]		=	69.34			(27)
Windows Type 2			0.6	x1/[1/(4.8)+ 0.04]		=	2.42			(27)
Windows Type 3			6	x1/[1/(4.8)+ 0.04]		=	24.16			(27)
Walls Type1	102.6	63.12	39.48	x	2.1	=	82.91			(29)
Walls Type2	54.8	0	54.8	x	0.28	=	15.34			(29)
Walls Type3	43.56	2.5	41.06	x	2.1	=	86.23			(29)
Walls Type4	15.05	0	15.05	x	0.3	=	4.52			(29)
Roof	85.21	0	85.21	x	2.3	=	195.98			(30)
Total area of elements, m²			301.22							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 602.3 (33)

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

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: High 450 (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 46.4 (36)

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

Total fabric heat loss (33) + (36) = 648.7 (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=	408.74	400.73	392.71	352.64	344.63	305.8	305.8	298.57	320.83	344.63	360.66	376.68	(38)

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

(39)m=	1057.44	1049.42	1041.41	1001.34	993.32	954.49	954.49	947.27	969.52	993.32	1009.35	1025.38	

Average = Sum(39)$_{1...12}$ /12= 999.73 (39)

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

(40)m=	4.28	4.25	4.22	4.05	4.02	3.86	3.86	3.84	3.93	4.02	4.09	4.15

Average = Sum(40)$_{1...12}$ /12= 4.05 (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 3.06 (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) + 36 106.95 (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=	117.64	113.36	109.09	104.81	100.53	96.25	96.25	100.53	104.81	109.09	113.36	117.64

Total = Sum(44)$_{1...12}$ = 1283.36 (44)

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

(45)m=	174.46	152.58	157.45	137.27	131.71	113.66	105.32	120.86	122.3	142.53	155.58	168.95

Total = Sum(45)$_{1...12}$ = 1682.69 (45)

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

(46)m=	26.17	22.89	23.62	20.59	19.76	17.05	15.8	18.13	18.35	21.38	23.34	25.34	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	229.74	202.51	212.73	190.76	186.99	167.15	160.6	176.14	175.8	197.81	209.08	224.23	(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=	229.74	202.51	212.73	190.76	186.99	167.15	160.6	176.14	175.8	197.81	209.08	224.23

Output from water heater (annual)$_{1...12}$ 2333.53 (64)

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

(65)m=	76.62	67.54	70.96	63.65	62.4	55.8	53.63	58.8	58.68	66	69.74	74.79	(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=	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	(66)

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

(67)m=	71.16	63.21	51.4	38.92	29.09	24.56	26.54	34.49	46.3	58.78	68.61	73.14	(67)

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

(68)m=	413.78	418.07	407.25	384.21	355.14	327.81	309.55	305.26	316.08	339.11	368.19	395.52	(68)

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

(69)m=	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	(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=	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	(71)

Water heating gains (Table 5)

(72)m=	102.98	100.51	95.38	88.41	83.88	77.5	72.08	79.03	81.49	88.71	96.86	100.52	(72)

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

(73)m=	656.86	650.73	622.98	580.48	537.05	498.82	477.12	487.72	512.81	555.55	602.61	638.13	(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	0.6	x	10.63	x	0.85	x	0.7	=	2.63	(74)
North	0.9x	0.77	x	0.6	x	20.32	x	0.85	x	0.7	=	5.03	(74)
North	0.9x	0.77	x	0.6	x	34.53	x	0.85	x	0.7	=	8.54	(74)
North	0.9x	0.77	x	0.6	x	55.46	x	0.85	x	0.7	=	13.72	(74)
North	0.9x	0.77	x	0.6	x	74.72	x	0.85	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	0.6	x	79.99	x	0.85	x	0.7	=	19.79	(74)
North	0.9x	0.77	x	0.6	x	74.68	x	0.85	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	0.6	x	59.25	x	0.85	x	0.7	=	14.66	(74)
North	0.9x	0.77	x	0.6	x	41.52	x	0.85	x	0.7	=	10.27	(74)
North	0.9x	0.77	x	0.6	x	24.19	x	0.85	x	0.7	=	5.98	(74)
North	0.9x	0.77	x	0.6	x	13.12	x	0.85	x	0.7	=	3.25	(74)
North	0.9x	0.77	x	0.6	x	8.86	x	0.85	x	0.7	=	2.19	(74)
East	0.9x	1	x	17.22	x	19.64	x	0.85	x	0.7	=	139.45	(76)
East	0.9x	1	x	17.22	x	38.42	x	0.85	x	0.7	=	272.8	(76)
East	0.9x	1	x	17.22	x	63.27	x	0.85	x	0.7	=	449.27	(76)
East	0.9x	1	x	17.22	x	92.28	x	0.85	x	0.7	=	655.23	(76)
East	0.9x	1	x	17.22	x	113.09	x	0.85	x	0.7	=	803	(76)
East	0.9x	1	x	17.22	x	115.77	x	0.85	x	0.7	=	822.02	(76)
East	0.9x	1	x	17.22	x	110.22	x	0.85	x	0.7	=	782.59	(76)
East	0.9x	1	x	17.22	x	94.68	x	0.85	x	0.7	=	672.24	(76)
East	0.9x	1	x	17.22	x	73.59	x	0.85	x	0.7	=	522.51	(76)
East	0.9x	1	x	17.22	x	45.59	x	0.85	x	0.7	=	323.7	(76)
East	0.9x	1	x	17.22	x	24.49	x	0.85	x	0.7	=	173.88	(76)
East	0.9x	1	x	17.22	x	16.15	x	0.85	x	0.7	=	114.68	(76)
West	0.9x	0.77	x	6	x	19.64	x	0.85	x	0.7	=	48.59	(80)
West	0.9x	0.77	x	6	x	38.42	x	0.85	x	0.7	=	95.05	(80)
West	0.9x	0.77	x	6	x	63.27	x	0.85	x	0.7	=	156.54	(80)
West	0.9x	0.77	x	6	x	92.28	x	0.85	x	0.7	=	228.3	(80)
West	0.9x	0.77	x	6	x	113.09	x	0.85	x	0.7	=	279.79	(80)
West	0.9x	0.77	x	6	x	115.77	x	0.85	x	0.7	=	286.42	(80)
West	0.9x	0.77	x	6	x	110.22	x	0.85	x	0.7	=	272.68	(80)
West	0.9x	0.77	x	6	x	94.68	x	0.85	x	0.7	=	234.23	(80)
West	0.9x	0.77	x	6	x	73.59	x	0.85	x	0.7	=	182.06	(80)
West	0.9x	0.77	x	6	x	45.59	x	0.85	x	0.7	=	112.79	(80)
West	0.9x	0.77	x	6	x	24.49	x	0.85	x	0.7	=	60.59	(80)
West	0.9x	0.77	x	6	x	16.15	x	0.85	x	0.7	=	39.96	(80)

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

(83)m=	190.67	372.88	614.35	897.25	1101.28	1128.22	1073.75	921.12	714.85	442.47	237.71	156.83	(83)

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

(84)m=	847.54	1023.61	1237.32	1477.73	1638.33	1627.04	1550.87	1408.85	1227.66	998.03	840.32	794.96	(84)

DER WorkSheet: New dwelling design stage

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	1	1	0.99	0.97	0.98	1	1	1	1	(86)

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

(87)m=	18.1	18.25	18.59	19.13	19.66	20.2	20.52	20.47	20.03	19.35	18.69	18.13	(87)

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

(88)m=	18.86	18.88	18.89	18.97	18.99	19.07	19.07	19.08	19.04	18.99	18.96	18.92	(88)

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

(89)m=	1	1	1	1	0.99	0.97	0.89	0.93	0.99	1	1	1	(89)

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

(90)m=	16.35	16.51	16.87	17.46	18	18.59	18.89	18.86	18.4	17.7	17	16.43	(90)

fLA = Living area ÷ (4) = | 0.55 | (91)

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

(92)m=	17.3	17.46	17.81	18.37	18.91	19.47	19.78	19.74	19.29	18.6	17.92	17.36	(92)

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

(93)m=	17.3	17.46	17.81	18.37	18.91	19.47	19.78	19.74	19.29	18.6	17.92	17.36	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	1	1	0.99	0.98	0.94	0.96	0.99	1	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	847.32	1023.12	1235.97	1473.47	1624.68	1587.98	1453.96	1346.66	1216.3	996.54	840	794.81	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	13751.53	13185.49	11779.18	9483.44	7157.6	4644.93	3036.91	3162.42	5032.37	7948.12	10924.76	13494.1	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	9600.73	8173.11	7844.15	5767.18	4116.49	0	0	0	0	5171.97	7261.03	9448.27	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 57382.93 | (98)

Space heating requirement in kWh/m²/year | 232.32 | (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)

DER WorkSheet: New dwelling design stage

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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		57382.93	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	66277.28	(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		2333.53	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2695.23	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	689.73	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		1256.76	(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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	22920.1	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	357.97	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	23278.06	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				23278.06	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	652.26	(379)
Total CO2, kg/year	sum of (376)…(382) =				23930.32	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				96.88	(384)
EI rating (section 14)					18.21	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 7

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	82	(1a) x	3.05	(2a) =	250.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	250.1	(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) =	0.08	(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		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.08	(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) =	0.92	(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

1.17	1.15	1.12	1.01	0.99	0.87	0.87	0.85	0.92	0.99	1.03	1.08

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=	1.17	1.15	1.12	1.01	0.99	0.88	0.88	0.86	0.92	0.99	1.03	1.08	(24d)

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

(25)m=	1.17	1.15	1.12	1.01	0.99	0.88	0.88	0.86	0.92	0.99	1.03	1.08	(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 Type 1			1.8	x	3	=	5.4			(26)
Doors Type 2			1.6	x	1.4	=	2.24			(26)
Windows Type 1			5.56	x1/[1/(4.8)+ 0.04]		=	22.39			(27)
Windows Type 2			4	x1/[1/(4.8)+ 0.04]		=	16.11			(27)
Windows Type 3			1.21	x1/[1/(4.8)+ 0.04]		=	4.87			(27)
Floor			82	x	1.25	=	102.5			(28)
Walls Type1	79.85	12.57	67.28	x	2.1	=	141.29			(29)
Walls Type2	20.23	1.6	18.63	x	2.1	=	39.12			(29)
Roof	19.77	0	19.77	x	2.3	=	45.47			(30)
Total area of elements, m²			201.85							(31)
Party wall			16.8	x	0	=	0			(32)
Party wall			5.8	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 379.39 (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: High 450 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 18.4 (36)

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

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Total fabric heat loss	(33) + (36) =	397.79	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	96.6	94.7	92.81	83.34	81.45	72.65	72.65	71.02	76.04	81.45	85.23	89.02	(38)

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

(39)m=	494.39	492.49	490.6	481.13	479.24	470.44	470.44	468.81	473.83	479.24	483.02	486.81	

Average = Sum(39)$_{1…12}$ /12= 480.87 (39)

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

(40)m=	6.03	6.01	5.98	5.87	5.84	5.74	5.74	5.72	5.78	5.84	5.89	5.94	

Average = Sum(40)$_{1…12}$ /12= 5.86 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.5 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.57 (43)

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

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

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

(44)m=	102.93	99.18	95.44	91.7	87.95	84.21	84.21	87.95	91.7	95.44	99.18	102.93	

Total = Sum(44)$_{1…12}$ = 1122.82 (44)

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

(45)m=	152.63	133.5	137.76	120.1	115.24	99.44	92.15	105.74	107	124.7	136.12	147.82	

Total = Sum(45)$_{1…12}$ = 1472.19 (45)

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

(46)m=	22.9	20.02	20.66	18.01	17.29	14.92	13.82	15.86	16.05	18.71	20.42	22.17	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	207.91	183.42	193.03	173.59	170.51	152.93	147.42	161.02	160.5	179.98	189.61	203.1	(62)

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

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

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

Output from water heater

(64)m=	207.91	183.42	193.03	173.59	170.51	152.93	147.42	161.02	160.5	179.98	189.61	203.1

Output from water heater (annual)1…12 — 2123.03 (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=	69.36	61.2	64.41	57.94	56.93	51.07	49.25	53.77	53.59	60.07	63.27	67.76	(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=	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	(66)

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

(67)m=	35.93	31.91	25.95	19.65	14.69	12.4	13.4	17.42	23.38	29.68	34.64	36.93	(67)

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

(68)m=	223.57	225.89	220.04	207.6	191.89	177.12	167.26	164.94	170.78	183.23	198.94	213.71	(68)

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

(69)m=	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	(71)

Water heating gains (Table 5)

(72)m=	93.23	91.07	86.58	80.48	76.51	70.94	66.19	72.27	74.43	80.74	87.87	91.07	(72)

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

(73)m=	413.22	409.37	393.07	368.22	343.58	320.95	307.35	315.12	329.08	354.15	381.95	402.21	(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	4	x	10.63	x	0.85	x	0.7	=	17.54	(74)
North	0.9x	0.77	x	4	x	20.32	x	0.85	x	0.7	=	33.52	(74)
North	0.9x	0.77	x	4	x	34.53	x	0.85	x	0.7	=	56.95	(74)
North	0.9x	0.77	x	4	x	55.46	x	0.85	x	0.7	=	91.48	(74)
North	0.9x	0.77	x	4	x	74.72	x	0.85	x	0.7	=	123.23	(74)
North	0.9x	0.77	x	4	x	79.99	x	0.85	x	0.7	=	131.92	(74)
North	0.9x	0.77	x	4	x	74.68	x	0.85	x	0.7	=	123.17	(74)
North	0.9x	0.77	x	4	x	59.25	x	0.85	x	0.7	=	97.72	(74)
North	0.9x	0.77	x	4	x	41.52	x	0.85	x	0.7	=	68.47	(74)
North	0.9x	0.77	x	4	x	24.19	x	0.85	x	0.7	=	39.9	(74)
North	0.9x	0.77	x	4	x	13.12	x	0.85	x	0.7	=	21.64	(74)
North	0.9x	0.77	x	4	x	8.86	x	0.85	x	0.7	=	14.62	(74)
East	0.9x	1	x	5.56	x	19.64	x	0.85	x	0.7	=	45.03	(76)
East	0.9x	1	x	5.56	x	38.42	x	0.85	x	0.7	=	88.08	(76)
East	0.9x	1	x	5.56	x	63.27	x	0.85	x	0.7	=	145.06	(76)
East	0.9x	1	x	5.56	x	92.28	x	0.85	x	0.7	=	211.56	(76)
East	0.9x	1	x	5.56	x	113.09	x	0.85	x	0.7	=	259.27	(76)
East	0.9x	1	x	5.56	x	115.77	x	0.85	x	0.7	=	265.41	(76)
East	0.9x	1	x	5.56	x	110.22	x	0.85	x	0.7	=	252.68	(76)
East	0.9x	1	x	5.56	x	94.68	x	0.85	x	0.7	=	217.05	(76)
East	0.9x	1	x	5.56	x	73.59	x	0.85	x	0.7	=	168.71	(76)
East	0.9x	1	x	5.56	x	45.59	x	0.85	x	0.7	=	104.52	(76)
East	0.9x	1	x	5.56	x	24.49	x	0.85	x	0.7	=	56.14	(76)
East	0.9x	1	x	5.56	x	16.15	x	0.85	x	0.7	=	37.03	(76)
West	0.9x	0.77	x	1.21	x	19.64	x	0.85	x	0.7	=	9.8	(80)
West	0.9x	0.77	x	1.21	x	38.42	x	0.85	x	0.7	=	19.17	(80)
West	0.9x	0.77	x	1.21	x	63.27	x	0.85	x	0.7	=	31.57	(80)
West	0.9x	0.77	x	1.21	x	92.28	x	0.85	x	0.7	=	46.04	(80)
West	0.9x	0.77	x	1.21	x	113.09	x	0.85	x	0.7	=	56.42	(80)
West	0.9x	0.77	x	1.21	x	115.77	x	0.85	x	0.7	=	57.76	(80)
West	0.9x	0.77	x	1.21	x	110.22	x	0.85	x	0.7	=	54.99	(80)
West	0.9x	0.77	x	1.21	x	94.68	x	0.85	x	0.7	=	47.24	(80)
West	0.9x	0.77	x	1.21	x	73.59	x	0.85	x	0.7	=	36.72	(80)
West	0.9x	0.77	x	1.21	x	45.59	x	0.85	x	0.7	=	22.75	(80)
West	0.9x	0.77	x	1.21	x	24.49	x	0.85	x	0.7	=	12.22	(80)
West	0.9x	0.77	x	1.21	x	16.15	x	0.85	x	0.7	=	8.06	(80)

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

(83)m=	72.36	140.77	233.58	349.08	438.93	455.1	430.84	362.01	273.9	167.16	90	59.71	(83)

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

(84)m=	485.59	550.13	626.65	717.3	782.52	776.05	738.19	677.12	602.98	521.31	471.95	461.91	(84)

DER WorkSheet: New dwelling design stage

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.99	0.97	0.95	0.96	0.99	1	1	1	(86)

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

(87)m=	17.47	17.64	18.04	18.65	19.3	19.95	20.36	20.3	19.76	18.94	18.14	17.47	(87)

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

(88)m=	18	18	18.01	18.07	18.08	18.13	18.13	18.14	18.11	18.08	18.05	18.03	(88)

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

(89)m=	1	1	1	0.99	0.97	0.91	0.7	0.77	0.96	0.99	1	1	(89)

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

(90)m=	15.14	15.31	15.72	16.37	17.02	17.69	18.04	18.01	17.5	16.67	15.84	15.16	(90)

fLA = Living area ÷ (4) = | 0.53 | (91)

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

(92)m=	16.38	16.55	16.95	17.58	18.23	18.89	19.27	19.23	18.7	17.88	17.06	16.39	(92)

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

(93)m=	16.38	16.55	16.95	17.58	18.23	18.89	19.27	19.23	18.7	17.88	17.06	16.39	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.97	0.94	0.87	0.9	0.97	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	484.46	548.29	623.05	708.92	762.04	728.53	640.12	606.56	583.86	516.89	470.39	460.99	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	5972.31	5738.37	5128.98	4176.77	3131.71	2019.47	1258.17	1324.54	2180.79	3487.6	4811.71	5934.28	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	4082.96	3487.73	3352.41	2496.85	1763.04	0	0	0	0	2210.21	3125.75	4072.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 24591.08 | (98)

Space heating requirement in kWh/m²/year | 299.89 | (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)

DER WorkSheet: New dwelling design stage

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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)

Space heating		**kWh/year**	
Annual space heating requirement		24591.08	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	28402.69	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating			
Annual water heating requirement		2123.03	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2452.1	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	308.55	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		634.57	(332)

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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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	10253.29	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	160.14	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	10413.42	(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) =				10413.42	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	329.34	(379)
Total CO2, kg/year	sum of (376)…(382) =				10742.76	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				131.01	(384)
EI rating (section 14)					16.91	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 8

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	70	(1a) x	3.5	(2a) =	245	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		245	(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) =	0.08	(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		20	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		1.08	(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) =	1	(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

1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18

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=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	(24d)

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

(25)m=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	(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			1.9	x	3	=	5.7			(26)
Windows Type 1			8.7	x1/[1/(4.8)+ 0.04]		=	35.03			(27)
Windows Type 2			6.5	x1/[1/(4.8)+ 0.04]		=	26.17			(27)
Windows Type 3			2.2	x1/[1/(4.8)+ 0.04]		=	8.86			(27)
Floor			70	x	1.25	=	87.5			(28)
Walls	116.5	19.3	97.2	x	2.1	=	204.12			(29)
Roof	26.7	0	26.7	x	2.3	=	61.41			(30)
Total area of elements, m²			213.2							(31)
Party wall			24.2	x	0	=	0			(32)
Party wall			8.6	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 428.8 (33)

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

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: High 450 (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 84.8 (36)

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

Total fabric heat loss (33) + (36) = 513.6 (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=	103.14	101.11	99.09	88.98	86.96	76.95	76.95	75.05	80.89	86.96	91	95.05	(38)

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

(39)m=	616.73	614.71	612.69	602.58	600.56	590.54	590.54	588.65	594.49	600.56	604.6	608.64

Average = Sum(39)$_{1...12}$ /12= 602.11 (39)

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

(40)m=	8.81	8.78	8.75	8.61	8.58	8.44	8.44	8.41	8.49	8.58	8.64	8.69

Average = Sum(40)$_{1...12}$ /12= 8.6 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.55 (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=	96.3	92.8	89.3	85.79	82.29	78.79	78.79	82.29	85.79	89.3	92.8	96.3

Total = Sum(44)$_{1...12}$ = 1050.55 (44)

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

(45)m=	142.81	124.9	128.89	112.37	107.82	93.04	86.22	98.93	100.12	116.67	127.36	138.3

Total = Sum(45)$_{1...12}$ = 1377.43 (45)

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

(46)m=	21.42	18.74	19.33	16.86	16.17	13.96	12.93	14.84	15.02	17.5	19.1	20.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

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

(62)m=	198.09	174.83	184.17	165.86	163.1	146.53	141.49	154.21	153.61	171.95	180.85	193.58	(62)

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

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

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

Output from water heater

(64)m=	198.09	174.83	184.17	165.86	163.1	146.53	141.49	154.21	153.61	171.95	180.85	193.58

Output from water heater (annual)$_{1...12}$ | 2028.27 | (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=	66.09	58.34	61.47	55.37	54.46	48.95	47.28	51.51	51.3	57.4	60.36	64.6	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	(66)

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

(67)m=	29.9	26.56	21.6	16.35	12.22	10.32	11.15	14.49	19.45	24.7	28.83	30.73	(67)

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

(68)m=	197.3	199.34	194.19	183.2	169.34	156.31	147.6	145.55	150.71	161.7	175.56	188.59	(68)

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

(69)m=	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	(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=	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	(71)

Water heating gains (Table 5)

(72)m=	88.84	86.81	82.61	76.91	73.2	67.98	63.54	69.23	71.25	77.16	83.83	86.82	(72)

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

(73)m=	372.73	369.41	355.09	333.15	311.45	291.3	278.99	285.97	298.11	320.24	344.91	362.84	(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	8.7	x	10.63	x	0.85	x	0.7	=	38.15	(74)
North	0.9x	0.77	x	8.7	x	20.32	x	0.85	x	0.7	=	72.9	(74)

North	0.9x	0.77	x	8.7	x	34.53	x	0.85	x	0.7	=	123.87	(74)
North	0.9x	0.77	x	8.7	x	55.46	x	0.85	x	0.7	=	198.97	(74)
North	0.9x	0.77	x	8.7	x	74.72	x	0.85	x	0.7	=	268.03	(74)
North	0.9x	0.77	x	8.7	x	79.99	x	0.85	x	0.7	=	286.93	(74)
North	0.9x	0.77	x	8.7	x	74.68	x	0.85	x	0.7	=	267.89	(74)
North	0.9x	0.77	x	8.7	x	59.25	x	0.85	x	0.7	=	212.54	(74)
North	0.9x	0.77	x	8.7	x	41.52	x	0.85	x	0.7	=	148.93	(74)
North	0.9x	0.77	x	8.7	x	24.19	x	0.85	x	0.7	=	86.78	(74)
North	0.9x	0.77	x	8.7	x	13.12	x	0.85	x	0.7	=	47.06	(74)
North	0.9x	0.77	x	8.7	x	8.86	x	0.85	x	0.7	=	31.8	(74)
South	0.9x	0.77	x	2.2	x	46.75	x	0.85	x	0.7	=	42.41	(78)
South	0.9x	0.77	x	2.2	x	76.57	x	0.85	x	0.7	=	69.46	(78)
South	0.9x	0.77	x	2.2	x	97.53	x	0.85	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.2	x	110.23	x	0.85	x	0.7	=	100	(78)
South	0.9x	0.77	x	2.2	x	114.87	x	0.85	x	0.7	=	104.2	(78)
South	0.9x	0.77	x	2.2	x	110.55	x	0.85	x	0.7	=	100.28	(78)
South	0.9x	0.77	x	2.2	x	108.01	x	0.85	x	0.7	=	97.98	(78)
South	0.9x	0.77	x	2.2	x	104.89	x	0.85	x	0.7	=	95.15	(78)
South	0.9x	0.77	x	2.2	x	101.89	x	0.85	x	0.7	=	92.42	(78)
South	0.9x	0.77	x	2.2	x	82.59	x	0.85	x	0.7	=	74.92	(78)
South	0.9x	0.77	x	2.2	x	55.42	x	0.85	x	0.7	=	50.27	(78)
South	0.9x	0.77	x	2.2	x	40.4	x	0.85	x	0.7	=	36.65	(78)
West	0.9x	0.77	x	6.5	x	19.64	x	0.85	x	0.7	=	52.64	(80)
West	0.9x	0.77	x	6.5	x	38.42	x	0.85	x	0.7	=	102.97	(80)
West	0.9x	0.77	x	6.5	x	63.27	x	0.85	x	0.7	=	169.58	(80)
West	0.9x	0.77	x	6.5	x	92.28	x	0.85	x	0.7	=	247.33	(80)
West	0.9x	0.77	x	6.5	x	113.09	x	0.85	x	0.7	=	303.11	(80)
West	0.9x	0.77	x	6.5	x	115.77	x	0.85	x	0.7	=	310.29	(80)
West	0.9x	0.77	x	6.5	x	110.22	x	0.85	x	0.7	=	295.4	(80)
West	0.9x	0.77	x	6.5	x	94.68	x	0.85	x	0.7	=	253.75	(80)
West	0.9x	0.77	x	6.5	x	73.59	x	0.85	x	0.7	=	197.23	(80)
West	0.9x	0.77	x	6.5	x	45.59	x	0.85	x	0.7	=	122.19	(80)
West	0.9x	0.77	x	6.5	x	24.49	x	0.85	x	0.7	=	65.64	(80)
West	0.9x	0.77	x	6.5	x	16.15	x	0.85	x	0.7	=	43.29	(80)

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

(83)m=	133.2	245.33	381.93	546.29	675.34	697.5	661.27	561.44	438.59	283.88	162.96	111.73	(83)

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

(84)m=	505.92	614.74	737.02	879.44	986.79	988.8	940.26	847.4	736.69	604.12	507.87	474.57	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	1	1	0.99	0.99	0.97	0.95	0.91	0.93	0.97	0.99	1	1	(86)

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

(87)m=	16.67	16.89	17.38	18.12	18.92	19.71	20.21	20.13	19.47	18.47	17.47	16.66	(87)

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

(88)m=	18	18	18	18	18	18	18	18	18	18	18	18	(88)

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

(89)m=	1	0.99	0.99	0.98	0.95	0.86	0.62	0.7	0.93	0.98	0.99	1	(89)

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

(90)m=	14.49	14.7	15.2	15.93	16.72	17.48	17.89	17.84	17.26	16.27	15.28	14.47	(90)

fLA = Living area ÷ (4) = 0.81 (91)

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

(92)m=	16.25	16.47	16.96	17.7	18.5	19.28	19.77	19.69	19.05	18.05	17.05	16.24	(92)

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

(93)m=	16.25	16.47	16.96	17.7	18.5	19.28	19.77	19.69	19.05	18.05	17.05	16.24	(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	0.99	0.98	0.95	0.91	0.85	0.88	0.95	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	503.35	609.98	727.44	857.98	940.63	902.61	803.57	747.04	700.58	594	504.26	472.49	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	7370.53	7111.39	6410.78	5304.13	4085.3	2766.28	1870.17	1937.31	2942.15	4471.55	6015.4	7326.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	5109.18	4368.95	4228.4	3201.23	2339.63	0	0	0	0	2884.9	3968.03	5099.26	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 31199.58 (98)

Space heating requirement in kWh/m²/year 445.71 (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 1.05 (305)

Distribution loss factor (Table 12c) for community heating system 1.1 (306)

Space heating **kWh/year**

Annual space heating requirement 31199.58

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	36035.51	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2028.27	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2342.65	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	383.78	(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		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		528.07	(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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	12753.36	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	199.18	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	12952.54	(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) =				12952.54	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	274.07	(379)
Total CO2, kg/year	sum of (376)…(382) =				13226.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				188.95	(384)
EI rating (section 14)					4.23	(385)

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User Details:

Assessor Name: 	**Stroma Number:**
Software Name: Stroma FSAP 2012 	**Software Version:** Version: 1.0.3.15

Property Address: Unit 9

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	124	(1a) x	2.37	(2a) =	293.88	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	124	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	293.88	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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) =	0.07	(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		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.07	(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) =	0.99	(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

1.26	1.23	1.21	1.09	1.06	0.94	0.94	0.91	0.99	1.06	1.11	1.16

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=	1.26	1.23	1.21	1.09	1.06	0.94	0.94	0.92	0.99	1.06	1.11	1.16	(24d)

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

(25)m=	1.26	1.23	1.21	1.09	1.06	0.94	0.94	0.92	0.99	1.06	1.11	1.16	(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			1.6	x	1.4	=	2.24			(26)
Windows Type 1			5.49	x1/[1/(4.8)+ 0.04]		=	22.11			(27)
Windows Type 2			4.7	x1/[1/(4.8)+ 0.04]		=	18.93			(27)
Walls Type1	11.85	1.6	10.25	x	2.1	=	21.52			(29)
Walls Type2	122	10.19	111.81	x	1.27	=	142.22			(29)
Roof	68.1	0	68.1	x	2.3	=	156.63			(30)
Total area of elements, m²			201.95							(31)
Party wall			4.8	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 363.65 (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: High 450 (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 30.4 (36)

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

Total fabric heat loss (33) + (36) = 394.05 (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=	122.16	119.76	117.37	105.39	103	91.2	91.2	88.99	95.82	103	107.79	112.58	(38)

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

(39)m=	516.21	513.81	511.42	499.44	497.04	485.25	485.25	483.03	489.86	497.04	501.83	506.62	

Average = Sum(39)$_{1…12}$ /12= 498.9 (39)

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

(40)m=	4.16	4.14	4.12	4.03	4.01	3.91	3.91	3.9	3.95	4.01	4.05	4.09

Average = Sum(40)$_{1...12}$ /12= 4.02 (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 2.88 (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) + 36 102.54 (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=	112.8	108.69	104.59	100.49	96.39	92.29	92.29	96.39	100.49	104.59	108.69	112.8

Total = Sum(44)$_{1...12}$ = 1230.5 (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=	167.27	146.3	150.97	131.62	126.29	108.98	100.98	115.88	117.26	136.66	149.18	161.99

Total = Sum(45)$_{1...12}$ = 1613.38 (45)

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

(46)m=	25.09	21.94	22.64	19.74	18.94	16.35	15.15	17.38	17.59	20.5	22.38	24.3	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	222.55	196.23	206.24	185.11	181.57	162.47	156.26	171.16	170.76	191.94	202.67	217.27	(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=	222.55	196.23	206.24	185.11	181.57	162.47	156.26	171.16	170.76	191.94	202.67	217.27	

Output from water heater (annual)$_{1...12}$ 2264.22 (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=	74.23	65.45	68.81	61.77	60.6	54.24	52.19	57.14	57	64.05	67.61	72.47	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	51.64	45.87	37.3	28.24	21.11	17.82	19.26	25.03	33.6	42.66	49.79	53.08	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	290.33	293.35	285.75	269.59	249.19	230.01	217.2	214.19	221.78	237.95	258.35	277.52	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	(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=	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	(71)
Water heating gains (Table 5)													
(72)m=	99.77	97.4	92.48	85.79	81.45	75.34	70.14	76.8	79.17	86.09	93.9	97.41	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	507.91	502.78	481.7	449.79	417.91	389.34	372.77	382.19	400.71	432.85	468.2	494.17	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.49	x	10.63	x	0.85	x	0.7	=	24.07	(74)
North	0.9x	0.77	x	5.49	x	20.32	x	0.85	x	0.7	=	46	(74)
North	0.9x	0.77	x	5.49	x	34.53	x	0.85	x	0.7	=	78.17	(74)
North	0.9x	0.77	x	5.49	x	55.46	x	0.85	x	0.7	=	125.56	(74)
North	0.9x	0.77	x	5.49	x	74.72	x	0.85	x	0.7	=	169.14	(74)

North	0.9x	0.77	x	5.49	x	79.99	x	0.85	x	0.7	=	181.06	(74)
North	0.9x	0.77	x	5.49	x	74.68	x	0.85	x	0.7	=	169.05	(74)
North	0.9x	0.77	x	5.49	x	59.25	x	0.85	x	0.7	=	134.12	(74)
North	0.9x	0.77	x	5.49	x	41.52	x	0.85	x	0.7	=	93.98	(74)
North	0.9x	0.77	x	5.49	x	24.19	x	0.85	x	0.7	=	54.76	(74)
North	0.9x	0.77	x	5.49	x	13.12	x	0.85	x	0.7	=	29.69	(74)
North	0.9x	0.77	x	5.49	x	8.86	x	0.85	x	0.7	=	20.07	(74)
South	0.9x	0.77	x	4.7	x	46.75	x	0.85	x	0.7	=	90.6	(78)
South	0.9x	0.77	x	4.7	x	76.57	x	0.85	x	0.7	=	148.39	(78)
South	0.9x	0.77	x	4.7	x	97.53	x	0.85	x	0.7	=	189.02	(78)
South	0.9x	0.77	x	4.7	x	110.23	x	0.85	x	0.7	=	213.63	(78)
South	0.9x	0.77	x	4.7	x	114.87	x	0.85	x	0.7	=	222.62	(78)
South	0.9x	0.77	x	4.7	x	110.55	x	0.85	x	0.7	=	214.24	(78)
South	0.9x	0.77	x	4.7	x	108.01	x	0.85	x	0.7	=	209.32	(78)
South	0.9x	0.77	x	4.7	x	104.89	x	0.85	x	0.7	=	203.28	(78)
South	0.9x	0.77	x	4.7	x	101.89	x	0.85	x	0.7	=	197.45	(78)
South	0.9x	0.77	x	4.7	x	82.59	x	0.85	x	0.7	=	160.05	(78)
South	0.9x	0.77	x	4.7	x	55.42	x	0.85	x	0.7	=	107.4	(78)
South	0.9x	0.77	x	4.7	x	40.4	x	0.85	x	0.7	=	78.29	(78)

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

(83)m=	114.68	194.39	267.18	339.19	391.75	395.3	378.37	337.4	291.43	214.81	137.09	98.36	(83)

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

(84)m=	622.58	697.16	748.88	788.98	809.67	784.64	751.14	719.59	692.14	647.66	605.29	592.53	(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	1	1	1	0.99	0.98	0.98	0.99	1	1	1	(86)

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

(87)m=	18.22	18.37	18.68	19.15	19.66	20.17	20.5	20.46	20.05	19.41	18.77	18.23	(87)

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

(88)m=	18.92	18.93	18.94	18.99	19	19.04	19.04	19.05	19.02	19	18.98	18.96	(88)

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

(89)m=	1	1	1	1	0.99	0.97	0.9	0.92	0.99	1	1	1	(89)

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

(90)m=	16.51	16.66	16.98	17.49	18	18.55	18.86	18.83	18.41	17.76	17.1	16.55	(90)

fLA = Living area ÷ (4) = 0.3 (91)

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

(92)m=	17.03	17.18	17.49	17.99	18.5	19.04	19.36	19.32	18.91	18.25	17.6	17.06	(92)

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

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(93)m=	17.03	17.18	17.49	17.99	18.5	19.04	19.36	19.32	18.91	18.25	17.6	17.06	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	1	1	0.99	0.97	0.92	0.94	0.98	1	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	622.1	696.35	747.41	785.94	802.09	763.16	691.52	674.31	681.21	645.35	604.58	592.16	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	6571.1	6307.98	5622.35	4542.03	3380.85	2154.23	1337.63	1412.34	2354.41	3804.33	5270.14	6514.35	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	4426.05	3771.02	3626.95	2704.38	1918.59	0	0	0	0	2350.28	3359.2	4406.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 26562.59 (98)

Space heating requirement in kWh/m²/year 214.21 (99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community 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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		26562.59	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	30679.79	(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		2264.22	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2615.17	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	332.95	(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		0	(330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		911.99	(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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	11064.17	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	172.8	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	11236.97	(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) =				11236.97	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	473.32	(379)
Total CO2, kg/year	sum of (376)…(382) =				11710.3	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				94.44	(384)
EI rating (section 14)					25.14	(385)

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User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 10

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	79	(1a) x	2.6	(2a) =	205.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.4	(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) =	0.1	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *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		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.1	(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) =	1.02	(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

1.29	1.27	1.24	1.12	1.09	0.96	0.96	0.94	1.02	1.09	1.14	1.19

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=	1.29	1.27	1.24	1.12	1.09	0.96	0.96	0.94	1.02	1.09	1.14	1.19	(24d)

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

(25)m=	1.29	1.27	1.24	1.12	1.09	0.96	0.96	0.94	1.02	1.09	1.14	1.19	(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			1.6	x	1.4	=	2.24			(26)
Windows Type 1			3.12	x1/[1/(4.8)+ 0.04]		=	12.56			(27)
Windows Type 2			3.66	x1/[1/(4.8)+ 0.04]		=	14.74			(27)
Walls Type1	89.2	6.78	82.42	x	1.27	=	104.83			(29)
Walls Type2	26.63	1.6	25.03	x	2.1	=	52.56			(29)
Roof	46.5	0	46.5	x	2.3	=	106.95			(30)
Total area of elements, m²			162.33							(31)
Party wall			5.3	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 293.89 (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: High 450 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 24.8 (36)

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

Total fabric heat loss (33) + (36) = 318.69 (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=	87.72	86	84.28	75.68	73.96	65.41	65.41	63.77	68.8	73.96	77.4	80.84	(38)

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

(39)m=	406.41	404.69	402.97	394.37	392.65	384.1	384.1	382.46	387.49	392.65	396.09	399.53	

Average = Sum(39)$_{1…12}$ /12= 393.96 (39)

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

(40)m=	5.14	5.12	5.1	4.99	4.97	4.86	4.86	4.84	4.9	4.97	5.01	5.06

Average = Sum(40)1…12 /12= 4.99 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.24 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.46	97.77	94.08	90.39	86.7	83.01	83.01	86.7	90.39	94.08	97.77	101.46	
											Total = Sum(44)1…12 =	1106.83	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	150.46	131.59	135.79	118.39	113.6	98.02	90.83	104.23	105.48	122.93	134.18	145.71	
											Total = Sum(45)1…12 =	1451.23	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.57	19.74	20.37	17.76	17.04	14.7	13.63	15.64	15.82	18.44	20.13	21.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	205.74	181.52	191.07	171.88	168.87	151.52	146.11	159.51	158.97	178.2	187.68	200.99	(62)

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

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

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

Output from water heater

(64)m=	205.74	181.52	191.07	171.88	168.87	151.52	146.11	159.51	158.97	178.2	187.68	200.99	

Output from water heater (annual)$_{1...12}$ 2102.07 (64)

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

(65)m=	68.64	60.56	63.76	57.37	56.38	50.6	48.81	53.27	53.08	59.48	62.63	67.06	(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=	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	38.31	34.03	27.68	20.95	15.66	13.22	14.29	18.57	24.93	31.65	36.94	39.38	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	217.34	219.59	213.91	201.81	186.54	172.18	162.59	160.34	166.02	178.12	193.39	207.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	(71)
Water heating gains (Table 5)													
(72)m=	92.26	90.13	85.7	79.69	75.78	70.28	65.61	71.6	73.72	79.95	86.98	90.13	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	407.56	403.4	386.94	362.1	337.64	315.34	302.14	310.16	324.33	349.38	376.97	396.92	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.66	x	10.63	x	0.85	x	0.7	=	16.05	(74)
North	0.9x	0.77	x	3.66	x	20.32	x	0.85	x	0.7	=	30.67	(74)
North	0.9x	0.77	x	3.66	x	34.53	x	0.85	x	0.7	=	52.11	(74)
North	0.9x	0.77	x	3.66	x	55.46	x	0.85	x	0.7	=	83.7	(74)
North	0.9x	0.77	x	3.66	x	74.72	x	0.85	x	0.7	=	112.76	(74)

North	0.9x	0.77	x	3.66	x	79.99	x	0.85	x	0.7	=	120.71	(74)
North	0.9x	0.77	x	3.66	x	74.68	x	0.85	x	0.7	=	112.7	(74)
North	0.9x	0.77	x	3.66	x	59.25	x	0.85	x	0.7	=	89.41	(74)
North	0.9x	0.77	x	3.66	x	41.52	x	0.85	x	0.7	=	62.65	(74)
North	0.9x	0.77	x	3.66	x	24.19	x	0.85	x	0.7	=	36.51	(74)
North	0.9x	0.77	x	3.66	x	13.12	x	0.85	x	0.7	=	19.8	(74)
North	0.9x	0.77	x	3.66	x	8.86	x	0.85	x	0.7	=	13.38	(74)
South	0.9x	0.77	x	3.12	x	46.75	x	0.85	x	0.7	=	60.15	(78)
South	0.9x	0.77	x	3.12	x	76.57	x	0.85	x	0.7	=	98.5	(78)
South	0.9x	0.77	x	3.12	x	97.53	x	0.85	x	0.7	=	125.48	(78)
South	0.9x	0.77	x	3.12	x	110.23	x	0.85	x	0.7	=	141.81	(78)
South	0.9x	0.77	x	3.12	x	114.87	x	0.85	x	0.7	=	147.78	(78)
South	0.9x	0.77	x	3.12	x	110.55	x	0.85	x	0.7	=	142.22	(78)
South	0.9x	0.77	x	3.12	x	108.01	x	0.85	x	0.7	=	138.96	(78)
South	0.9x	0.77	x	3.12	x	104.89	x	0.85	x	0.7	=	134.95	(78)
South	0.9x	0.77	x	3.12	x	101.89	x	0.85	x	0.7	=	131.07	(78)
South	0.9x	0.77	x	3.12	x	82.59	x	0.85	x	0.7	=	106.25	(78)
South	0.9x	0.77	x	3.12	x	55.42	x	0.85	x	0.7	=	71.29	(78)
South	0.9x	0.77	x	3.12	x	40.4	x	0.85	x	0.7	=	51.97	(78)

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

(83)m=	76.19	129.17	177.59	225.52	260.54	262.93	251.65	224.36	193.73	142.75	91.09	65.35	(83)

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

(84)m=	483.76	532.57	564.53	587.62	598.17	578.27	553.8	534.52	518.06	492.13	468.06	462.27	(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	1	1	0.99	0.98	0.97	0.97	0.99	1	1	1	(86)

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

(87)m=	17.82	17.98	18.33	18.87	19.44	20.03	20.41	20.36	19.89	19.17	18.44	17.83	(87)

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

(88)m=	18.43	18.44	18.45	18.5	18.51	18.57	18.57	18.58	18.55	18.51	18.49	18.47	(88)

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

(89)m=	1	1	1	0.99	0.99	0.95	0.83	0.87	0.97	0.99	1	1	(89)

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

(90)m=	15.78	15.94	16.3	16.87	17.45	18.07	18.42	18.39	17.92	17.18	16.43	15.81	(90)

fLA = Living area ÷ (4) = | 0.28 | (91)

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

(92)m=	16.34	16.5	16.86	17.42	18	18.61	18.97	18.93	18.47	17.73	16.99	16.37	(92)

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

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(93)m=	16.34	16.5	16.86	17.42	18	18.61	18.97	18.93	18.47	17.73	16.99	16.37	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	1	0.99	0.98	0.96	0.88	0.9	0.97	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	482.74	531.02	562.01	583	587.96	552.27	486.72	481.18	503.12	488.25	466.61	461.44	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	4894.57	4696.37	4175.08	3360.71	2473.16	1539.74	908.64	968.7	1691.43	2798.15	3916.09	4862.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	3282.4	2799.11	2688.12	1999.95	1402.58	0	0	0	0	1718.57	2483.62	3274.32	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 19648.68 (98)

Space heating requirement in kWh/m²/year 248.72 (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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		19648.68	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	22694.22	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2102.07	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2427.89	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	251.22	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				676.65	(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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	8348.27	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	130.38	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	8478.65	(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) =				8478.65	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	351.18	(379)
Total CO2, kg/year	sum of (376)…(382) =				8829.84	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				111.77	(384)
EI rating (section 14)					24.01	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 11

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	1.9	(2a) =	96.9	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	96.9	(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)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.21	(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		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.21	(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) =	1.12	(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

1.42	1.39	1.37	1.23	1.2	1.06	1.06	1.03	1.12	1.2	1.26	1.31

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	1.42	1.39	1.37	1.23	1.2	1.06	1.06	1.03	1.12	1.2	1.26	1.31	(24d)

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

(25)m=	1.42	1.39	1.37	1.23	1.2	1.06	1.06	1.03	1.12	1.2	1.26	1.31	(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			1.9	x 1.4	= 2.66			(26)
Windows Type 1			1.67	x1/[1/(4.8)+ 0.04]	= 6.72			(27)
Windows Type 2			0.84	x1/[1/(4.8)+ 0.04]	= 3.38			(27)
Walls Type1	45.3	2.51	42.79	x 2.1	= 89.86			(29)
Walls Type2	15.39	1.9	13.49	x 2.1	= 28.33			(29)
Roof	31.9	0	31.9	x 2.3	= 73.37			(30)
Total area of elements, m²			92.59					(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 204.33 (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: High 450 (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 (36)

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

Total fabric heat loss (33) + (36) = 218.33 (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=	45.5	44.6	43.71	39.25	38.36	33.9	33.9	33.01	35.68	38.36	40.14	41.93	(38)

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

(39)m=	263.82	262.93	262.04	257.58	256.69	252.22	252.22	251.33	254.01	256.69	258.47	260.25	

Average = Sum(39)$_{1…12}$ /12= 257.35 (39)

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

(40)m=	5.17	5.16	5.14	5.05	5.03	4.95	4.95	4.93	4.98	5.03	5.07	5.1

Average = Sum(40)$_{1...12}$ /12= 5.05 (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 — 1.72 (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 — 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	
										Total = Sum(44)$_{1...12}$ =		900.48	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55	
										Total = Sum(45)$_{1...12}$ =		1180.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 160 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

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

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

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

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

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

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)

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

(67)m=	29.11	25.86	21.03	15.92	11.9	10.05	10.86	14.11	18.94	24.05	28.07	29.92	(67)

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

(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)

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

(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)

Water heating gains (Table 5)

(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)

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

(73)m=	307.46	304.02	291.68	273.33	255.61	239.38	229.78	236.35	246.83	265.35	285.61	299.93	(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	1	x	1.67	x	19.64	x	0.85	x	0.7	=	13.52	(76)
East	0.9x	1	x	1.67	x	38.42	x	0.85	x	0.7	=	26.46	(76)
East	0.9x	1	x	1.67	x	63.27	x	0.85	x	0.7	=	43.57	(76)
East	0.9x	1	x	1.67	x	92.28	x	0.85	x	0.7	=	63.54	(76)
East	0.9x	1	x	1.67	x	113.09	x	0.85	x	0.7	=	77.88	(76)

East	0.9x	1	x	1.67	x	115.77	x	0.85	x	0.7	=	79.72	(76)
East	0.9x	1	x	1.67	x	110.22	x	0.85	x	0.7	=	75.9	(76)
East	0.9x	1	x	1.67	x	94.68	x	0.85	x	0.7	=	65.19	(76)
East	0.9x	1	x	1.67	x	73.59	x	0.85	x	0.7	=	50.67	(76)
East	0.9x	1	x	1.67	x	45.59	x	0.85	x	0.7	=	31.39	(76)
East	0.9x	1	x	1.67	x	24.49	x	0.85	x	0.7	=	16.86	(76)
East	0.9x	1	x	1.67	x	16.15	x	0.85	x	0.7	=	11.12	(76)
West	0.9x	0.77	x	0.84	x	19.64	x	0.85	x	0.7	=	6.8	(80)
West	0.9x	0.77	x	0.84	x	38.42	x	0.85	x	0.7	=	13.31	(80)
West	0.9x	0.77	x	0.84	x	63.27	x	0.85	x	0.7	=	21.92	(80)
West	0.9x	0.77	x	0.84	x	92.28	x	0.85	x	0.7	=	31.96	(80)
West	0.9x	0.77	x	0.84	x	113.09	x	0.85	x	0.7	=	39.17	(80)
West	0.9x	0.77	x	0.84	x	115.77	x	0.85	x	0.7	=	40.1	(80)
West	0.9x	0.77	x	0.84	x	110.22	x	0.85	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	0.84	x	94.68	x	0.85	x	0.7	=	32.79	(80)
West	0.9x	0.77	x	0.84	x	73.59	x	0.85	x	0.7	=	25.49	(80)
West	0.9x	0.77	x	0.84	x	45.59	x	0.85	x	0.7	=	15.79	(80)
West	0.9x	0.77	x	0.84	x	24.49	x	0.85	x	0.7	=	8.48	(80)
West	0.9x	0.77	x	0.84	x	16.15	x	0.85	x	0.7	=	5.59	(80)

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

(83)m=	20.33	39.76	65.49	95.51	117.05	119.82	114.07	97.99	76.16	47.18	25.35	16.72	(83)

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

(84)m=	327.78	343.79	357.16	368.84	372.65	359.2	343.85	334.34	322.99	312.53	310.96	316.64	(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	1	1	1	0.99	0.99	0.97	0.97	0.99	1	1	1	(86)

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

(87)m=	17.82	17.97	18.31	18.84	19.41	20	20.38	20.34	19.87	19.14	18.42	17.83	(87)

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

(88)m=	18.41	18.42	18.43	18.47	18.48	18.53	18.53	18.54	18.51	18.48	18.47	18.45	(88)

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

(89)m=	1	1	1	0.99	0.99	0.96	0.84	0.87	0.97	0.99	1	1	(89)

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

(90)m=	15.77	15.92	16.27	16.82	17.4	18.01	18.37	18.34	17.87	17.14	16.4	15.79	(90)

fLA = Living area ÷ (4) = 0.56 (91)

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

(92)m=	16.93	17.08	17.42	17.96	18.54	19.14	19.51	19.47	19	18.27	17.54	16.94	(92)

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

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(93)m=	16.93	17.08	17.42	17.96	18.54	19.14	19.51	19.47	19	18.27	17.54	16.94	(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=	1	1	1	0.99	0.99	0.97	0.93	0.94	0.98	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	327.09	342.89	355.83	366.5	367.85	348.07	318.4	313.43	316.45	310.54	310.05	316.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	3332.06	3201.23	2862.09	2334.25	1755.12	1144.26	733.51	771.75	1244.54	1968.7	2699.55	3315.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	2235.7	1920.8	1864.66	1416.78	1032.13	0	0	0	0	1233.67	1720.44	2231.8	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 13655.97 (98)

Space heating requirement in kWh/m²/year 267.76 (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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		13655.97	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	15772.65	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2115.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	178.88	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				514.14	(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			65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	5944.33	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	92.84	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	6037.17	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			6037.17	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	266.84	(379)
Total CO2, kg/year	sum of (376)…(382) =			6304.01	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			123.61	(384)
EI rating (section 14)				27.35	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 12

Address : , London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	55	(1a) x	2.17	(2a) =	119.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	119.35	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(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		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.17	(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) =	0.99	(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

1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17

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=	1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17	(24d)

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

(25)m=	1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.6	x1/[1/(1.6)+ 0.04]		=	6.92			(27)
Windows Type 2			1.87	x1/[1/(4.8)+ 0.04]		=	7.53			(27)
Windows Type 3			0.65	x1/[1/(4.8)+ 0.04]		=	2.62			(27)
Windows Type 4			1.87	x1/[1/(1.6)+ 0.04]		=	2.81			(27)
Floor			55	x	0.93	=	51.15			(28)
Walls Type1	28.9	8.34	20.56	x	2.1	=	43.18			(29)
Walls Type2	7.81	2.55	5.26	x	2.1	=	11.05			(29)
Total area of elements, m²			91.71							(31)
Party wall			27.9	x	0	=	0			(32)
Party wall			1.13	x	0	=	0			(32)

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	127.91	(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: High	450	(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		14.4	(36)

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

Total fabric heat loss	(33) + (36) =	142.31	(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=	49.84	48.86	47.88	43	42.02	37.2	37.2	36.29	39.09	42.02	43.97	45.93	(38)

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

(39)m=	192.15	191.17	190.19	185.31	184.33	179.51	179.51	178.6	181.4	184.33	186.28	188.24	

Average = Sum(39)$_{1…12}$ /12= 185.08 (39)

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

(40)m=	3.49	3.48	3.46	3.37	3.35	3.26	3.26	3.25	3.3	3.35	3.39	3.42	

Average = Sum(40)$_{1…12}$ /12= 3.37 (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 — 1.84 (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 — 77.84 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	85.62	82.51	79.39	76.28	73.17	70.05	70.05	73.17	76.28	79.39	82.51	85.62	

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

Total = Sum(44)$_{1…12}$ = 934.05 (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=	126.97	111.05	114.6	99.91	95.86	82.72	76.65	87.96	89.01	103.74	113.24	122.97	

Total = Sum(45)$_{1…12}$ = 1224.68 (45)

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

(46)m=	19.05	16.66	17.19	14.99	14.38	12.41	11.5	13.19	13.35	15.56	16.99	18.45	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 160 (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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24	(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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24

Output from water heater (annual)$_{1...12}$ | 1875.52 | (64)

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

(65)m=	60.83	53.73	56.71	51.23	50.48	45.51	44.1	47.86	47.61	53.1	55.66	59.5	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	25.06	22.26	18.1	13.7	10.24	8.65	9.35	12.15	16.3	20.7	24.16	25.76	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	160.19	161.85	157.66	148.74	137.49	126.91	119.84	118.18	122.36	131.28	142.54	153.12	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	(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=	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	(71)
Water heating gains (Table 5)													
(72)m=	81.76	79.96	76.23	71.15	67.86	63.22	59.27	64.32	66.12	71.37	77.31	79.97	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	317.57	314.63	302.55	284.16	266.15	249.33	239.01	245.21	255.35	273.92	294.57	309.4	(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	1.87	x	10.63	x	0.85	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	0.65	x	10.63	x	0.85	x	0.7	=	2.85	(74)
North	0.9x	0.77	x	1.87	x	20.32	x	0.85	x	0.7	=	15.67	(74)
North	0.9x	0.77	x	0.65	x	20.32	x	0.85	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	1.87	x	34.53	x	0.85	x	0.7	=	26.63	(74)
North	0.9x	0.77	x	0.65	x	34.53	x	0.85	x	0.7	=	9.25	(74)
North	0.9x	0.77	x	1.87	x	55.46	x	0.85	x	0.7	=	42.77	(74)
North	0.9x	0.77	x	0.65	x	55.46	x	0.85	x	0.7	=	14.87	(74)
North	0.9x	0.77	x	1.87	x	74.72	x	0.85	x	0.7	=	57.61	(74)
North	0.9x	0.77	x	0.65	x	74.72	x	0.85	x	0.7	=	20.03	(74)
North	0.9x	0.77	x	1.87	x	79.99	x	0.85	x	0.7	=	61.67	(74)
North	0.9x	0.77	x	0.65	x	79.99	x	0.85	x	0.7	=	21.44	(74)
North	0.9x	0.77	x	1.87	x	74.68	x	0.85	x	0.7	=	57.58	(74)
North	0.9x	0.77	x	0.65	x	74.68	x	0.85	x	0.7	=	20.01	(74)
North	0.9x	0.77	x	1.87	x	59.25	x	0.85	x	0.7	=	45.68	(74)
North	0.9x	0.77	x	0.65	x	59.25	x	0.85	x	0.7	=	15.88	(74)
North	0.9x	0.77	x	1.87	x	41.52	x	0.85	x	0.7	=	32.01	(74)
North	0.9x	0.77	x	0.65	x	41.52	x	0.85	x	0.7	=	11.13	(74)
North	0.9x	0.77	x	1.87	x	24.19	x	0.85	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	0.65	x	24.19	x	0.85	x	0.7	=	6.48	(74)
North	0.9x	0.77	x	1.87	x	13.12	x	0.85	x	0.7	=	10.11	(74)
North	0.9x	0.77	x	0.65	x	13.12	x	0.85	x	0.7	=	3.52	(74)
North	0.9x	0.77	x	1.87	x	8.86	x	0.85	x	0.7	=	6.84	(74)
North	0.9x	0.77	x	0.65	x	8.86	x	0.85	x	0.7	=	2.38	(74)
East	0.9x	1	x	1.87	x	19.64	x	0.76	x	0.7	=	13.54	(76)
East	0.9x	1	x	1.87	x	38.42	x	0.76	x	0.7	=	26.49	(76)
East	0.9x	1	x	1.87	x	63.27	x	0.76	x	0.7	=	43.62	(76)
East	0.9x	1	x	1.87	x	92.28	x	0.76	x	0.7	=	63.62	(76)
East	0.9x	1	x	1.87	x	113.09	x	0.76	x	0.7	=	77.97	(76)
East	0.9x	1	x	1.87	x	115.77	x	0.76	x	0.7	=	79.81	(76)
East	0.9x	1	x	1.87	x	110.22	x	0.76	x	0.7	=	75.99	(76)
East	0.9x	1	x	1.87	x	94.68	x	0.76	x	0.7	=	65.27	(76)
East	0.9x	1	x	1.87	x	73.59	x	0.76	x	0.7	=	50.73	(76)
East	0.9x	1	x	1.87	x	45.59	x	0.76	x	0.7	=	31.43	(76)
East	0.9x	1	x	1.87	x	24.49	x	0.76	x	0.7	=	16.88	(76)
East	0.9x	1	x	1.87	x	16.15	x	0.76	x	0.7	=	11.14	(76)
South	0.9x	0.77	x	4.6	x	46.75	x	0.76	x	0.7	=	79.29	(78)
South	0.9x	0.77	x	4.6	x	76.57	x	0.76	x	0.7	=	129.85	(78)
South	0.9x	0.77	x	4.6	x	97.53	x	0.76	x	0.7	=	165.41	(78)
South	0.9x	0.77	x	4.6	x	110.23	x	0.76	x	0.7	=	186.95	(78)
South	0.9x	0.77	x	4.6	x	114.87	x	0.76	x	0.7	=	194.81	(78)

South	0.9x	0.77	x	4.6	x	110.55	x	0.76	x	0.7	=	187.48	(78)
South	0.9x	0.77	x	4.6	x	108.01	x	0.76	x	0.7	=	183.18	(78)
South	0.9x	0.77	x	4.6	x	104.89	x	0.76	x	0.7	=	177.89	(78)
South	0.9x	0.77	x	4.6	x	101.89	x	0.76	x	0.7	=	172.79	(78)
South	0.9x	0.77	x	4.6	x	82.59	x	0.76	x	0.7	=	140.06	(78)
South	0.9x	0.77	x	4.6	x	55.42	x	0.76	x	0.7	=	93.98	(78)
South	0.9x	0.77	x	4.6	x	40.4	x	0.76	x	0.7	=	68.51	(78)

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

(83)m=	103.88	177.46	244.91	308.2	350.42	350.41	336.76	304.73	266.66	196.62	124.5	88.86	(83)

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

(84)m=	421.44	492.08	547.46	592.36	616.56	599.74	575.77	549.93	522.01	470.54	419.06	398.26	(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	1	0.99	0.98	0.95	0.88	0.91	0.97	0.99	1	1	(86)

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

(87)m=	18.69	18.85	19.16	19.61	20.07	20.51	20.76	20.73	20.37	19.78	19.18	18.69	(87)

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

(88)m=	19.25	19.26	19.27	19.32	19.32	19.37	19.37	19.38	19.35	19.32	19.31	19.29	(88)

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

(89)m=	1	1	1	0.99	0.97	0.89	0.72	0.77	0.94	0.99	1	1	(89)

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

(90)m=	17.22	17.39	17.7	18.19	18.65	19.1	19.3	19.28	18.96	18.37	17.75	17.25	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	18.03	18.19	18.5	18.97	19.43	19.87	20.1	20.08	19.74	19.14	18.54	18.04	(92)

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

(93)m=	18.03	18.19	18.5	18.97	19.43	19.87	20.1	20.08	19.74	19.14	18.54	18.04	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.97	0.92	0.81	0.84	0.95	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	420.73	490.58	544.26	584.8	597.23	550.1	468.29	464.34	496.95	465.63	417.85	397.73	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2637.43	2541.11	2282.93	1866.14	1424.26	946.56	628.68	656.45	1022.44	1574.85	2130.72	2605.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1649.22	1377.95	1293.57	922.56	615.31	0	0	0	0	825.26	1233.26	1642.75	

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	Total per year (kWh/year) = Sum(98)1...5,9...12 =	9559.89	(98)
Space heating requirement in kWh/m²/year		173.82	(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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		9559.89	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	11041.67	(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		1875.52	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2166.23	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	132.08	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		442.58	(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				65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	4389.09	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	68.55	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	4457.64	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			4457.64	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	229.7	(379)
Total CO2, kg/year	sum of (376)…(382) =			4687.33	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			85.22	(384)
EI rating (section 14)				41.26	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 13

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.17	(2a) =	110.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	110.67	(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) =	0.18	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.18	(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) =	0.92	(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

1.17	1.14	1.12	1.01	0.98	0.87	0.87	0.85	0.92	0.98	1.03	1.08

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=	1.17	1.14	1.12	1.01	0.98	0.88	0.88	0.86	0.92	0.98	1.03	1.08	(24d)

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

(25)m=	1.17	1.14	1.12	1.01	0.98	0.88	0.88	0.86	0.92	0.98	1.03	1.08	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.59	x1/[1/(1.6)+ 0.04]		=	6.9			(27)
Windows Type 2			4.64	x1/[1/(4.8)+ 0.04]		=	18.68			(27)
Floor			51	x	0.99	=	50.49			(28)
Walls Type1	16.14	4.59	11.55	x	2.1	=	24.25			(29)
Walls Type2	16.1	6.54	9.56	x	2.1	=	20.08			(29)
Total area of elements, m²			83.24							(31)
Party wall			33.3	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 123.07 (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: High 450 (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 12.8 (36)

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

Total fabric heat loss (33) + (36) = 135.87 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.61	41.77	40.94	36.76	35.93	32.06	32.06	31.34	33.55	35.93	37.6	39.27	(38)

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

(39)m=	178.48	177.64	176.81	172.63	171.8	167.93	167.93	167.21	169.42	171.8	173.46	175.13	

Average = Sum(39)$_{1…12}$ /12= 172.52 (39)

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

(40)m=	3.5	3.48	3.47	3.38	3.37	3.29	3.29	3.28	3.32	3.37	3.4	3.43

Average = Sum(40)$_{1…12}$ /12= 3.38 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54

Total = Sum(44)$_{1…12}$ = 900.48 (44)

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

(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55

Total = Sum(45)$_{1…12}$ = 1180.67 (45)

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

(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(57)

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

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

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

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

(59)

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

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

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

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

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

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

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

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)

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

(67)m=	22.97	20.4	16.59	12.56	9.39	7.93	8.57	11.13	14.94	18.98	22.15	23.61	(67)

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

(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)

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

(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)

Water heating gains (Table 5)

(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)

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

(73)m=	301.32	298.57	287.24	269.98	253.1	237.27	227.49	233.38	242.84	260.27	279.69	293.62	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.64	x	10.63	x	0.85	x	0.7	=	20.34	(74)
North	0.9x	0.77	x	4.64	x	20.32	x	0.85	x	0.7	=	38.88	(74)
North	0.9x	0.77	x	4.64	x	34.53	x	0.85	x	0.7	=	66.06	(74)
North	0.9x	0.77	x	4.64	x	55.46	x	0.85	x	0.7	=	106.12	(74)
North	0.9x	0.77	x	4.64	x	74.72	x	0.85	x	0.7	=	142.95	(74)

North	0.9x	0.77	x	4.64	x	79.99	x	0.85	x	0.7	=	153.03	(74)
North	0.9x	0.77	x	4.64	x	74.68	x	0.85	x	0.7	=	142.87	(74)
North	0.9x	0.77	x	4.64	x	59.25	x	0.85	x	0.7	=	113.35	(74)
North	0.9x	0.77	x	4.64	x	41.52	x	0.85	x	0.7	=	79.43	(74)
North	0.9x	0.77	x	4.64	x	24.19	x	0.85	x	0.7	=	46.28	(74)
North	0.9x	0.77	x	4.64	x	13.12	x	0.85	x	0.7	=	25.1	(74)
North	0.9x	0.77	x	4.64	x	8.86	x	0.85	x	0.7	=	16.96	(74)
South	0.9x	0.77	x	4.59	x	46.75	x	0.76	x	0.7	=	79.11	(78)
South	0.9x	0.77	x	4.59	x	76.57	x	0.76	x	0.7	=	129.57	(78)
South	0.9x	0.77	x	4.59	x	97.53	x	0.76	x	0.7	=	165.05	(78)
South	0.9x	0.77	x	4.59	x	110.23	x	0.76	x	0.7	=	186.54	(78)
South	0.9x	0.77	x	4.59	x	114.87	x	0.76	x	0.7	=	194.39	(78)
South	0.9x	0.77	x	4.59	x	110.55	x	0.76	x	0.7	=	187.07	(78)
South	0.9x	0.77	x	4.59	x	108.01	x	0.76	x	0.7	=	182.78	(78)
South	0.9x	0.77	x	4.59	x	104.89	x	0.76	x	0.7	=	177.5	(78)
South	0.9x	0.77	x	4.59	x	101.89	x	0.76	x	0.7	=	172.41	(78)
South	0.9x	0.77	x	4.59	x	82.59	x	0.76	x	0.7	=	139.75	(78)
South	0.9x	0.77	x	4.59	x	55.42	x	0.76	x	0.7	=	93.78	(78)
South	0.9x	0.77	x	4.59	x	40.4	x	0.76	x	0.7	=	68.36	(78)

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

(83)m=	99.46	168.45	231.11	292.66	337.34	340.1	325.65	290.86	251.84	186.03	118.88	85.32	(83)

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

(84)m=	400.77	467.02	518.35	562.63	590.43	577.37	553.14	524.23	494.68	446.31	398.57	378.94	(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=	1	1	1	0.99	0.98	0.95	0.88	0.9	0.97	0.99	1	1	(86)

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

(87)m=	18.69	18.86	19.17	19.62	20.08	20.52	20.77	20.73	20.37	19.79	19.18	18.7	(87)

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

(88)m=	19.25	19.26	19.27	19.31	19.32	19.35	19.35	19.36	19.34	19.32	19.3	19.28	(88)

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

(89)m=	1	1	0.99	0.99	0.96	0.89	0.7	0.76	0.94	0.99	1	1	(89)

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

(90)m=	17.22	17.39	17.71	18.19	18.65	19.09	19.29	19.27	18.95	18.36	17.75	17.25	(90)

fLA = Living area ÷ (4) = | 0.55 | (91)

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

(92)m=	18.04	18.21	18.52	18.98	19.44	19.88	20.11	20.08	19.74	19.15	18.55	18.05	(92)

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

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(93)m=	18.04	18.21	18.52	18.98	19.44	19.88	20.11	20.08	19.74	19.15	18.55	18.05	(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=	1	1	0.99	0.99	0.97	0.91	0.8	0.84	0.95	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	400.04	465.49	515.13	554.95	570.35	525.77	444.34	439.13	469.74	441.33	397.32	378.39	(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=	2452.14	2363.57	2124.4	1740.29	1329.98	887.27	589.33	615.38	955.98	1469.13	1985.5	2425.87	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1526.76	1275.51	1197.3	853.44	565.17	0	0	0	0	764.69	1143.49	1523.32	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 8849.69 (98)

Space heating requirement in kWh/m²/year 173.52 (99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community 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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		8849.69	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	10221.39	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2115.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	123.37	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				405.69	(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			65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	= 4099.61	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 64.03	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 4163.63	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			4163.63	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 210.55	(379)
Total CO2, kg/year	sum of (376)…(382) =			4374.19	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			85.77	(384)
EI rating (section 14)				42.43	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 14

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.18	(2a) =	111.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	111.18	(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) =	0.18	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.18	(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) =	1	(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

1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18

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=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	(24d)

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

(25)m=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.42	x1/[1/(1.6)+ 0.04]		=	6.65			(27)
Windows Type 2			4.96	x1/[1/(4.8)+ 0.04]		=	19.97			(27)
Floor			51	x	0.97	=	49.47			(28)
Walls Type1	39.2	4.96	34.24	x	2.1	=	71.9			(29)
Walls Type2	10.99	6.32	4.67	x	2.1	=	9.81			(29)
Total area of elements, m²			101.19							(31)
Party wall			16.1	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 160.46 (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: High 450 (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 15.2 (36)

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

Total fabric heat loss (33) + (36) = 175.66 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	46.91	45.99	45.08	40.48	39.56	35	35	34.13	36.8	39.56	41.4	43.24	(38)

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

(39)m=	222.58	221.66	220.74	216.14	215.22	210.66	210.66	209.79	212.46	215.22	217.06	218.9	

Average = Sum(39)$_{1…12}$ /12= 215.92 (39)

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

(40)m=	4.36	4.35	4.33	4.24	4.22	4.13	4.13	4.11	4.17	4.22	4.26	4.29

Average = Sum(40)$_{1...12}$ /12= 4.23 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	
Total = Sum(44)$_{1...12}$ =												900.48	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55	
Total = Sum(45)$_{1...12}$ =												1180.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H													
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

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

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

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

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	22.92	20.36	16.55	12.53	9.37	7.91	8.55	11.11	14.91	18.93	22.1	23.55	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)
Water heating gains (Table 5)													
(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	301.26	298.52	287.2	269.95	253.08	237.25	227.47	233.35	242.8	260.23	279.64	293.56	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.96	x	10.63	x	0.85	x	0.7	=	21.75	(74)
North	0.9x	0.77	x	4.96	x	20.32	x	0.85	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	4.96	x	34.53	x	0.85	x	0.7	=	70.62	(74)
North	0.9x	0.77	x	4.96	x	55.46	x	0.85	x	0.7	=	113.43	(74)
North	0.9x	0.77	x	4.96	x	74.72	x	0.85	x	0.7	=	152.81	(74)

North	0.9x	0.77	x	4.96	x	79.99	x	0.85	x	0.7	=	163.58	(74)
North	0.9x	0.77	x	4.96	x	74.68	x	0.85	x	0.7	=	152.73	(74)
North	0.9x	0.77	x	4.96	x	59.25	x	0.85	x	0.7	=	121.17	(74)
North	0.9x	0.77	x	4.96	x	41.52	x	0.85	x	0.7	=	84.91	(74)
North	0.9x	0.77	x	4.96	x	24.19	x	0.85	x	0.7	=	49.47	(74)
North	0.9x	0.77	x	4.96	x	13.12	x	0.85	x	0.7	=	26.83	(74)
North	0.9x	0.77	x	4.96	x	8.86	x	0.85	x	0.7	=	18.13	(74)
South	0.9x	0.77	x	4.42	x	46.75	x	0.76	x	0.7	=	76.18	(78)
South	0.9x	0.77	x	4.42	x	76.57	x	0.76	x	0.7	=	124.77	(78)
South	0.9x	0.77	x	4.42	x	97.53	x	0.76	x	0.7	=	158.94	(78)
South	0.9x	0.77	x	4.42	x	110.23	x	0.76	x	0.7	=	179.63	(78)
South	0.9x	0.77	x	4.42	x	114.87	x	0.76	x	0.7	=	187.19	(78)
South	0.9x	0.77	x	4.42	x	110.55	x	0.76	x	0.7	=	180.14	(78)
South	0.9x	0.77	x	4.42	x	108.01	x	0.76	x	0.7	=	176.01	(78)
South	0.9x	0.77	x	4.42	x	104.89	x	0.76	x	0.7	=	170.93	(78)
South	0.9x	0.77	x	4.42	x	101.89	x	0.76	x	0.7	=	166.03	(78)
South	0.9x	0.77	x	4.42	x	82.59	x	0.76	x	0.7	=	134.58	(78)
South	0.9x	0.77	x	4.42	x	55.42	x	0.76	x	0.7	=	90.3	(78)
South	0.9x	0.77	x	4.42	x	40.4	x	0.76	x	0.7	=	65.83	(78)

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

(83)m=	97.93	166.33	229.56	293.07	340	343.73	328.74	292.1	250.94	184.05	117.13	83.96	(83)

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

(84)m=	399.19	464.85	516.76	563.01	593.07	580.97	556.21	525.45	493.74	444.28	396.77	377.52	(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	1	1	0.99	0.98	0.95	0.9	0.92	0.97	0.99	1	1	(86)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													
(87)m=	18.24	18.42	18.76	19.27	19.81	20.33	20.64	20.59	20.17	19.49	18.8	18.24	(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)													
(88)m=	18.82	18.83	18.84	18.88	18.89	18.93	18.93	18.94	18.92	18.89	18.87	18.85	(88)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)													
(89)m=	1	1	0.99	0.99	0.96	0.89	0.7	0.76	0.94	0.99	1	1	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m=	16.47	16.65	17	17.54	18.07	18.6	18.85	18.83	18.44	17.76	17.06	16.49	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	17.31	17.48	17.83	18.36	18.89	19.42	19.7	19.66	19.26	18.58	17.89	17.32	(92)

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

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(93)m=	17.31	17.48	17.83	18.36	18.89	19.42	19.7	19.66	19.26	18.58	17.89	17.32	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.96	0.91	0.81	0.84	0.95	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	398.11	462.77	512.68	554.06	571.5	529.3	449.02	441.67	467.88	438.34	395.04	376.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2894.91	2789.11	2501.17	2044.2	1547.59	1014.5	652.1	684.29	1096.11	1716.87	2341.08	2871.55	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1857.62	1563.3	1479.44	1072.9	726.21	0	0	0	0	951.23	1401.15	1856.18	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 10908.02 (98)

Space heating requirement in kWh/m²/year 213.88 (99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community 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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		10908.02	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	12598.76	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2115.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	147.14	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				404.74	(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			65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	4889.63	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	76.37	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	4965.99	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			4965.99	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	210.06	(379)
Total CO2, kg/year	sum of (376)…(382) =			5176.05	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			101.49	(384)
EI rating (section 14)				35.49	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 15

Address : , London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	55	(1a) x	2.17	(2a) =	119.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	119.35	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(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		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.17	(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) =	0.99	(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

1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17

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=	1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17	(24d)

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

(25)m=	1.27	1.24	1.22	1.09	1.07	0.94	0.94	0.92	0.99	1.07	1.12	1.17	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			3	x1/[1/(1.6)+ 0.04]		=	4.51			(27)
Windows Type 2			1.76	x1/[1/(4.8)+ 0.04]		=	7.09			(27)
Windows Type 3			0.64	x1/[1/(4.8)+ 0.04]		=	2.58			(27)
Windows Type 4			3.84	x1/[1/(1.6)+ 0.04]		=	5.77			(27)
Floor			55	x	0.93	=	51.15			(28)
Walls Type1	28.9	8.6	20.3	x	2.1	=	42.63			(29)
Walls Type2	7.81	2.54	5.27	x	2.1	=	11.07			(29)
Total area of elements, m²			91.71							(31)
Party wall			27.9	x	0	=	0			(32)
Party wall			1.13	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	127.46	(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: High	450	(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		14.4	(36)

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

Total fabric heat loss	(33) + (36) =	141.86	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	49.84	48.86	47.88	43	42.02	37.2	37.2	36.29	39.09	42.02	43.97	45.93	(38)

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

(39)m=	191.69	190.72	189.74	184.85	183.88	179.05	179.05	178.15	180.95	183.88	185.83	187.79	

Average = Sum(39)$_{1…12}$ /12= 184.63 (39)

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

(40)m=	3.49	3.47	3.45	3.36	3.34	3.26	3.26	3.24	3.29	3.34	3.38	3.41	

Average = Sum(40)$_{1…12}$ /12= 3.36 (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 1.84 (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 77.84 (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=	85.62	82.51	79.39	76.28	73.17	70.05	70.05	73.17	76.28	79.39	82.51	85.62	

Total = Sum(44)$_{1…12}$ = 934.05 (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=	126.97	111.05	114.6	99.91	95.86	82.72	76.65	87.96	89.01	103.74	113.24	122.97	

Total = Sum(45)$_{1…12}$ = 1224.68 (45)

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

(46)m=	19.05	16.66	17.19	14.99	14.38	12.41	11.5	13.19	13.35	15.56	16.99	18.45	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24	(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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24

Output from water heater (annual)$_{1…12}$ — 1875.52 (64)

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

(65)m=	60.83	53.73	56.71	51.23	50.48	45.51	44.1	47.86	47.61	53.1	55.66	59.5	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	(66)

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

(67)m=	24.95	22.16	18.02	13.64	10.2	8.61	9.3	12.09	16.23	20.61	24.05	25.64	(67)

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

(68)m=	160.19	161.85	157.66	148.74	137.49	126.91	119.84	118.18	122.36	131.28	142.54	153.12	(68)

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

(69)m=	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	(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=	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	(71)

Water heating gains (Table 5)

(72)m=	81.76	79.96	76.23	71.15	67.86	63.22	59.27	64.32	66.12	71.37	77.31	79.97	(72)

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

(73)m=	317.45	314.53	302.47	284.1	266.1	249.29	238.97	245.15	255.28	273.83	294.46	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)

North	0.9x	0.77	x	1.76	x	10.63	x	0.85	x	0.7	=	7.72	(74)
North	0.9x	0.77	x	0.64	x	10.63	x	0.85	x	0.7	=	2.81	(74)
North	0.9x	0.77	x	1.76	x	20.32	x	0.85	x	0.7	=	14.75	(74)
North	0.9x	0.77	x	0.64	x	20.32	x	0.85	x	0.7	=	5.36	(74)
North	0.9x	0.77	x	1.76	x	34.53	x	0.85	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	0.64	x	34.53	x	0.85	x	0.7	=	9.11	(74)
North	0.9x	0.77	x	1.76	x	55.46	x	0.85	x	0.7	=	40.25	(74)
North	0.9x	0.77	x	0.64	x	55.46	x	0.85	x	0.7	=	14.64	(74)
North	0.9x	0.77	x	1.76	x	74.72	x	0.85	x	0.7	=	54.22	(74)
North	0.9x	0.77	x	0.64	x	74.72	x	0.85	x	0.7	=	19.72	(74)
North	0.9x	0.77	x	1.76	x	79.99	x	0.85	x	0.7	=	58.05	(74)
North	0.9x	0.77	x	0.64	x	79.99	x	0.85	x	0.7	=	21.11	(74)
North	0.9x	0.77	x	1.76	x	74.68	x	0.85	x	0.7	=	54.19	(74)
North	0.9x	0.77	x	0.64	x	74.68	x	0.85	x	0.7	=	19.71	(74)
North	0.9x	0.77	x	1.76	x	59.25	x	0.85	x	0.7	=	43	(74)
North	0.9x	0.77	x	0.64	x	59.25	x	0.85	x	0.7	=	15.63	(74)
North	0.9x	0.77	x	1.76	x	41.52	x	0.85	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	0.64	x	41.52	x	0.85	x	0.7	=	10.96	(74)
North	0.9x	0.77	x	1.76	x	24.19	x	0.85	x	0.7	=	17.55	(74)
North	0.9x	0.77	x	0.64	x	24.19	x	0.85	x	0.7	=	6.38	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.85	x	0.7	=	9.52	(74)
North	0.9x	0.77	x	0.64	x	13.12	x	0.85	x	0.7	=	3.46	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.85	x	0.7	=	6.43	(74)
North	0.9x	0.77	x	0.64	x	8.86	x	0.85	x	0.7	=	2.34	(74)
East	0.9x	1	x	3.84	x	19.64	x	0.76	x	0.7	=	27.81	(76)
East	0.9x	1	x	3.84	x	38.42	x	0.76	x	0.7	=	54.39	(76)
East	0.9x	1	x	3.84	x	63.27	x	0.76	x	0.7	=	89.58	(76)
East	0.9x	1	x	3.84	x	92.28	x	0.76	x	0.7	=	130.64	(76)
East	0.9x	1	x	3.84	x	113.09	x	0.76	x	0.7	=	160.11	(76)
East	0.9x	1	x	3.84	x	115.77	x	0.76	x	0.7	=	163.9	(76)
East	0.9x	1	x	3.84	x	110.22	x	0.76	x	0.7	=	156.04	(76)
East	0.9x	1	x	3.84	x	94.68	x	0.76	x	0.7	=	134.03	(76)
East	0.9x	1	x	3.84	x	73.59	x	0.76	x	0.7	=	104.18	(76)
East	0.9x	1	x	3.84	x	45.59	x	0.76	x	0.7	=	64.54	(76)
East	0.9x	1	x	3.84	x	24.49	x	0.76	x	0.7	=	34.67	(76)
East	0.9x	1	x	3.84	x	16.15	x	0.76	x	0.7	=	22.87	(76)
South	0.9x	0.77	x	3	x	46.75	x	0.76	x	0.7	=	51.71	(78)
South	0.9x	0.77	x	3	x	76.57	x	0.76	x	0.7	=	84.69	(78)
South	0.9x	0.77	x	3	x	97.53	x	0.76	x	0.7	=	107.88	(78)
South	0.9x	0.77	x	3	x	110.23	x	0.76	x	0.7	=	121.92	(78)
South	0.9x	0.77	x	3	x	114.87	x	0.76	x	0.7	=	127.05	(78)

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South	0.9x	0.77	x	3	x	110.55	x	0.76	x	0.7	=	122.27	(78)
South	0.9x	0.77	x	3	x	108.01	x	0.76	x	0.7	=	119.46	(78)
South	0.9x	0.77	x	3	x	104.89	x	0.76	x	0.7	=	116.02	(78)
South	0.9x	0.77	x	3	x	101.89	x	0.76	x	0.7	=	112.69	(78)
South	0.9x	0.77	x	3	x	82.59	x	0.76	x	0.7	=	91.34	(78)
South	0.9x	0.77	x	3	x	55.42	x	0.76	x	0.7	=	61.29	(78)
South	0.9x	0.77	x	3	x	40.4	x	0.76	x	0.7	=	44.68	(78)

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

(83)m=	90.04	159.19	231.62	307.45	361.1	365.32	349.4	308.68	257.95	179.82	108.94	76.32	(83)

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

(84)m=	407.49	473.72	534.09	591.55	627.2	614.61	588.37	553.83	513.23	453.65	403.4	385.61	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.98	0.95	0.88	0.9	0.97	0.99	1	1	(86)

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

(87)m=	18.68	18.84	19.15	19.62	20.08	20.52	20.77	20.73	20.37	19.77	19.17	18.69	(87)

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

(88)m=	19.26	19.27	19.28	19.32	19.33	19.37	19.37	19.38	19.36	19.33	19.31	19.29	(88)

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

(89)m=	1	1	1	0.99	0.97	0.89	0.71	0.76	0.94	0.99	1	1	(89)

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

(90)m=	17.22	17.38	17.7	18.19	18.66	19.11	19.31	19.29	18.96	18.36	17.75	17.25	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	18.02	18.18	18.5	18.97	19.44	19.89	20.11	20.08	19.73	19.13	18.53	18.04	(92)

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

(93)m=	18.02	18.18	18.5	18.97	19.44	19.89	20.11	20.08	19.73	19.13	18.53	18.04	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.97	0.91	0.81	0.84	0.95	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	406.87	472.44	531.2	584.04	606.62	560.74	474.04	466.31	489.62	449.4	402.37	385.15	(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=	2630.15	2533.33	2276.47	1862.38	1423.02	946.44	628.47	655.6	1019.39	1569.27	2124.11	2598.62	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1654.12	1384.92	1298.48	920.4	607.41	0	0	0	0	833.18	1239.65	1646.83	

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	9584.99	(98)
Space heating requirement in kWh/m²/year		174.27	(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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		9584.99	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	11070.66	(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		1875.52	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2166.23	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	132.37	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		440.61	(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			65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0	=	4398.72	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	68.7	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	4467.42	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)

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CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			4467.42	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	228.68	(379)
Total CO2, kg/year	sum of (376)…(382) =			4696.1	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			85.38	(384)
EI rating (section 14)				41.18	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 16

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.17	(2a) =	110.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	110.67	(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) =	0.18	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.18	(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) =	0.92	(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

1.17	1.14	1.12	1.01	0.98	0.87	0.87	0.85	0.92	0.98	1.03	1.08

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=	1.17	1.14	1.12	1.01	0.98	0.88	0.88	0.86	0.92	0.98	1.03	1.08	(24d)

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

(25)m=	1.17	1.14	1.12	1.01	0.98	0.88	0.88	0.86	0.92	0.98	1.03	1.08	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.8	x1/[1/(1.6)+ 0.04]		=	7.22			(27)
Windows Type 2			4.16	x1/[1/(4.8)+ 0.04]		=	16.75			(27)
Floor			51	x	0.99	=	50.49			(28)
Walls Type1	16.14	4.8	11.34	x	2.1	=	23.81			(29)
Walls Type2	16.1	6.06	10.04	x	2.1	=	21.08			(29)
Total area of elements, m²			83.24							(31)
Party wall			33.3	x	0	=	0			(32)

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 122.02 (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: High 450 (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 12.8 (36)

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

Total fabric heat loss (33) + (36) = 134.82 (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=	42.61	41.77	40.94	36.76	35.93	32.06	32.06	31.34	33.55	35.93	37.6	39.27	(38)

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

(39)m=	177.43	176.59	175.76	171.58	170.75	166.88	166.88	166.16	168.37	170.75	172.41	174.08	

Average = $Sum(39)_{1...12}$ /12= 171.47 (39)

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

(40)m=	3.48	3.46	3.45	3.36	3.35	3.27	3.27	3.26	3.3	3.35	3.38	3.41

Average = Sum(40)$_{1...12}$ /12= 3.36 (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 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54

Total = Sum(44)$_{1...12}$ = 900.48 (44)

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

(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55

Total = Sum(45)$_{1...12}$ = 1180.67 (45)

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

(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

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

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

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

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

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

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)

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

(67)m=	23.08	20.5	16.67	12.62	9.43	7.96	8.61	11.19	15.01	19.06	22.25	23.72	(67)

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

(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)

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

(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)

Water heating gains (Table 5)

(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)

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

(73)m=	301.42	298.66	287.32	270.03	253.14	237.3	227.53	233.43	242.91	260.36	279.8	293.73	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.16	x	10.63	x	0.85	x	0.7	=	18.24	(74)
North	0.9x	0.77	x	4.16	x	20.32	x	0.85	x	0.7	=	34.86	(74)
North	0.9x	0.77	x	4.16	x	34.53	x	0.85	x	0.7	=	59.23	(74)
North	0.9x	0.77	x	4.16	x	55.46	x	0.85	x	0.7	=	95.14	(74)
North	0.9x	0.77	x	4.16	x	74.72	x	0.85	x	0.7	=	128.16	(74)

North	0.9x	0.77	x	4.16	x	79.99	x	0.85	x	0.7	=	137.2	(74)
North	0.9x	0.77	x	4.16	x	74.68	x	0.85	x	0.7	=	128.09	(74)
North	0.9x	0.77	x	4.16	x	59.25	x	0.85	x	0.7	=	101.63	(74)
North	0.9x	0.77	x	4.16	x	41.52	x	0.85	x	0.7	=	71.21	(74)
North	0.9x	0.77	x	4.16	x	24.19	x	0.85	x	0.7	=	41.49	(74)
North	0.9x	0.77	x	4.16	x	13.12	x	0.85	x	0.7	=	22.5	(74)
North	0.9x	0.77	x	4.16	x	8.86	x	0.85	x	0.7	=	15.21	(74)
South	0.9x	0.77	x	4.8	x	46.75	x	0.76	x	0.7	=	82.73	(78)
South	0.9x	0.77	x	4.8	x	76.57	x	0.76	x	0.7	=	135.5	(78)
South	0.9x	0.77	x	4.8	x	97.53	x	0.76	x	0.7	=	172.6	(78)
South	0.9x	0.77	x	4.8	x	110.23	x	0.76	x	0.7	=	195.08	(78)
South	0.9x	0.77	x	4.8	x	114.87	x	0.76	x	0.7	=	203.28	(78)
South	0.9x	0.77	x	4.8	x	110.55	x	0.76	x	0.7	=	195.63	(78)
South	0.9x	0.77	x	4.8	x	108.01	x	0.76	x	0.7	=	191.14	(78)
South	0.9x	0.77	x	4.8	x	104.89	x	0.76	x	0.7	=	185.63	(78)
South	0.9x	0.77	x	4.8	x	101.89	x	0.76	x	0.7	=	180.3	(78)
South	0.9x	0.77	x	4.8	x	82.59	x	0.76	x	0.7	=	146.15	(78)
South	0.9x	0.77	x	4.8	x	55.42	x	0.76	x	0.7	=	98.07	(78)
South	0.9x	0.77	x	4.8	x	40.4	x	0.76	x	0.7	=	71.49	(78)

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

(83)m=	100.97	170.35	231.83	290.21	331.44	332.83	319.24	287.25	251.52	187.64	120.57	86.7	(83)

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

(84)m=	402.4	469.02	519.15	560.25	584.58	570.13	546.77	520.68	494.42	448	400.37	380.42	(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	1	0.99	0.98	0.95	0.88	0.9	0.97	0.99	1	1	(86)

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

(87)m=	18.71	18.87	19.18	19.62	20.08	20.52	20.77	20.73	20.38	19.79	19.2	18.71	(87)

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

(88)m=	19.26	19.27	19.28	19.32	19.33	19.36	19.36	19.37	19.35	19.33	19.31	19.29	(88)

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

(89)m=	1	1	0.99	0.99	0.97	0.89	0.71	0.76	0.94	0.99	1	1	(89)

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

(90)m=	17.24	17.41	17.72	18.2	18.66	19.1	19.3	19.28	18.97	18.38	17.77	17.27	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	18.06	18.22	18.53	18.99	19.45	19.89	20.11	20.09	19.75	19.16	18.56	18.07	(92)

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

(93)m=	18.06	18.22	18.53	18.99	19.45	19.89	20.11	20.09	19.75	19.16	18.56	18.07	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.97	0.91	0.81	0.84	0.95	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	401.66	467.47	515.92	552.71	565.2	520.44	440.95	436.91	469.49	442.97	399.1	379.87	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2440.61	2352.49	2114.31	1731.46	1322.83	882.33	586.33	612.39	951.5	1462.29	1976.03	2414.17	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1516.98	1266.73	1189.2	848.7	563.68	0	0	0	0	758.38	1135.39	1513.52	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	8792.58	(98)
Space heating requirement in kWh/m²/year		172.4	(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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		8792.58	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	10155.43	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2115.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	122.71	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

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warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		0	(331)
Energy for lighting (calculated in Appendix L)			407.59	(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			65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	= 4077.69	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 63.69	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 4141.37	(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) =			4141.37	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 211.54	(379)
Total CO2, kg/year	sum of (376)…(382) =			4352.91	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			85.35	(384)
EI rating (section 14)				42.63	(385)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.3.15

Property Address: Unit 17

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.18	(2a) =	111.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	111.18	(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)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.18	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.18	(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) =	1	(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

1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18

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=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	(24d)

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

(25)m=	1.28	1.25	1.23	1.1	1.08	0.95	0.95	0.93	1	1.08	1.13	1.18	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.8	x1/[1/(1.6)+ 0.04]		=	7.22			(27)
Windows Type 2			4.32	x1/[1/(4.8)+ 0.04]		=	17.4			(27)
Floor			51	x	0.97	=	49.47			(28)
Walls Type1	39.2	4.32	34.88	x	2.1	=	73.25			(29)
Walls Type2	10.99	6.7	4.29	x	2.1	=	9.01			(29)
Total area of elements, m²			101.19							(31)
Party wall			16.1	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 159 (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: High 450 (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 15.2 (36)

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

Total fabric heat loss (33) + (36) = 174.2 (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=	46.91	45.99	45.08	40.48	39.56	35	35	34.13	36.8	39.56	41.4	43.24	(38)

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

(39)m=	221.12	220.2	219.28	214.68	213.76	209.2	209.2	208.33	211	213.76	215.6	217.44	

Average = Sum(39)$_{1…12}$ /12= 214.46 (39)

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

(40)m=	4.34	4.32	4.3	4.21	4.19	4.1	4.1	4.08	4.14	4.19	4.23	4.26

Average = Sum(40)$_{1…12}$ /12= 4.21 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54

Total = Sum(44)$_{1…12}$ = 900.48 (44)

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

(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55

Total = Sum(45)$_{1…12}$ = 1180.67 (45)

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

(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

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

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

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

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(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=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.02	20.44	16.63	12.59	9.41	7.94	8.58	11.16	14.98	19.01	22.19	23.66	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)
Water heating gains (Table 5)													
(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	301.36	298.61	287.27	270	253.12	237.28	227.51	233.4	242.87	260.31	279.74	293.66	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.32	x	10.63	x	0.85	x	0.7	=	18.94	(74)
North	0.9x	0.77	x	4.32	x	20.32	x	0.85	x	0.7	=	36.2	(74)
North	0.9x	0.77	x	4.32	x	34.53	x	0.85	x	0.7	=	61.51	(74)
North	0.9x	0.77	x	4.32	x	55.46	x	0.85	x	0.7	=	98.8	(74)
North	0.9x	0.77	x	4.32	x	74.72	x	0.85	x	0.7	=	133.09	(74)

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North	0.9x	0.77	x	4.32	x	79.99	x	0.85	x	0.7	=	142.48	(74)
North	0.9x	0.77	x	4.32	x	74.68	x	0.85	x	0.7	=	133.02	(74)
North	0.9x	0.77	x	4.32	x	59.25	x	0.85	x	0.7	=	105.53	(74)
North	0.9x	0.77	x	4.32	x	41.52	x	0.85	x	0.7	=	73.95	(74)
North	0.9x	0.77	x	4.32	x	24.19	x	0.85	x	0.7	=	43.09	(74)
North	0.9x	0.77	x	4.32	x	13.12	x	0.85	x	0.7	=	23.37	(74)
North	0.9x	0.77	x	4.32	x	8.86	x	0.85	x	0.7	=	15.79	(74)
South	0.9x	0.77	x	4.8	x	46.75	x	0.76	x	0.7	=	82.73	(78)
South	0.9x	0.77	x	4.8	x	76.57	x	0.76	x	0.7	=	135.5	(78)
South	0.9x	0.77	x	4.8	x	97.53	x	0.76	x	0.7	=	172.6	(78)
South	0.9x	0.77	x	4.8	x	110.23	x	0.76	x	0.7	=	195.08	(78)
South	0.9x	0.77	x	4.8	x	114.87	x	0.76	x	0.7	=	203.28	(78)
South	0.9x	0.77	x	4.8	x	110.55	x	0.76	x	0.7	=	195.63	(78)
South	0.9x	0.77	x	4.8	x	108.01	x	0.76	x	0.7	=	191.14	(78)
South	0.9x	0.77	x	4.8	x	104.89	x	0.76	x	0.7	=	185.63	(78)
South	0.9x	0.77	x	4.8	x	101.89	x	0.76	x	0.7	=	180.3	(78)
South	0.9x	0.77	x	4.8	x	82.59	x	0.76	x	0.7	=	146.15	(78)
South	0.9x	0.77	x	4.8	x	55.42	x	0.76	x	0.7	=	98.07	(78)
South	0.9x	0.77	x	4.8	x	40.4	x	0.76	x	0.7	=	71.49	(78)

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

(83)m=	101.68	171.7	234.11	293.87	336.37	338.11	324.16	291.16	254.25	189.24	121.43	87.28	(83)

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

(84)m=	403.04	470.31	521.38	563.87	589.49	575.39	551.67	524.56	497.12	449.55	401.17	380.95	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.98	0.95	0.9	0.92	0.97	0.99	1	1	(86)

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

(87)m=	18.26	18.44	18.78	19.29	19.81	20.33	20.64	20.6	20.18	19.5	18.82	18.26	(87)

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

(88)m=	18.83	18.84	18.85	18.9	18.9	18.95	18.95	18.96	18.93	18.9	18.89	18.87	(88)

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

(89)m=	1	1	0.99	0.99	0.96	0.89	0.71	0.76	0.94	0.99	1	1	(89)

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

(90)m=	16.49	16.67	17.02	17.56	18.09	18.61	18.86	18.84	18.46	17.78	17.09	16.52	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	17.33	17.51	17.85	18.37	18.9	19.42	19.7	19.67	19.27	18.6	17.91	17.34	(92)

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

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(93)m=	17.33	17.51	17.85	18.37	18.9	19.42	19.7	19.67	19.27	18.6	17.91	17.34	(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=	1	1	0.99	0.98	0.96	0.91	0.81	0.84	0.95	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	401.93	468.15	517.2	554.91	568.37	525.13	446.54	441.04	470.71	443.39	399.39	380.09	(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=	2880.84	2775.86	2489.34	2033.99	1539.48	1009.14	649.23	681.51	1091.59	1709.24	2329.82	2857.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1844.31	1550.78	1467.27	1064.94	722.5	0	0	0	0	941.79	1389.91	1842.98	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 10824.48 (98)

Space heating requirement in kWh/m²/year 212.24 (99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		10824.48	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	12502.28	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2115.39	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	146.18	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

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warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				406.51	(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			65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	4857.56	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	75.87	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	4933.43	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			4933.43	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	210.98	(379)
Total CO2, kg/year	sum of (376)…(382) =			5144.41	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			100.87	(384)
EI rating (section 14)				35.74	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 18

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	79	(1a) x	2.6	(2a) =	205.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.4	(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) =	0.1	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		20	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	1.1	(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) =	1.02	(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

1.29	1.27	1.24	1.12	1.09	0.96	0.96	0.94	1.02	1.09	1.14	1.19

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=	1.29	1.27	1.24	1.12	1.09	0.96	0.96	0.94	1.02	1.09	1.14	1.19	(24d)

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

(25)m=	1.29	1.27	1.24	1.12	1.09	0.96	0.96	0.94	1.02	1.09	1.14	1.19	(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			1.6	x	1.4	=	2.24			(26)
Windows Type 1			11.64	x1/[1/(4.8)+ 0.04]		=	46.87			(27)
Windows Type 2			4.55	x1/[1/(4.8)+ 0.04]		=	18.32			(27)
Walls Type1	89.2	16.19	73.01	x	1.27	=	92.87			(29)
Walls Type2	26.63	1.6	25.03	x	2.1	=	52.56			(29)
Total area of elements, m²			115.83							(31)
Party wall			5.3	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 212.86 (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: High 450 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 24.8 (36)

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

Total fabric heat loss (33) + (36) = 237.66 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	87.72	86	84.28	75.68	73.96	65.41	65.41	63.77	68.8	73.96	77.4	80.84	(38)

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

(39)m=	325.39	323.67	321.95	313.35	311.63	303.07	303.07	301.43	306.47	311.63	315.07	318.51	

Average = Sum(39)$_{1…12}$ /12= 312.93 (39)

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

(40)m=	4.12	4.1	4.08	3.97	3.94	3.84	3.84	3.82	3.88	3.94	3.99	4.03

Average = Sum(40)$_{1…12}$ /12= 3.96 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.24 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.46	97.77	94.08	90.39	86.7	83.01	83.01	86.7	90.39	94.08	97.77	101.46	
										Total = Sum(44)$_{1…12}$ =		1106.83	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	150.46	131.59	135.79	118.39	113.6	98.02	90.83	104.23	105.48	122.93	134.18	145.71	
										Total = Sum(45)$_{1…12}$ =		1451.23	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.57	19.74	20.37	17.76	17.04	14.7	13.63	15.64	15.82	18.44	20.13	21.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	205.74	181.52	191.07	171.88	168.87	151.52	146.11	159.51	158.97	178.2	187.68	200.99	(62)

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

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

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

Output from water heater

(64)m=	205.74	181.52	191.07	171.88	168.87	151.52	146.11	159.51	158.97	178.2	187.68	200.99	

Output from water heater (annual)$_{1...12}$ 2102.07 (64)

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

(65)m=	68.64	60.56	63.76	57.37	56.38	50.6	48.81	53.27	53.08	59.48	62.63	67.06	(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=	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	(66)

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

(67)m=	32.94	29.26	23.79	18.01	13.46	11.37	12.28	15.97	21.43	27.21	31.76	33.85	(67)

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

(68)m=	217.34	219.59	213.91	201.81	186.54	172.18	162.59	160.34	166.02	178.12	193.39	207.75	(68)

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

(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	(71)

Water heating gains (Table 5)

(72)m=	92.26	90.13	85.7	79.69	75.78	70.28	65.61	71.6	73.72	79.95	86.98	90.13	(72)

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

(73)m=	402.19	398.63	383.06	359.16	335.44	313.49	300.14	307.56	320.83	344.93	371.79	391.39	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.55	x	10.63	x	0.85	x	0.7	=	19.95	(74)
North	0.9x	0.77	x	4.55	x	20.32	x	0.85	x	0.7	=	38.12	(74)
North	0.9x	0.77	x	4.55	x	34.53	x	0.85	x	0.7	=	64.78	(74)
North	0.9x	0.77	x	4.55	x	55.46	x	0.85	x	0.7	=	104.06	(74)
North	0.9x	0.77	x	4.55	x	74.72	x	0.85	x	0.7	=	140.18	(74)

North	0.9x	0.77	x	4.55	x	79.99	x	0.85	x	0.7	=	150.06	(74)
North	0.9x	0.77	x	4.55	x	74.68	x	0.85	x	0.7	=	140.1	(74)
North	0.9x	0.77	x	4.55	x	59.25	x	0.85	x	0.7	=	111.15	(74)
North	0.9x	0.77	x	4.55	x	41.52	x	0.85	x	0.7	=	77.89	(74)
North	0.9x	0.77	x	4.55	x	24.19	x	0.85	x	0.7	=	45.38	(74)
North	0.9x	0.77	x	4.55	x	13.12	x	0.85	x	0.7	=	24.61	(74)
North	0.9x	0.77	x	4.55	x	8.86	x	0.85	x	0.7	=	16.63	(74)
South	0.9x	0.77	x	11.64	x	46.75	x	0.85	x	0.7	=	224.39	(78)
South	0.9x	0.77	x	11.64	x	76.57	x	0.85	x	0.7	=	367.49	(78)
South	0.9x	0.77	x	11.64	x	97.53	x	0.85	x	0.7	=	468.12	(78)
South	0.9x	0.77	x	11.64	x	110.23	x	0.85	x	0.7	=	529.08	(78)
South	0.9x	0.77	x	11.64	x	114.87	x	0.85	x	0.7	=	551.33	(78)
South	0.9x	0.77	x	11.64	x	110.55	x	0.85	x	0.7	=	530.58	(78)
South	0.9x	0.77	x	11.64	x	108.01	x	0.85	x	0.7	=	518.41	(78)
South	0.9x	0.77	x	11.64	x	104.89	x	0.85	x	0.7	=	503.45	(78)
South	0.9x	0.77	x	11.64	x	101.89	x	0.85	x	0.7	=	489.01	(78)
South	0.9x	0.77	x	11.64	x	82.59	x	0.85	x	0.7	=	396.38	(78)
South	0.9x	0.77	x	11.64	x	55.42	x	0.85	x	0.7	=	265.98	(78)
South	0.9x	0.77	x	11.64	x	40.4	x	0.85	x	0.7	=	193.89	(78)

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

(83)m=	244.34	405.62	532.9	633.14	691.51	680.65	658.51	614.6	566.9	441.76	290.59	210.52	(83)

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

(84)m=	646.53	804.25	915.96	992.3	1026.95	994.13	958.65	922.16	887.73	786.69	662.37	601.92	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.99	0.97	0.94	0.87	0.89	0.96	0.99	1	1	(86)

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

(87)m=	18.38	18.58	18.94	19.44	19.95	20.44	20.72	20.68	20.3	19.63	18.94	18.38	(87)

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

(88)m=	18.94	18.95	18.96	19.02	19.03	19.08	19.08	19.09	19.06	19.03	19.01	18.98	(88)

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

(89)m=	1	1	0.99	0.98	0.95	0.86	0.66	0.71	0.91	0.98	1	1	(89)

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

(90)m=	16.69	16.9	17.26	17.8	18.3	18.8	19.02	19	18.66	18	17.3	16.72	(90)

fLA = Living area ÷ (4) = | 0.28 | (91)

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

(92)m=	17.15	17.36	17.72	18.25	18.76	19.25	19.49	19.47	19.11	18.45	17.75	17.18	(92)

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

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(93)m=	17.15	17.36	17.72	18.25	18.76	19.25	19.49	19.47	19.11	18.45	17.75	17.18	(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=	1	0.99	0.99	0.98	0.95	0.87	0.72	0.76	0.92	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	644.59	799.41	905.44	969.19	973.44	868.03	694.41	702.66	813.49	770.92	658.83	600.52	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	4182.76	4033.88	3612.68	2930.74	2199	1410.02	874.6	924.55	1536.9	2446.33	3355.66	4133.94	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	2632.4	2173.56	2014.19	1412.31	911.82	0	0	0	0	1246.5	1941.71	2628.87	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 14961.36 (98)

Space heating requirement in kWh/m²/year 189.38 (99)

9b. Energy requirements – Community heating scheme

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

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

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

Fraction of heat from Community 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		1.05	(305)
Distribution loss factor (Table 12c) for community heating system		1.1	(306)
Space heating		**kWh/year**	
Annual space heating requirement		14961.36	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	17280.37	(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		2102.07	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2427.89	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	197.08	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				581.71	(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			65	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	6549.21	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	102.29	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	6651.49	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			6651.49	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	301.91	(379)
Total CO2, kg/year	sum of (376)…(382) =			6953.4	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			88.02	(384)
EI rating (section 14)				33.87	(385)

Appendix B - SAP outputs for the 'Be Lean' stage

The DER outputs from the FSAP modelling of the proposed development with the upgraded fabric and building services systems were used to calculate the 'Be Lean' stage CO_2 emissions of the development.

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 1

Address : , london, NW3 4PB

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	33	(1a) x	2.25	(2a) =	74.25	(3a)
Ground floor	19	(1b) x	1.65	(2b) =	31.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	105.6	(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) =	0.19	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.69	(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) =	0.64	(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

(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

0.81	0.8	0.78	0.7	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75

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=	0.83	0.82	0.81	0.75	0.73	0.68	0.68	0.67	0.7	0.73	0.76	0.78	(24d)

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

(25)m=	0.83	0.82	0.81	0.75	0.73	0.68	0.68	0.67	0.7	0.73	0.76	0.78	(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 Type 1			7.3	x	1.4	=	10.22			(26)
Doors Type 2			4.3	x	1.4	=	6.02			(26)
Windows Type 1			1.6	x1/[1/(2.1)+ 0.04]		=	3.1			(27)
Windows Type 2			1.97	x1/[1/(2.1)+ 0.04]		=	3.82			(27)
Floor			34.3	x	0.22	=	7.546			(28)
Walls Type1	29.4	15.17	14.23	x	0.28	=	3.98			(29)
Walls Type2	44.1	0	44.1	x	0.28	=	12.35			(29)
Roof	19	0	19	x	0.16	=	3.04			(30)
Total area of elements, m²			126.8							(31)
Party wall			14.9	x	0	=	0			(32)

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.07 (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: High 450 (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 (36)

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

Total fabric heat loss (33) + (36) = 70.07 (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=	28.94	28.49	28.06	26	25.61	23.82	23.82	23.49	24.51	25.61	26.39	27.21	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	99.02	98.57	98.13	96.07	95.69	93.89	93.89	93.56	94.58	95.69	96.47	97.28	

Average = Sum(39)$_{1…12}$ /12= 96.07 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.9	1.9	1.89	1.85	1.84	1.81	1.81	1.8	1.82	1.84	1.86	1.87	

Average = Sum(40)$_{1…12}$ /12= 1.85 (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 1.75 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.74 (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=	83.31	80.28	77.26	74.23	71.2	68.17	68.17	71.2	74.23	77.26	80.28	83.31	

Total = Sum(44)$_{1…12}$ = 908.89 (44)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	123.55	108.06	111.51	97.22	93.28	80.49	74.59	85.59	86.62	100.94	110.19	119.65	

Total = Sum(45)$_{1…12}$ = 1191.69 (45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.53	16.21	16.73	14.58	13.99	12.07	11.19	12.84	12.99	15.14	16.53	17.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	178.83	157.99	166.79	150.71	148.56	133.99	129.87	140.87	140.11	156.22	163.68	174.93	(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=	178.83	157.99	166.79	150.71	148.56	133.99	129.87	140.87	140.11	156.22	163.68	174.93	

Output from water heater (annual)$_{1...12}$ | 1842.53 | (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=	59.69	52.74	55.69	50.33	49.63	44.77	43.41	47.07	46.81	52.17	54.65	58.4	(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=	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	(66)

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

(67)m=	16.66	14.8	12.03	9.11	6.81	5.75	6.21	8.08	10.84	13.76	16.06	17.12	(67)

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

(68)m=	152.43	154.01	150.02	141.54	130.83	120.76	114.03	112.45	116.44	124.92	135.63	145.7	(68)

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

(69)m=	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	(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=	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	(71)

Water heating gains (Table 5)

(72)m=	80.23	78.48	74.85	69.91	66.7	62.19	58.35	63.27	65.01	70.12	75.9	78.49	(72)

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

(73)m=	298.55	296.52	286.14	269.79	253.57	237.93	227.83	233.03	241.52	258.05	276.83	290.55	(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	1.97	x	10.63	x	0.76	x	0.7	=	7.72	(74)
North	0.9x	0.77	x	1.97	x	20.32	x	0.76	x	0.7	=	14.76	(74)
North	0.9x	0.77	x	1.97	x	34.53	x	0.76	x	0.7	=	25.08	(74)
North	0.9x	0.77	x	1.97	x	55.46	x	0.76	x	0.7	=	40.28	(74)
North	0.9x	0.77	x	1.97	x	74.72	x	0.76	x	0.7	=	54.27	(74)
North	0.9x	0.77	x	1.97	x	79.99	x	0.76	x	0.7	=	58.09	(74)
North	0.9x	0.77	x	1.97	x	74.68	x	0.76	x	0.7	=	54.24	(74)
North	0.9x	0.77	x	1.97	x	59.25	x	0.76	x	0.7	=	43.03	(74)
North	0.9x	0.77	x	1.97	x	41.52	x	0.76	x	0.7	=	30.15	(74)
North	0.9x	0.77	x	1.97	x	24.19	x	0.76	x	0.7	=	17.57	(74)
North	0.9x	0.77	x	1.97	x	13.12	x	0.76	x	0.7	=	9.53	(74)
North	0.9x	0.77	x	1.97	x	8.86	x	0.76	x	0.7	=	6.44	(74)
South	0.9x	0.77	x	1.6	x	46.75	x	0.76	x	0.7	=	27.58	(78)
South	0.9x	0.77	x	1.6	x	76.57	x	0.76	x	0.7	=	45.17	(78)
South	0.9x	0.77	x	1.6	x	97.53	x	0.76	x	0.7	=	57.53	(78)
South	0.9x	0.77	x	1.6	x	110.23	x	0.76	x	0.7	=	65.03	(78)
South	0.9x	0.77	x	1.6	x	114.87	x	0.76	x	0.7	=	67.76	(78)
South	0.9x	0.77	x	1.6	x	110.55	x	0.76	x	0.7	=	65.21	(78)
South	0.9x	0.77	x	1.6	x	108.01	x	0.76	x	0.7	=	63.71	(78)
South	0.9x	0.77	x	1.6	x	104.89	x	0.76	x	0.7	=	61.88	(78)
South	0.9x	0.77	x	1.6	x	101.89	x	0.76	x	0.7	=	60.1	(78)
South	0.9x	0.77	x	1.6	x	82.59	x	0.76	x	0.7	=	48.72	(78)
South	0.9x	0.77	x	1.6	x	55.42	x	0.76	x	0.7	=	32.69	(78)
South	0.9x	0.77	x	1.6	x	40.4	x	0.76	x	0.7	=	23.83	(78)

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

(83)m=	35.3	59.92	82.61	105.31	122.03	123.3	117.95	104.91	90.25	66.28	42.22	30.27	(83)

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

(84)m=	333.85	356.45	368.75	375.1	375.6	361.23	345.78	337.93	331.78	324.33	319.05	320.82	(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	1	1	1	0.98	0.91	0.93	0.99	1	1	1	(86)

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

(87)m=	19.65	19.74	19.92	20.19	20.47	20.74	20.9	20.88	20.67	20.31	19.95	19.65	(87)

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

(88)m=	19.4	19.4	19.41	19.44	19.44	19.47	19.47	19.47	19.46	19.44	19.43	19.42	(88)

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

(89)m=	1	1	1	1	0.99	0.93	0.73	0.77	0.97	1	1	1	(89)

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

(90)m=	17.66	17.8	18.06	18.48	18.89	19.28	19.44	19.43	19.18	18.66	18.12	17.68	(90)

fLA = Living area ÷ (4) = 0.66 (91)

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

(92)m=	18.98	19.08	19.29	19.61	19.93	20.25	20.4	20.39	20.16	19.75	19.33	18.98	(92)

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

(93)m=	18.98	19.08	19.29	19.61	19.93	20.25	20.4	20.39	20.16	19.75	19.33	18.98	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	1	1	0.99	0.96	0.86	0.89	0.98	1	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	333.76	356.28	368.41	374.18	372.3	346.74	298.09	300.02	324.98	323.49	318.87	320.75	(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=	1453.12	1397.82	1255.08	1028.73	787.57	530.19	357.02	373.04	573.05	875.26	1179.74	1438.11	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	832.81	699.91	659.68	471.27	308.96	0	0	0	0	410.52	619.82	831.32	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 4834.29 (98)

Space heating requirement in kWh/m²/year 92.97 (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 4834.29

Space heat from Community boilers (98) x (304a) x (305) x (306) = 5076.01 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1842.53

If DHW from community scheme:

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Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1934.66	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	70.11	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		294.24	(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				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	1682.56	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	36.39	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1718.95	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1718.95	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	152.71	(379)
Total CO2, kg/year	sum of (376)…(382) =				1871.66	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				35.99	(384)
EI rating (section 14)					74.14	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 2

Address : , London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	55	(1a) x	2.17	(2a) =	119.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	119.35	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.67	(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) =	0.57	(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

0.72	0.71	0.7	0.62	0.61	0.54	0.54	0.52	0.57	0.61	0.64	0.67

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=	0.76	0.75	0.74	0.69	0.69	0.65	0.65	0.64	0.66	0.69	0.7	0.72	(24d)

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

(25)m=	0.76	0.75	0.74	0.69	0.69	0.65	0.65	0.64	0.66	0.69	0.7	0.72	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			9.03	x1/[1/(1.6)+ 0.04]		=	13.58			(27)
Windows Type 2			1.82	x1/[1/(4.8)+ 0.04]		=	7.33			(27)
Windows Type 3			0.87	x1/[1/(4.8)+ 0.04]		=	3.5			(27)
Floor			55	x	0.93	=	51.15			(28)
Walls Type1	28.9	10.85	18.05	x	2.1	=	37.9			(29)
Walls Type2	7.81	2.77	5.04	x	2.1	=	10.58			(29)
Total area of elements, m²			91.71							(31)
Party wall			27.9	x	0	=	0			(32)
Party wall			1.13	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 126.71 (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: High 450 (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 14.4 (36)

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

Total fabric heat loss (33) + (36) = 141.11 (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=	30	29.6	29.21	27.37	27.02	25.42	25.42	25.12	26.03	27.02	27.72	28.45	(38)

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

(39)m=	171.11	170.71	170.32	168.48	168.13	166.53	166.53	166.23	167.14	168.13	168.83	169.56	

Average = Sum(39)1…12 /12= 168.47 (39)

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

(40)m=	3.11	3.1	3.1	3.06	3.06	3.03	3.03	3.02	3.04	3.06	3.07	3.08	

Average = Sum(40)1…12 /12= 3.06 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.84 (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 77.84 (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=	85.62	82.51	79.39	76.28	73.17	70.05	70.05	73.17	76.28	79.39	82.51	85.62	

Total = Sum(44)1…12 = 934.05 (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=	126.97	111.05	114.6	99.91	95.86	82.72	76.65	87.96	89.01	103.74	113.24	122.97	

Total = Sum(45)1…12 = 1224.68 (45)

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

(46)m=	19.05	16.66	17.19	14.99	14.38	12.41	11.5	13.19	13.35	15.56	16.99	18.45	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24	(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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24

Output from water heater (annual)$_{1...12}$ | 1875.52 | (64)

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

(65)m=	60.83	53.73	56.71	51.23	50.48	45.51	44.1	47.86	47.61	53.1	55.66	59.5	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	(66)

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

(67)m=	14.29	12.69	10.32	7.81	5.84	4.93	5.33	6.93	9.29	11.8	13.77	14.68	(67)

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

(68)m=	160.19	161.85	157.66	148.74	137.49	126.91	119.84	118.18	122.36	131.28	142.54	153.12	(68)

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

(69)m=	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	(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=	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	(71)

Water heating gains (Table 5)

(72)m=	81.76	79.96	76.23	71.15	67.86	63.22	59.27	64.32	66.12	71.37	77.31	79.97	(72)

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

(73)m=	306.79	305.06	294.77	278.27	261.74	245.61	235	239.99	248.34	265.02	284.18	298.33	(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)	
North	0.9x	0.77	x	1.82	x	10.63	x	0.85	x	0.7	=	7.98	(74)
North	0.9x	0.77	x	0.87	x	10.63	x	0.85	x	0.7	=	3.81	(74)

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North	0.9x	0.77	x	1.82	x	20.32	x	0.85	x	0.7	=	15.25	(74)
North	0.9x	0.77	x	0.87	x	20.32	x	0.85	x	0.7	=	7.29	(74)
North	0.9x	0.77	x	1.82	x	34.53	x	0.85	x	0.7	=	25.91	(74)
North	0.9x	0.77	x	0.87	x	34.53	x	0.85	x	0.7	=	12.39	(74)
North	0.9x	0.77	x	1.82	x	55.46	x	0.85	x	0.7	=	41.62	(74)
North	0.9x	0.77	x	0.87	x	55.46	x	0.85	x	0.7	=	19.9	(74)
North	0.9x	0.77	x	1.82	x	74.72	x	0.85	x	0.7	=	56.07	(74)
North	0.9x	0.77	x	0.87	x	74.72	x	0.85	x	0.7	=	26.8	(74)
North	0.9x	0.77	x	1.82	x	79.99	x	0.85	x	0.7	=	60.02	(74)
North	0.9x	0.77	x	0.87	x	79.99	x	0.85	x	0.7	=	28.69	(74)
North	0.9x	0.77	x	1.82	x	74.68	x	0.85	x	0.7	=	56.04	(74)
North	0.9x	0.77	x	0.87	x	74.68	x	0.85	x	0.7	=	26.79	(74)
North	0.9x	0.77	x	1.82	x	59.25	x	0.85	x	0.7	=	44.46	(74)
North	0.9x	0.77	x	0.87	x	59.25	x	0.85	x	0.7	=	21.25	(74)
North	0.9x	0.77	x	1.82	x	41.52	x	0.85	x	0.7	=	31.16	(74)
North	0.9x	0.77	x	0.87	x	41.52	x	0.85	x	0.7	=	14.89	(74)
North	0.9x	0.77	x	1.82	x	24.19	x	0.85	x	0.7	=	18.15	(74)
North	0.9x	0.77	x	0.87	x	24.19	x	0.85	x	0.7	=	8.68	(74)
North	0.9x	0.77	x	1.82	x	13.12	x	0.85	x	0.7	=	9.84	(74)
North	0.9x	0.77	x	0.87	x	13.12	x	0.85	x	0.7	=	4.71	(74)
North	0.9x	0.77	x	1.82	x	8.86	x	0.85	x	0.7	=	6.65	(74)
North	0.9x	0.77	x	0.87	x	8.86	x	0.85	x	0.7	=	3.18	(74)
South	0.9x	0.77	x	9.03	x	46.75	x	0.76	x	0.7	=	155.64	(78)
South	0.9x	0.77	x	9.03	x	76.57	x	0.76	x	0.7	=	254.91	(78)
South	0.9x	0.77	x	9.03	x	97.53	x	0.76	x	0.7	=	324.7	(78)
South	0.9x	0.77	x	9.03	x	110.23	x	0.76	x	0.7	=	366.99	(78)
South	0.9x	0.77	x	9.03	x	114.87	x	0.76	x	0.7	=	382.42	(78)
South	0.9x	0.77	x	9.03	x	110.55	x	0.76	x	0.7	=	368.03	(78)
South	0.9x	0.77	x	9.03	x	108.01	x	0.76	x	0.7	=	359.59	(78)
South	0.9x	0.77	x	9.03	x	104.89	x	0.76	x	0.7	=	349.21	(78)
South	0.9x	0.77	x	9.03	x	101.89	x	0.76	x	0.7	=	339.19	(78)
South	0.9x	0.77	x	9.03	x	82.59	x	0.76	x	0.7	=	274.94	(78)
South	0.9x	0.77	x	9.03	x	55.42	x	0.76	x	0.7	=	184.49	(78)
South	0.9x	0.77	x	9.03	x	40.4	x	0.76	x	0.7	=	134.49	(78)

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

(83)m=	167.44	277.44	363	428.51	465.3	456.75	442.42	414.92	385.24	301.77	199.04	144.32	(83)

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

(84)m=	474.23	582.5	657.77	706.77	727.04	702.36	677.41	654.91	633.58	566.79	483.22	442.65	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	1	1	0.99	0.99	0.97	0.92	0.82	0.85	0.95	0.99	1	1	(86)

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

(87)m=	18.95	19.14	19.44	19.84	20.26	20.64	20.85	20.82	20.52	19.98	19.39	18.93	(87)

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

(88)m=	18.7	18.7	18.7	18.72	18.72	18.74	18.74	18.74	18.73	18.72	18.72	18.71	(88)

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

(89)m=	1	1	0.99	0.98	0.93	0.78	0.5	0.56	0.86	0.98	1	1	(89)

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

(90)m=	16.19	16.47	16.91	17.5	18.08	18.56	18.72	18.71	18.44	17.7	16.85	16.17	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	17.71	17.93	18.3	18.79	19.28	19.7	19.89	19.87	19.58	18.95	18.25	17.68	(92)

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

(93)m=	17.71	17.93	18.3	18.79	19.28	19.7	19.89	19.87	19.58	18.95	18.25	17.68	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.98	0.94	0.86	0.7	0.74	0.91	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	473.09	579.42	650.56	689.72	685.51	602.12	473.11	482.39	574.15	555.11	480.92	441.84	(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=	2294.53	2224.91	2009.32	1665.79	1274.13	849.16	547.18	576.24	916.65	1403.57	1881.75	2286.19	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1355.15	1105.77	1010.92	702.77	437.93	0	0	0	0	631.26	1008.6	1372.2	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 7624.6 (98)

Space heating requirement in kWh/m²/year 138.63 (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 7624.6

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	8005.83	(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		1875.52	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1969.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	99.75	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		252.32	(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				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	2394.03	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	51.77	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	2445.8	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				2445.8	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	130.95	(379)
Total CO2, kg/year	sum of (376)…(382) =				2576.75	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				46.85	(384)
EI rating (section 14)					65.47	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 3

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.17	(2a) =	110.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	110.67	(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)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.18	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.68	(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) =	0.53	(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

0.67	0.66	0.65	0.58	0.57	0.5	0.5	0.49	0.53	0.57	0.59	0.62

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=	0.73	0.72	0.71	0.67	0.66	0.63	0.63	0.62	0.64	0.66	0.68	0.69	(24d)

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

(25)m=	0.73	0.72	0.71	0.67	0.66	0.63	0.63	0.62	0.64	0.66	0.68	0.69	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			9.03	x1/[1/(1.6)+ 0.04]		=	13.58			(27)
Windows Type 2			2.89	x1/[1/(4.8)+ 0.04]		=	11.64			(27)
Floor			51	x	0.99	=	50.49			(28)
Walls Type1	16.14	9.03	7.11	x	2.1	=	14.93			(29)
Walls Type2	16.1	4.79	11.31	x	2.1	=	23.75			(29)
Total area of elements, m²			83.24							(31)
Party wall			33.3	x	0	=	0			(32)

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** 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) = 117.05 (33)

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

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: High 450 (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 12.8 (36)

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

Total fabric heat loss (33) + (36) = 129.85 (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=	26.52	26.2	25.89	24.41	24.13	22.85	22.85	22.61	23.34	24.13	24.69	25.28	(38)

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

(39)m=	156.37	156.05	155.74	154.26	153.98	152.7	152.7	152.46	153.19	153.98	154.54	155.13	

Average = $Sum(39)_{1…12}$ /12= 154.26 (39)

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

(40)m=	3.07	3.06	3.05	3.02	3.02	2.99	2.99	2.99	3	3.02	3.03	3.04	

Average = Sum(40)$_{1…12}$ /12= 3.02 (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 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	

Total = Sum(44)$_{1…12}$ = 900.48 (44)

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

(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55	

Total = Sum(45)$_{1…12}$ = 1180.67 (45)

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

(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

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

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

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

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

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

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(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=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.36	11.86	9.65	7.3	5.46	4.61	4.98	6.47	8.69	11.03	12.88	13.73	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)
Water heating gains (Table 5)													
(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	291.7	290.03	280.3	264.72	249.17	233.95	223.91	228.72	236.58	252.33	270.42	283.74	(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	2.89	x	10.63	x	0.85	x	0.7	=	12.67	(74)
North	0.9x	0.77	x	2.89	x	20.32	x	0.85	x	0.7	=	24.22	(74)
North	0.9x	0.77	x	2.89	x	34.53	x	0.85	x	0.7	=	41.15	(74)
North	0.9x	0.77	x	2.89	x	55.46	x	0.85	x	0.7	=	66.09	(74)
North	0.9x	0.77	x	2.89	x	74.72	x	0.85	x	0.7	=	89.03	(74)

North	0.9x	0.77	x	2.89	x	79.99	x	0.85	x	0.7	=	95.31	(74)
North	0.9x	0.77	x	2.89	x	74.68	x	0.85	x	0.7	=	88.99	(74)
North	0.9x	0.77	x	2.89	x	59.25	x	0.85	x	0.7	=	70.6	(74)
North	0.9x	0.77	x	2.89	x	41.52	x	0.85	x	0.7	=	49.47	(74)
North	0.9x	0.77	x	2.89	x	24.19	x	0.85	x	0.7	=	28.83	(74)
North	0.9x	0.77	x	2.89	x	13.12	x	0.85	x	0.7	=	15.63	(74)
North	0.9x	0.77	x	2.89	x	8.86	x	0.85	x	0.7	=	10.56	(74)
South	0.9x	0.77	x	9.03	x	46.75	x	0.76	x	0.7	=	155.64	(78)
South	0.9x	0.77	x	9.03	x	76.57	x	0.76	x	0.7	=	254.91	(78)
South	0.9x	0.77	x	9.03	x	97.53	x	0.76	x	0.7	=	324.7	(78)
South	0.9x	0.77	x	9.03	x	110.23	x	0.76	x	0.7	=	366.99	(78)
South	0.9x	0.77	x	9.03	x	114.87	x	0.76	x	0.7	=	382.42	(78)
South	0.9x	0.77	x	9.03	x	110.55	x	0.76	x	0.7	=	368.03	(78)
South	0.9x	0.77	x	9.03	x	108.01	x	0.76	x	0.7	=	359.59	(78)
South	0.9x	0.77	x	9.03	x	104.89	x	0.76	x	0.7	=	349.21	(78)
South	0.9x	0.77	x	9.03	x	101.89	x	0.76	x	0.7	=	339.19	(78)
South	0.9x	0.77	x	9.03	x	82.59	x	0.76	x	0.7	=	274.94	(78)
South	0.9x	0.77	x	9.03	x	55.42	x	0.76	x	0.7	=	184.49	(78)
South	0.9x	0.77	x	9.03	x	40.4	x	0.76	x	0.7	=	134.49	(78)

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

(83)m=	168.32	279.12	365.85	433.08	471.46	463.34	448.58	419.81	388.67	303.76	200.12	145.05	(83)

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

(84)m=	460.02	569.15	646.15	697.8	720.62	697.29	672.48	648.53	625.25	556.1	470.55	428.79	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.96	0.9	0.79	0.82	0.94	0.99	1	1	(86)

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

(87)m=	19	19.19	19.5	19.9	20.31	20.67	20.87	20.84	20.56	20.02	19.43	18.97	(87)

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

(88)m=	18.72	18.72	18.72	18.74	18.74	18.75	18.75	18.76	18.75	18.74	18.73	18.73	(88)

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

(89)m=	1	0.99	0.99	0.97	0.92	0.75	0.47	0.53	0.84	0.97	1	1	(89)

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

(90)m=	16.27	16.55	17	17.59	18.16	18.6	18.74	18.73	18.49	17.77	16.92	16.24	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	17.79	18.02	18.38	18.87	19.35	19.75	19.92	19.9	19.64	19.02	18.31	17.76	(92)

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

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(93)m=	17.79	18.02	18.38	18.87	19.35	19.75	19.92	19.9	19.64	19.02	18.31	17.76	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.93	0.84	0.67	0.71	0.89	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	458.76	565.64	637.78	677.73	671.88	582.75	449.14	459.36	557.53	542.67	467.96	427.9	(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=	2108.88	2046.99	1850.88	1538.12	1178.44	786.6	506.95	533.92	848.6	1295.9	1733.15	2102.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1227.68	995.47	902.55	619.48	376.88	0	0	0	0	560.4	910.94	1246.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6839.48 (98)

Space heating requirement in kWh/m²/year 134.11 (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		6839.48	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	7181.45	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1923.08	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	91.05	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

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warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		235.9	(332)

12b. CO_2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	2185.09	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	47.25	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	2232.34	(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) =				2232.34	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	122.43	(379)
Total CO2, kg/year	sum of (376)…(382) =				2354.77	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				46.17	(384)
EI rating (section 14)					67.13	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 4

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.18	(2a) =	111.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	111.18	(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) =	0.18	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.68	(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) =	0.58	(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

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

0.74	0.72	0.71	0.64	0.62	0.55	0.55	0.53	0.58	0.62	0.65	0.68

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=	0.77	0.76	0.75	0.7	0.69	0.65	0.65	0.64	0.67	0.69	0.71	0.73	(24d)

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

(25)m=	0.77	0.76	0.75	0.7	0.69	0.65	0.65	0.64	0.67	0.69	0.71	0.73	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			9.03	x1/[1/(1.6)+ 0.04]		=	13.58			(27)
Windows Type 2			0.39	x1/[1/(4.8)+ 0.04]		=	1.57			(27)
Floor			51	x	0.97	=	49.47			(28)
Walls Type1	39.2	0.39	38.81	x	2.1	=	81.5			(29)
Walls Type2	10.99	10.93	0.06	x	2.1	=	0.13			(29)
Total area of elements, m²			101.19							(31)
Party wall			16.1	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	148.91	(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: High	450	(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		15.2	(36)

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

Total fabric heat loss	(33) + (36) =	164.11	(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=	28.3	27.92	27.54	25.76	25.42	23.87	23.87	23.59	24.47	25.42	26.1	26.8	(38)

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

(39)m=	192.41	192.02	191.64	189.86	189.53	187.98	187.98	187.69	188.58	189.53	190.21	190.91	

Average = Sum(39)$_{1…12}$ /12= 189.86 (39)

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

(40)m=	3.77	3.77	3.76	3.72	3.72	3.69	3.69	3.68	3.7	3.72	3.73	3.74

Average = $Sum(40)_{1...12}$ /12= 3.72 (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 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54

Total = $Sum(44)_{1...12}$ = 900.48 (44)

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

(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55

Total = $Sum(45)_{1...12}$ = 1180.67 (45)

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

(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

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

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

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

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

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

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1\ldots12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(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=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.58	12.06	9.81	7.43	5.55	4.69	5.06	6.58	8.83	11.22	13.09	13.96	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)
Water heating gains (Table 5)													
(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	291.92	290.23	280.46	264.84	249.26	234.02	223.99	228.82	236.72	252.51	270.64	283.96	(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)	
North	0.9x	0.77	x	0.39	x	10.63	x	0.85	x	0.7	=	1.71	(74)
North	0.9x	0.77	x	0.39	x	20.32	x	0.85	x	0.7	=	3.27	(74)
North	0.9x	0.77	x	0.39	x	34.53	x	0.85	x	0.7	=	5.55	(74)
North	0.9x	0.77	x	0.39	x	55.46	x	0.85	x	0.7	=	8.92	(74)
North	0.9x	0.77	x	0.39	x	74.72	x	0.85	x	0.7	=	12.02	(74)

North	0.9x	0.77	x	0.39	x	79.99	x	0.85	x	0.7	=	12.86	(74)
North	0.9x	0.77	x	0.39	x	74.68	x	0.85	x	0.7	=	12.01	(74)
North	0.9x	0.77	x	0.39	x	59.25	x	0.85	x	0.7	=	9.53	(74)
North	0.9x	0.77	x	0.39	x	41.52	x	0.85	x	0.7	=	6.68	(74)
North	0.9x	0.77	x	0.39	x	24.19	x	0.85	x	0.7	=	3.89	(74)
North	0.9x	0.77	x	0.39	x	13.12	x	0.85	x	0.7	=	2.11	(74)
North	0.9x	0.77	x	0.39	x	8.86	x	0.85	x	0.7	=	1.43	(74)
South	0.9x	0.77	x	9.03	x	46.75	x	0.76	x	0.7	=	155.64	(78)
South	0.9x	0.77	x	9.03	x	76.57	x	0.76	x	0.7	=	254.91	(78)
South	0.9x	0.77	x	9.03	x	97.53	x	0.76	x	0.7	=	324.7	(78)
South	0.9x	0.77	x	9.03	x	110.23	x	0.76	x	0.7	=	366.99	(78)
South	0.9x	0.77	x	9.03	x	114.87	x	0.76	x	0.7	=	382.42	(78)
South	0.9x	0.77	x	9.03	x	110.55	x	0.76	x	0.7	=	368.03	(78)
South	0.9x	0.77	x	9.03	x	108.01	x	0.76	x	0.7	=	359.59	(78)
South	0.9x	0.77	x	9.03	x	104.89	x	0.76	x	0.7	=	349.21	(78)
South	0.9x	0.77	x	9.03	x	101.89	x	0.76	x	0.7	=	339.19	(78)
South	0.9x	0.77	x	9.03	x	82.59	x	0.76	x	0.7	=	274.94	(78)
South	0.9x	0.77	x	9.03	x	55.42	x	0.76	x	0.7	=	184.49	(78)
South	0.9x	0.77	x	9.03	x	40.4	x	0.76	x	0.7	=	134.49	(78)

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

(83)m=	157.35	258.17	330.26	375.91	394.44	380.89	371.6	358.74	345.87	278.83	186.6	135.92	(83)

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

(84)m=	449.28	548.4	610.71	640.74	643.7	614.92	595.58	587.56	582.59	531.34	457.24	419.88	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.99	0.98	0.94	0.87	0.89	0.96	0.99	1	1	(86)

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

(87)m=	18.59	18.78	19.1	19.54	20	20.45	20.73	20.7	20.35	19.73	19.08	18.56	(87)

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

(88)m=	18.41	18.42	18.42	18.43	18.43	18.45	18.45	18.45	18.44	18.43	18.43	18.42	(88)

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

(89)m=	1	0.99	0.99	0.98	0.94	0.82	0.54	0.59	0.88	0.98	0.99	1	(89)

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

(90)m=	15.52	15.79	16.27	16.91	17.57	18.17	18.41	18.4	18.04	17.19	16.25	15.48	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	16.97	17.2	17.61	18.15	18.72	19.25	19.51	19.48	19.13	18.39	17.59	16.94	(92)

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

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(93)m=	16.97	17.2	17.61	18.15	18.72	19.25	19.51	19.48	19.13	18.39	17.59	16.94	(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=	1	0.99	0.99	0.98	0.95	0.88	0.73	0.76	0.91	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	447.66	544.53	602.84	625.01	610.66	540.22	435.55	446.46	530.02	518.82	454.23	418.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2437.25	2362.67	2128.76	1757.19	1331.1	873.45	546.37	579.02	949.06	1477.12	1994.9	2431.55	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1480.25	1221.79	1135.28	815.17	536.01	0	0	0	0	712.98	1109.28	1497.58	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	8508.34	(98)
Space heating requirement in kWh/m²/year	166.83	(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		8508.34	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	8933.76	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1923.08	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	108.57	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				239.8	(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			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	= 2605.64	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 56.35	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 2661.99	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			2661.99	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 124.46	(379)
Total CO2, kg/year	sum of (376)…(382) =			2786.44	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			54.64	(384)
EI rating (section 14)				61.04	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 5

Address : , london

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	128	(1a)	x	4.08	(2a)	=	522.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	128	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	522.24	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.06	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.56	(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) =	0.47	(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

0.6	0.59	0.58	0.52	0.51	0.45	0.45	0.44	0.47	0.51	0.53	0.56

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]

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

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)

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]

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
(24d)m=	0.68	0.68	0.67	0.64	0.63	0.6	0.6	0.6	0.61	0.63	0.64	0.65	(24d)
(25)m=	0.68	0.68	0.67	0.64	0.63	0.6	0.6	0.6	0.61	0.63	0.64	0.65	(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 Type 1			2.8	x	1.4	=	3.92			(26)
Doors Type 2			1.5	x	1.4	=	2.1			(26)
Windows Type 1			17.35	x1/[1/(4.8)+ 0.04]		=	69.87			(27)
Windows Type 2			2.48	x1/[1/(1.6)+ 0.04]		=	3.73			(27)
Windows Type 3			1.5	x1/[1/(4.8)+ 0.04]		=	6.04			(27)
Floor			128	x	0.79	=	101.12			(28)
Walls Type1	74.26	18.85	55.41	x	2.1	=	116.36			(29)
Walls Type2	46.4	5.28	41.12	x	0.28	=	11.51			(29)
Walls Type3	71.16	1.5	69.66	x	2.1	=	146.29			(29)
Walls Type4	5.34	0	5.34	x	0.3	=	1.6			(29)
Roof	17	0	17	x	2.3	=	39.1			(30)
Total area of elements, m²			342.16							(31)
Party wall			22.1	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 501.64 (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: High 450 (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 52 (36)

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

Total fabric heat loss (33) + (36) = 553.64 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	117.62	116.4	115.2	109.58	108.53	103.63	103.63	102.72	105.52	108.53	110.65	112.88	(38)

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

(39)m=	671.26	670.04	668.84	663.22	662.16	657.27	657.27	656.36	659.15	662.16	664.29	666.52	

Average = $Sum(39)_{1...12}$ /12= 663.21 (39)

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

(40)m=	5.24	5.23	5.23	5.18	5.17	5.13	5.13	5.13	5.15	5.17	5.19	5.21	

Average = $Sum(40)_{1...12}$ /12= 5.18 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.89 (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) + 36 102.83 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	113.11	109	104.88	100.77	96.66	92.55	92.55	96.66	100.77	104.88	109	113.11	

Total = $Sum(44)_{1...12}$ = 1233.94 (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=	167.74	146.71	151.39	131.98	126.64	109.28	101.27	116.2	117.59	137.04	149.59	162.45	

Total = $Sum(45)_{1...12}$ = 1617.89 (45)

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

(46)m=	25.16	22.01	22.71	19.8	19	16.39	15.19	17.43	17.64	20.56	22.44	24.37	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	223.02	196.63	206.67	185.48	181.92	162.78	156.54	171.48	171.09	192.32	203.09	217.72	(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=	223.02	196.63	206.67	185.48	181.92	162.78	156.54	171.48	171.09	192.32	203.09	217.72	

Output from water heater (annual)$_{1...12}$ | 2268.73 | (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=	74.38	65.59	68.95	61.89	60.72	54.35	52.28	57.25	57.11	64.18	67.75	72.62	(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=	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	144.48	(66)

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

(67)m=	26.77	23.78	19.34	14.64	10.94	9.24	9.98	12.98	17.42	22.12	25.81	27.52	(67)

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

(68)m=	295.29	298.36	290.64	274.2	253.45	233.94	220.91	217.85	225.57	242.01	262.76	282.26	(68)

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

(69)m=	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	37.45	(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=	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	-115.58	(71)

Water heating gains (Table 5)

(72)m=	99.98	97.6	92.67	85.96	81.61	75.48	70.27	76.95	79.32	86.26	94.1	97.61	(72)

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

(73)m=	488.39	486.08	468.99	441.15	412.35	385.01	367.51	374.12	388.65	416.73	449.01	473.74	(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	2.48	x	10.63	x	0.76	x	0.7	=	9.72	(74)
North	0.9x	0.77	x	2.48	x	20.32	x	0.76	x	0.7	=	18.58	(74)
North	0.9x	0.77	x	2.48	x	34.53	x	0.76	x	0.7	=	31.57	(74)
North	0.9x	0.77	x	2.48	x	55.46	x	0.76	x	0.7	=	50.71	(74)
North	0.9x	0.77	x	2.48	x	74.72	x	0.76	x	0.7	=	68.31	(74)
North	0.9x	0.77	x	2.48	x	79.99	x	0.76	x	0.7	=	73.13	(74)
North	0.9x	0.77	x	2.48	x	74.68	x	0.76	x	0.7	=	68.28	(74)
North	0.9x	0.77	x	2.48	x	59.25	x	0.76	x	0.7	=	54.17	(74)
North	0.9x	0.77	x	2.48	x	41.52	x	0.76	x	0.7	=	37.96	(74)
North	0.9x	0.77	x	2.48	x	24.19	x	0.76	x	0.7	=	22.12	(74)
North	0.9x	0.77	x	2.48	x	13.12	x	0.76	x	0.7	=	11.99	(74)
North	0.9x	0.77	x	2.48	x	8.86	x	0.76	x	0.7	=	8.1	(74)
South	0.9x	0.77	x	17.35	x	46.75	x	0.85	x	0.7	=	334.46	(78)
South	0.9x	0.77	x	17.35	x	76.57	x	0.85	x	0.7	=	547.77	(78)
South	0.9x	0.77	x	17.35	x	97.53	x	0.85	x	0.7	=	697.76	(78)
South	0.9x	0.77	x	17.35	x	110.23	x	0.85	x	0.7	=	788.62	(78)
South	0.9x	0.77	x	17.35	x	114.87	x	0.85	x	0.7	=	821.79	(78)
South	0.9x	0.77	x	17.35	x	110.55	x	0.85	x	0.7	=	790.86	(78)
South	0.9x	0.77	x	17.35	x	108.01	x	0.85	x	0.7	=	772.72	(78)
South	0.9x	0.77	x	17.35	x	104.89	x	0.85	x	0.7	=	750.42	(78)
South	0.9x	0.77	x	17.35	x	101.89	x	0.85	x	0.7	=	728.89	(78)
South	0.9x	0.77	x	17.35	x	82.59	x	0.85	x	0.7	=	590.82	(78)
South	0.9x	0.77	x	17.35	x	55.42	x	0.85	x	0.7	=	396.45	(78)
South	0.9x	0.77	x	17.35	x	40.4	x	0.85	x	0.7	=	289.01	(78)
West	0.9x	0.77	x	1.5	x	19.64	x	0.85	x	0.7	=	12.15	(80)
West	0.9x	0.77	x	1.5	x	38.42	x	0.85	x	0.7	=	23.76	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.85	x	0.7	=	39.13	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.85	x	0.7	=	57.08	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.85	x	0.7	=	69.95	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.85	x	0.7	=	71.6	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.85	x	0.7	=	68.17	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.85	x	0.7	=	58.56	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.85	x	0.7	=	45.52	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.85	x	0.7	=	28.2	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.85	x	0.7	=	15.15	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.85	x	0.7	=	9.99	(80)

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

(83)m=	356.33	590.11	768.46	896.41	960.05	935.6	909.17	863.14	812.37	641.13	423.6	307.1	(83)

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

(84)m=	844.72	1076.2	1237.45	1337.55	1372.4	1320.6	1276.68	1237.26	1201.02	1057.86	872.61	780.84	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.98	0.97	0.93	0.94	0.98	0.99	1	1	(86)

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

(87)m=	17.8	18	18.38	18.92	19.51	20.09	20.47	20.42	19.95	19.19	18.41	17.78	(87)

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

(88)m=	18.05	18.05	18.05	18.06	18.06	18.06	18.06	18.06	18.06	18.06	18.05	18.05	(88)

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

(89)m=	1	1	0.99	0.98	0.96	0.88	0.62	0.68	0.92	0.99	1	1	(89)

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

(90)m=	14.26	14.55	15.11	15.9	16.75	17.56	17.98	17.95	17.38	16.29	15.15	14.22	(90)

fLA = Living area ÷ (4) = 0.36 (91)

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

(92)m=	15.54	15.8	16.29	16.99	17.74	18.47	18.88	18.84	18.31	17.33	16.32	15.5	(92)

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

(93)m=	15.54	15.8	16.29	16.99	17.74	18.47	18.88	18.84	18.31	17.33	16.32	15.5	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.98	0.96	0.91	0.78	0.81	0.93	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	842.13	1069.77	1224.12	1310.56	1316.04	1195.18	994.79	1002.17	1120.99	1038.9	867.95	778.91	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	7543.21	7300.23	6549.17	5364.93	4001.2	2543.96	1498.73	1602.18	2772.76	4459.64	6127.76	7534.9	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	4985.6	4186.87	3961.84	2919.14	1997.76	0	0	0	0	2545.03	3787.07	5026.45	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 29409.76 (98)

Space heating requirement in kWh/m²/year — 229.76 (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)

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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		29409.76	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	30880.24	(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		2268.73	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2382.17	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	332.62	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		472.83	(332)

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12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	7982.98	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	172.63	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	8155.61	(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) =				8155.61	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	245.4	(379)
Total CO2, kg/year	sum of (376)…(382) =				8401.01	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				65.63	(384)
EI rating (section 14)					39.8	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 6

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	247	(1a) x	4.09	(2a) =	1010.23	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	247	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	1010.23	(5)

2. Ventilation rate:

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

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.04	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.54	(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) =	0.5	(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

0.64	0.62	0.61	0.55	0.54	0.47	0.47	0.46	0.5	0.54	0.56	0.59

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=	0.7	0.69	0.69	0.65	0.64	0.61	0.61	0.61	0.62	0.64	0.66	0.67	(24d)

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

(25)m=	0.7	0.69	0.69	0.65	0.64	0.61	0.61	0.61	0.62	0.64	0.66	0.67	(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 Type 1			13.1	x	3	=	39.3			(26)
Doors Type 2			13.1	x	3	=	39.3			(26)
Doors Type 3			13.1	x	3	=	39.3			(26)
Doors Type 4			2.5	x	1.4	=	3.5			(26)
Windows Type 1			17.22	x1/[1/(4.8)+ 0.04]		=	69.34			(27)
Windows Type 2			0.6	x1/[1/(4.8)+ 0.04]		=	2.42			(27)
Windows Type 3			6	x1/[1/(4.8)+ 0.04]		=	24.16			(27)
Walls Type1	102.6	63.12	39.48	x	2.1	=	82.91			(29)
Walls Type2	54.8	0	54.8	x	0.28	=	15.34			(29)
Walls Type3	43.56	2.5	41.06	x	2.1	=	86.23			(29)
Walls Type4	15.05	0	15.05	x	0.3	=	4.52			(29)
Roof	85.21	0	85.21	x	2.3	=	195.98			(30)
Total area of elements, m²			301.22							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 602.3 (33)

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

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: High 450 (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 46.4 (36)

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

Total fabric heat loss (33) + (36) = 648.7 (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=	234.19	231.57	229	216.93	214.68	204.17	204.17	202.22	208.21	214.68	219.24	224.02	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(39)m=	882.89	880.27	877.7	865.63	863.37	852.86	852.86	850.91	856.91	863.37	867.94	872.72

Average = $Sum(39)_{1...12}$ /12= 865.62 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(40)m=	3.57	3.56	3.55	3.5	3.5	3.45	3.45	3.44	3.47	3.5	3.51	3.53

Average = $Sum(40)_{1...12}$ /12= 3.5 (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 3.06 (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) + 36 106.95 (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=	117.64	113.36	109.09	104.81	100.53	96.25	96.25	100.53	104.81	109.09	113.36	117.64

Total = $Sum(44)_{1...12}$ = 1283.36 (44)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(45)m=	174.46	152.58	157.45	137.27	131.71	113.66	105.32	120.86	122.3	142.53	155.58	168.95

Total = $Sum(45)_{1...12}$ = 1682.69 (45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	26.17	22.89	23.62	20.59	19.76	17.05	15.8	18.13	18.35	21.38	23.34	25.34	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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)

DER WorkSheet: New dwelling design stage

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=	229.74	202.51	212.73	190.76	186.99	167.15	160.6	176.14	175.8	197.81	209.08	224.23	(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=	229.74	202.51	212.73	190.76	186.99	167.15	160.6	176.14	175.8	197.81	209.08	224.23

Output from water heater (annual)1…12 2333.53 (64)

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

(65)m=	76.62	67.54	70.96	63.65	62.4	55.8	53.63	58.8	58.68	66	69.74	74.79	(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=	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	153.15	(66)

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

(67)m=	41.86	37.18	30.24	22.89	17.11	14.45	15.61	20.29	27.23	34.58	40.36	43.02	(67)

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

(68)m=	413.78	418.07	407.25	384.21	355.14	327.81	309.55	305.26	316.08	339.11	368.19	395.52	(68)

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

(69)m=	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	38.32	(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=	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	-122.52	(71)

Water heating gains (Table 5)

(72)m=	102.98	100.51	95.38	88.41	83.88	77.5	72.08	79.03	81.49	88.71	96.86	100.52	(72)

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

(73)m=	627.56	624.7	601.81	564.46	525.07	488.7	466.19	473.52	493.75	531.35	574.36	608.01	(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	0.6	x	10.63	x	0.85	x	0.7	=	2.63	(74)
North	0.9x	0.77	x	0.6	x	20.32	x	0.85	x	0.7	=	5.03	(74)
North	0.9x	0.77	x	0.6	x	34.53	x	0.85	x	0.7	=	8.54	(74)
North	0.9x	0.77	x	0.6	x	55.46	x	0.85	x	0.7	=	13.72	(74)
North	0.9x	0.77	x	0.6	x	74.72	x	0.85	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	0.6	x	79.99	x	0.85	x	0.7	=	19.79	(74)
North	0.9x	0.77	x	0.6	x	74.68	x	0.85	x	0.7	=	18.48	(74)
North	0.9x	0.77	x	0.6	x	59.25	x	0.85	x	0.7	=	14.66	(74)
North	0.9x	0.77	x	0.6	x	41.52	x	0.85	x	0.7	=	10.27	(74)
North	0.9x	0.77	x	0.6	x	24.19	x	0.85	x	0.7	=	5.98	(74)
North	0.9x	0.77	x	0.6	x	13.12	x	0.85	x	0.7	=	3.25	(74)
North	0.9x	0.77	x	0.6	x	8.86	x	0.85	x	0.7	=	2.19	(74)
East	0.9x	1	x	17.22	x	19.64	x	0.85	x	0.7	=	139.45	(76)
East	0.9x	1	x	17.22	x	38.42	x	0.85	x	0.7	=	272.8	(76)
East	0.9x	1	x	17.22	x	63.27	x	0.85	x	0.7	=	449.27	(76)
East	0.9x	1	x	17.22	x	92.28	x	0.85	x	0.7	=	655.23	(76)
East	0.9x	1	x	17.22	x	113.09	x	0.85	x	0.7	=	803	(76)
East	0.9x	1	x	17.22	x	115.77	x	0.85	x	0.7	=	822.02	(76)
East	0.9x	1	x	17.22	x	110.22	x	0.85	x	0.7	=	782.59	(76)
East	0.9x	1	x	17.22	x	94.68	x	0.85	x	0.7	=	672.24	(76)
East	0.9x	1	x	17.22	x	73.59	x	0.85	x	0.7	=	522.51	(76)
East	0.9x	1	x	17.22	x	45.59	x	0.85	x	0.7	=	323.7	(76)
East	0.9x	1	x	17.22	x	24.49	x	0.85	x	0.7	=	173.88	(76)
East	0.9x	1	x	17.22	x	16.15	x	0.85	x	0.7	=	114.68	(76)
West	0.9x	0.77	x	6	x	19.64	x	0.85	x	0.7	=	48.59	(80)
West	0.9x	0.77	x	6	x	38.42	x	0.85	x	0.7	=	95.05	(80)
West	0.9x	0.77	x	6	x	63.27	x	0.85	x	0.7	=	156.54	(80)
West	0.9x	0.77	x	6	x	92.28	x	0.85	x	0.7	=	228.3	(80)
West	0.9x	0.77	x	6	x	113.09	x	0.85	x	0.7	=	279.79	(80)
West	0.9x	0.77	x	6	x	115.77	x	0.85	x	0.7	=	286.42	(80)
West	0.9x	0.77	x	6	x	110.22	x	0.85	x	0.7	=	272.68	(80)
West	0.9x	0.77	x	6	x	94.68	x	0.85	x	0.7	=	234.23	(80)
West	0.9x	0.77	x	6	x	73.59	x	0.85	x	0.7	=	182.06	(80)
West	0.9x	0.77	x	6	x	45.59	x	0.85	x	0.7	=	112.79	(80)
West	0.9x	0.77	x	6	x	24.49	x	0.85	x	0.7	=	60.59	(80)
West	0.9x	0.77	x	6	x	16.15	x	0.85	x	0.7	=	39.96	(80)

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

(83)m=	190.67	372.88	614.35	897.25	1101.28	1128.22	1073.75	921.12	714.85	442.47	237.71	156.83	(83)

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

(84)m=	818.24	997.59	1216.16	1461.71	1626.35	1616.93	1539.94	1394.64	1208.6	973.82	812.07	764.84	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	1	1	0.99	0.97	0.98	1	1	1	1	(86)

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

(87)m=	18.45	18.58	18.89	19.34	19.82	20.28	20.58	20.53	20.13	19.52	18.93	18.44	(87)

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

(88)m=	18.49	18.49	18.5	18.52	18.52	18.54	18.54	18.54	18.53	18.52	18.52	18.51	(88)

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

(89)m=	1	1	1	1	0.99	0.96	0.8	0.86	0.99	1	1	1	(89)

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

(90)m=	15.35	15.55	15.99	16.66	17.37	18.05	18.43	18.38	17.83	16.94	16.06	15.35	(90)

fLA = Living area ÷ (4) = | 0.55 | (91)

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

(92)m=	17.04	17.21	17.57	18.12	18.71	19.27	19.6	19.55	19.09	18.35	17.63	17.04	(92)

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

(93)m=	17.04	17.21	17.57	18.12	18.71	19.27	19.6	19.55	19.09	18.35	17.63	17.04	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	1	1	0.99	0.97	0.92	0.95	0.99	1	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	818.11	997.27	1215.14	1457.85	1612.35	1571.83	1419.1	1318.87	1196.74	972.6	811.86	764.75	(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=	11248.74	10832.37	9719.62	7985.28	6048.25	3983.27	2562.21	2682.19	4271.75	6690.73	9136.25	11205.5	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	7760.39	6609.19	6327.33	4699.75	3300.31	0	0	0	0	4254.29	5993.56	7767.91	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 46712.73 | (98)

Space heating requirement in kWh/m²/year | 189.12 | (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301)

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

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

Fraction of heat from Community boilers | 1 | (303a)

DER WorkSheet: New dwelling design stage

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		46712.73	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	49048.37	(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		2333.53	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2450.21	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	514.99	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		739.27	(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				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	12359.66	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	267.28	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	12626.94	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				12626.94	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	383.68	(379)
Total CO2, kg/year	sum of (376)…(382) =				13010.62	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				52.67	(384)
EI rating (section 14)					43.35	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 7

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	82	(1a) x	3.05	(2a) =	250.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	250.1	(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)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.08	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.58	(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) =	0.49	(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

0.63	0.62	0.6	0.54	0.53	0.47	0.47	0.46	0.49	0.53	0.55	0.58

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=	0.7	0.69	0.68	0.65	0.64	0.61	0.61	0.6	0.62	0.64	0.65	0.67	(24d)

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

(25)m=	0.7	0.69	0.68	0.65	0.64	0.61	0.61	0.6	0.62	0.64	0.65	0.67	(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 Type 1			1.8	x	3	=	5.4			(26)
Doors Type 2			1.6	x	1.4	=	2.24			(26)
Windows Type 1			5.56	x1/[1/(4.8)+ 0.04]		=	22.39			(27)
Windows Type 2			4	x1/[1/(4.8)+ 0.04]		=	16.11			(27)
Windows Type 3			1.21	x1/[1/(4.8)+ 0.04]		=	4.87			(27)
Floor			82	x	1.25	=	102.5			(28)
Walls Type1	79.85	12.57	67.28	x	2.1	=	141.29			(29)
Walls Type2	20.23	1.6	18.63	x	2.1	=	39.12			(29)
Roof	19.77	0	19.77	x	0.28	=	5.54			(30)
Total area of elements, m²			201.85							(31)
Party wall			16.8	x	0	=	0			(32)
Party wall			5.8	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	339.46	(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: High	450	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K	18.4	(36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss	(33) + (36) =	357.86	(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=	57.57	56.94	56.32	53.4	52.86	50.32	50.32	49.85	51.3	52.86	53.96	55.11	(38)

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

(39)m=	415.43	414.79	414.17	411.26	410.71	408.17	408.17	407.7	409.15	410.71	411.81	412.97	

Average = Sum(39)$_{1...12}$ /12= 411.25 (39)

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

(40)m=	5.07	5.06	5.05	5.02	5.01	4.98	4.98	4.97	4.99	5.01	5.02	5.04	

Average = Sum(40)$_{1...12}$ /12= 5.02 (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 2.5 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.57 (43)

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

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

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

(44)m=	102.93	99.18	95.44	91.7	87.95	84.21	84.21	87.95	91.7	95.44	99.18	102.93

Total = Sum(44)$_{1...12}$ = 1122.82 (44)

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

(45)m=	152.63	133.5	137.76	120.1	115.24	99.44	92.15	105.74	107	124.7	136.12	147.82

Total = Sum(45)$_{1...12}$ = 1472.19 (45)

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

(46)m=	22.9	20.02	20.66	18.01	17.29	14.92	13.82	15.86	16.05	18.71	20.42	22.17	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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)

DER WorkSheet: New dwelling design stage

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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

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

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

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

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

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

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

(62)m=	207.91	183.42	193.03	173.59	170.51	152.93	147.42	161.02	160.5	179.98	189.61	203.1	(62)

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

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

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

Output from water heater

(64)m=	207.91	183.42	193.03	173.59	170.51	152.93	147.42	161.02	160.5	179.98	189.61	203.1	

Output from water heater (annual)1…12 — 2123.03 (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=	69.36	61.2	64.41	57.94	56.93	51.07	49.25	53.77	53.59	60.07	63.27	67.76	(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=	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	124.99	(66)

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

(67)m=	21.14	18.77	15.27	11.56	8.64	7.29	7.88	10.24	13.75	17.46	20.38	21.72	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	223.57	225.89	220.04	207.6	191.89	177.12	167.26	164.94	170.78	183.23	198.94	213.71	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	-99.99	(71)

Water heating gains (Table 5)

(72)m=	93.23	91.07	86.58	80.48	76.51	70.94	66.19	72.27	74.43	80.74	87.87	91.07	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	398.43	396.22	382.38	360.13	337.54	315.85	301.83	307.95	319.46	341.93	367.69	387	(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	4	x	10.63	x	0.85	x	0.7	=	17.54	(74)
North	0.9x	0.77	x	4	x	20.32	x	0.85	x	0.7	=	33.52	(74)
North	0.9x	0.77	x	4	x	34.53	x	0.85	x	0.7	=	56.95	(74)
North	0.9x	0.77	x	4	x	55.46	x	0.85	x	0.7	=	91.48	(74)
North	0.9x	0.77	x	4	x	74.72	x	0.85	x	0.7	=	123.23	(74)
North	0.9x	0.77	x	4	x	79.99	x	0.85	x	0.7	=	131.92	(74)
North	0.9x	0.77	x	4	x	74.68	x	0.85	x	0.7	=	123.17	(74)
North	0.9x	0.77	x	4	x	59.25	x	0.85	x	0.7	=	97.72	(74)
North	0.9x	0.77	x	4	x	41.52	x	0.85	x	0.7	=	68.47	(74)
North	0.9x	0.77	x	4	x	24.19	x	0.85	x	0.7	=	39.9	(74)
North	0.9x	0.77	x	4	x	13.12	x	0.85	x	0.7	=	21.64	(74)
North	0.9x	0.77	x	4	x	8.86	x	0.85	x	0.7	=	14.62	(74)
East	0.9x	1	x	5.56	x	19.64	x	0.85	x	0.7	=	45.03	(76)
East	0.9x	1	x	5.56	x	38.42	x	0.85	x	0.7	=	88.08	(76)
East	0.9x	1	x	5.56	x	63.27	x	0.85	x	0.7	=	145.06	(76)
East	0.9x	1	x	5.56	x	92.28	x	0.85	x	0.7	=	211.56	(76)
East	0.9x	1	x	5.56	x	113.09	x	0.85	x	0.7	=	259.27	(76)
East	0.9x	1	x	5.56	x	115.77	x	0.85	x	0.7	=	265.41	(76)
East	0.9x	1	x	5.56	x	110.22	x	0.85	x	0.7	=	252.68	(76)
East	0.9x	1	x	5.56	x	94.68	x	0.85	x	0.7	=	217.05	(76)
East	0.9x	1	x	5.56	x	73.59	x	0.85	x	0.7	=	168.71	(76)
East	0.9x	1	x	5.56	x	45.59	x	0.85	x	0.7	=	104.52	(76)
East	0.9x	1	x	5.56	x	24.49	x	0.85	x	0.7	=	56.14	(76)
East	0.9x	1	x	5.56	x	16.15	x	0.85	x	0.7	=	37.03	(76)
West	0.9x	0.77	x	1.21	x	19.64	x	0.85	x	0.7	=	9.8	(80)
West	0.9x	0.77	x	1.21	x	38.42	x	0.85	x	0.7	=	19.17	(80)
West	0.9x	0.77	x	1.21	x	63.27	x	0.85	x	0.7	=	31.57	(80)
West	0.9x	0.77	x	1.21	x	92.28	x	0.85	x	0.7	=	46.04	(80)
West	0.9x	0.77	x	1.21	x	113.09	x	0.85	x	0.7	=	56.42	(80)
West	0.9x	0.77	x	1.21	x	115.77	x	0.85	x	0.7	=	57.76	(80)
West	0.9x	0.77	x	1.21	x	110.22	x	0.85	x	0.7	=	54.99	(80)
West	0.9x	0.77	x	1.21	x	94.68	x	0.85	x	0.7	=	47.24	(80)
West	0.9x	0.77	x	1.21	x	73.59	x	0.85	x	0.7	=	36.72	(80)
West	0.9x	0.77	x	1.21	x	45.59	x	0.85	x	0.7	=	22.75	(80)
West	0.9x	0.77	x	1.21	x	24.49	x	0.85	x	0.7	=	12.22	(80)
West	0.9x	0.77	x	1.21	x	16.15	x	0.85	x	0.7	=	8.06	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	72.36	140.77	233.58	349.08	438.93	455.1	430.84	362.01	273.9	167.16	90	59.71	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	470.79	536.99	615.96	709.21	776.47	770.94	732.67	669.95	593.36	509.09	457.68	446.71	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	1	0.99	0.97	0.94	0.96	0.99	1	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	17.84	18	18.36	18.91	19.5	20.08	20.46	20.39	19.9	19.15	18.42	17.82	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.07	18.07	18.08	18.08	18.08	18.09	18.09	18.09	18.09	18.08	18.08	18.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.99	0.97	0.9	0.66	0.74	0.96	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	14.32	14.55	15.08	15.87	16.74	17.56	18	17.95	17.32	16.24	15.16	14.29	(90)

fLA = Living area ÷ (4) = | 0.53 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.19	16.38	16.83	17.49	18.21	18.9	19.3	19.25	18.69	17.79	16.89	16.17	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.19	16.38	16.83	17.49	18.21	18.9	19.3	19.25	18.69	17.79	16.89	16.17	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.97	0.93	0.86	0.89	0.97	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	469.94	535.52	612.86	701.28	755.79	720.67	626.89	594.99	574.38	505.18	456.44	446.02	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	4940.07	4762.98	4277.34	3531.33	2673.64	1756.47	1103.99	1161.27	1879.05	2952.33	4033.49	4942.52	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	3325.78	2840.86	2726.37	2037.63	1426.88	0	0	0	0	1820.68	2575.48	3345.4	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 20099.07 | (98)

Space heating requirement in kWh/m²/year | 245.11 | (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)

DER WorkSheet: New dwelling design stage

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		20099.07	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	21104.02	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2123.03	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2229.18	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	233.33	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		373.27	(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				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	5599.97	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	121.1	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	5721.07	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				5721.07	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	193.73	(379)
Total CO2, kg/year	sum of (376)…(382) =				5914.8	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				72.13	(384)
EI rating (section 14)					41.53	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 8

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	70	(1a) x	3.5	(2a) =	245	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	245	(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) =	0.08	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.58	(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) =	0.54	(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

0.69	0.67	0.66	0.59	0.58	0.51	0.51	0.5	0.54	0.58	0.61	0.63

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=	0.74	0.73	0.72	0.68	0.67	0.63	0.63	0.62	0.64	0.67	0.68	0.7	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.74	0.73	0.72	0.68	0.67	0.63	0.63	0.62	0.64	0.67	0.68	0.7	(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			1.9	x	3	=	5.7			(26)
Windows Type 1			8.7	x1/[1/(4.8)+ 0.04]		=	35.03			(27)
Windows Type 2			6.5	x1/[1/(4.8)+ 0.04]		=	26.17			(27)
Windows Type 3			2.2	x1/[1/(4.8)+ 0.04]		=	8.86			(27)
Floor			70	x	1.25	=	87.5			(28)
Walls	116.5	19.3	97.2	x	2.1	=	204.12			(29)
Roof	26.7	0	26.7	x	0.28	=	7.48			(30)
Total area of elements, m²			213.2							(31)
Party wall			24.2	x	0	=	0			(32)
Party wall			8.6	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 374.86 (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: High 450 (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 31.98 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 406.84 (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=	59.45	58.71	57.98	54.58	53.95	50.99	50.99	50.44	52.13	53.95	55.23	56.58

(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	466.29	465.55	464.83	461.43	460.79	457.83	457.83	457.28	458.97	460.79	462.08	463.42

Average = Sum(39)$_{1...12}$ /12= 461.42 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	6.66	6.65	6.64	6.59	6.58	6.54	6.54	6.53	6.56	6.58	6.6	6.62

Average = Sum(40)$_{1...12}$ /12= 6.59 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.55 (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=	96.3	92.8	89.3	85.79	82.29	78.79	78.79	82.29	85.79	89.3	92.8	96.3

Total = Sum(44)$_{1...12}$ = 1050.55 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	142.81	124.9	128.89	112.37	107.82	93.04	86.22	98.93	100.12	116.67	127.36	138.3

Total = Sum(45)$_{1...12}$ = 1377.43 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.42	18.74	19.33	16.86	16.17	13.96	12.93	14.84	15.02	17.5	19.1	20.75

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	198.09	174.83	184.17	165.86	163.1	146.53	141.49	154.21	153.61	171.95	180.85	193.58	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	198.09	174.83	184.17	165.86	163.1	146.53	141.49	154.21	153.61	171.95	180.85	193.58

Output from water heater (annual)$_{1...12}$ | 2028.27 | (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=	66.09	58.34	61.47	55.37	54.46	48.95	47.28	51.51	51.3	57.4	60.36	64.6	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	112.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.59	15.62	12.71	9.62	7.19	6.07	6.56	8.53	11.44	14.53	16.96	18.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	197.3	199.34	194.19	183.2	169.34	156.31	147.6	145.55	150.71	161.7	175.56	188.59	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	(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=	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	-89.84	(71)

Water heating gains (Table 5)

(72)m=	88.84	86.81	82.61	76.91	73.2	67.98	63.54	69.23	71.25	77.16	83.83	86.82	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	360.41	358.47	346.2	326.42	306.42	287.05	274.4	280	290.1	310.07	333.04	350.18	(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	8.7	x	10.63	x	0.85	x	0.7	=	38.15	(74)
North	0.9x	0.77	x	8.7	x	20.32	x	0.85	x	0.7	=	72.9	(74)

North	0.9x	0.77	x	8.7	x	34.53	x	0.85	x	0.7	=	123.87	(74)
North	0.9x	0.77	x	8.7	x	55.46	x	0.85	x	0.7	=	198.97	(74)
North	0.9x	0.77	x	8.7	x	74.72	x	0.85	x	0.7	=	268.03	(74)
North	0.9x	0.77	x	8.7	x	79.99	x	0.85	x	0.7	=	286.93	(74)
North	0.9x	0.77	x	8.7	x	74.68	x	0.85	x	0.7	=	267.89	(74)
North	0.9x	0.77	x	8.7	x	59.25	x	0.85	x	0.7	=	212.54	(74)
North	0.9x	0.77	x	8.7	x	41.52	x	0.85	x	0.7	=	148.93	(74)
North	0.9x	0.77	x	8.7	x	24.19	x	0.85	x	0.7	=	86.78	(74)
North	0.9x	0.77	x	8.7	x	13.12	x	0.85	x	0.7	=	47.06	(74)
North	0.9x	0.77	x	8.7	x	8.86	x	0.85	x	0.7	=	31.8	(74)
South	0.9x	0.77	x	2.2	x	46.75	x	0.85	x	0.7	=	42.41	(78)
South	0.9x	0.77	x	2.2	x	76.57	x	0.85	x	0.7	=	69.46	(78)
South	0.9x	0.77	x	2.2	x	97.53	x	0.85	x	0.7	=	88.48	(78)
South	0.9x	0.77	x	2.2	x	110.23	x	0.85	x	0.7	=	100	(78)
South	0.9x	0.77	x	2.2	x	114.87	x	0.85	x	0.7	=	104.2	(78)
South	0.9x	0.77	x	2.2	x	110.55	x	0.85	x	0.7	=	100.28	(78)
South	0.9x	0.77	x	2.2	x	108.01	x	0.85	x	0.7	=	97.98	(78)
South	0.9x	0.77	x	2.2	x	104.89	x	0.85	x	0.7	=	95.15	(78)
South	0.9x	0.77	x	2.2	x	101.89	x	0.85	x	0.7	=	92.42	(78)
South	0.9x	0.77	x	2.2	x	82.59	x	0.85	x	0.7	=	74.92	(78)
South	0.9x	0.77	x	2.2	x	55.42	x	0.85	x	0.7	=	50.27	(78)
South	0.9x	0.77	x	2.2	x	40.4	x	0.85	x	0.7	=	36.65	(78)
West	0.9x	0.77	x	6.5	x	19.64	x	0.85	x	0.7	=	52.64	(80)
West	0.9x	0.77	x	6.5	x	38.42	x	0.85	x	0.7	=	102.97	(80)
West	0.9x	0.77	x	6.5	x	63.27	x	0.85	x	0.7	=	169.58	(80)
West	0.9x	0.77	x	6.5	x	92.28	x	0.85	x	0.7	=	247.33	(80)
West	0.9x	0.77	x	6.5	x	113.09	x	0.85	x	0.7	=	303.11	(80)
West	0.9x	0.77	x	6.5	x	115.77	x	0.85	x	0.7	=	310.29	(80)
West	0.9x	0.77	x	6.5	x	110.22	x	0.85	x	0.7	=	295.4	(80)
West	0.9x	0.77	x	6.5	x	94.68	x	0.85	x	0.7	=	253.75	(80)
West	0.9x	0.77	x	6.5	x	73.59	x	0.85	x	0.7	=	197.23	(80)
West	0.9x	0.77	x	6.5	x	45.59	x	0.85	x	0.7	=	122.19	(80)
West	0.9x	0.77	x	6.5	x	24.49	x	0.85	x	0.7	=	65.64	(80)
West	0.9x	0.77	x	6.5	x	16.15	x	0.85	x	0.7	=	43.29	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	133.2	245.33	381.93	546.29	675.34	697.5	661.27	561.44	438.59	283.88	162.96	111.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	493.61	603.8	728.13	872.71	981.76	984.55	935.67	841.44	728.68	593.95	496	461.92	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(86)m=	1	1	0.99	0.99	0.97	0.94	0.9	0.92	0.97	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	17.29	17.49	17.93	18.59	19.3	19.97	20.4	20.32	19.74	18.85	17.97	17.26	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18	18	18	18	18	18	18	18	18	18	18	18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.94	0.83	0.56	0.64	0.92	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	13.61	13.9	14.55	15.49	16.52	17.45	17.91	17.86	17.16	15.88	14.6	13.57	(90)

fLA = Living area ÷ (4) = 0.81 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.58	16.8	17.29	17.99	18.76	19.49	19.92	19.85	19.25	18.28	17.33	16.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.58	16.8	17.29	17.99	18.76	19.49	19.92	19.85	19.25	18.28	17.33	16.55	(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	0.99	0.98	0.95	0.91	0.84	0.87	0.95	0.99	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	491.8	600.15	720.09	852.85	935.49	893.15	785.81	733.63	693.05	585.27	493.29	460.48	(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=	5727.59	5541.17	5013.65	4196.15	3254.99	2238.36	1520.54	1576.29	2361.74	3539.62	4724.93	5725.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	3895.43	3320.36	3194.41	2407.18	1725.71	0	0	0	0	2198.04	3046.78	3917.06	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 23704.96 (98)

Space heating requirement in kWh/m²/year 338.64 (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	23704.96	

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Space heat from Community boilers	(98) x (304a) x (305) x (306) =	24890.21	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2028.27	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2129.68	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	270.2	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		310.63	(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				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	6484.77	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	140.23	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	6625.01	(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) =				6625.01	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	161.22	(379)
Total CO2, kg/year	sum of (376)…(382) =				6786.22	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				96.95	(384)
EI rating (section 14)					31.76	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 9

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	124	(1a) x	2.37	(2a) =	293.88	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	124	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	293.88	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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) =	0.07	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.57	(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) =	0.53	(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

0.67	0.66	0.64	0.58	0.56	0.5	0.5	0.49	0.53	0.56	0.59	0.62

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=	0.72	0.72	0.71	0.67	0.66	0.62	0.62	0.62	0.64	0.66	0.67	0.69	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.72	0.72	0.71	0.67	0.66	0.62	0.62	0.62	0.64	0.66	0.67	0.69	(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			1.6	x	1.4	=	2.24			(26)
Windows Type 1			5.49	x1/[1/(4.8)+ 0.04]		=	22.11			(27)
Windows Type 2			4.7	x1/[1/(4.8)+ 0.04]		=	18.93			(27)
Walls Type1	11.85	1.6	10.25	x	2.1	=	21.52			(29)
Walls Type2	122	10.19	111.81	x	1.27	=	142.22			(29)
Roof	68.1	0	68.1	x	0.28	=	19.07			(30)
Total area of elements, m²			201.95							(31)
Party wall			4.8	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 226.08 (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: High 450 (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 30.4 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 256.48 (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	
(38)m=	70.25	69.41	68.58	64.69	63.96	60.57	60.57	59.95	61.88	63.96	65.43	66.97	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	326.74	325.89	325.06	321.17	320.45	317.06	317.06	316.43	318.36	320.45	321.92	323.46	

Average = Sum(39)$_{1…12}$ /12= 321.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	2.63	2.63	2.62	2.59	2.58	2.56	2.56	2.55	2.57	2.58	2.6	2.61

Average = Sum(40)1…12 /12= 2.59 (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 2.88 (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) + 36 102.54 (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=	112.8	108.69	104.59	100.49	96.39	92.29	92.29	96.39	100.49	104.59	108.69	112.8	
										Total = Sum(44)1…12 =		1230.5	(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=	167.27	146.3	150.97	131.62	126.29	108.98	100.98	115.88	117.26	136.66	149.18	161.99	
										Total = Sum(45)1…12 =		1613.38	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	25.09	21.94	22.64	19.74	18.94	16.35	15.15	17.38	17.59	20.5	22.38	24.3	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	222.55	196.23	206.24	185.11	181.57	162.47	156.26	171.16	170.76	191.94	202.67	217.27	(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=	222.55	196.23	206.24	185.11	181.57	162.47	156.26	171.16	170.76	191.94	202.67	217.27	

Output from water heater (annual)$_{1...12}$ 2264.22 (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=	74.23	65.45	68.81	61.77	60.6	54.24	52.19	57.14	57	64.05	67.61	72.47	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	143.88	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	30.38	26.98	21.94	16.61	12.42	10.48	11.33	14.72	19.76	25.09	29.29	31.22	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	290.33	293.35	285.75	269.59	249.19	230.01	217.2	214.19	221.78	237.95	258.35	277.52	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	(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=	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	(71)

Water heating gains (Table 5)

(72)m=	99.77	97.4	92.48	85.79	81.45	75.34	70.14	76.8	79.17	86.09	93.9	97.41	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	486.64	483.89	466.34	438.16	409.22	382	364.84	371.88	386.87	415.29	447.7	472.32	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.49	x	10.63	x	0.85	x	0.7	=	24.07	(74)
North	0.9x	0.77	x	5.49	x	20.32	x	0.85	x	0.7	=	46	(74)
North	0.9x	0.77	x	5.49	x	34.53	x	0.85	x	0.7	=	78.17	(74)
North	0.9x	0.77	x	5.49	x	55.46	x	0.85	x	0.7	=	125.56	(74)
North	0.9x	0.77	x	5.49	x	74.72	x	0.85	x	0.7	=	169.14	(74)

North	0.9x	0.77	x	5.49	x	79.99	x	0.85	x	0.7	=	181.06	(74)
North	0.9x	0.77	x	5.49	x	74.68	x	0.85	x	0.7	=	169.05	(74)
North	0.9x	0.77	x	5.49	x	59.25	x	0.85	x	0.7	=	134.12	(74)
North	0.9x	0.77	x	5.49	x	41.52	x	0.85	x	0.7	=	93.98	(74)
North	0.9x	0.77	x	5.49	x	24.19	x	0.85	x	0.7	=	54.76	(74)
North	0.9x	0.77	x	5.49	x	13.12	x	0.85	x	0.7	=	29.69	(74)
North	0.9x	0.77	x	5.49	x	8.86	x	0.85	x	0.7	=	20.07	(74)
South	0.9x	0.77	x	4.7	x	46.75	x	0.85	x	0.7	=	90.6	(78)
South	0.9x	0.77	x	4.7	x	76.57	x	0.85	x	0.7	=	148.39	(78)
South	0.9x	0.77	x	4.7	x	97.53	x	0.85	x	0.7	=	189.02	(78)
South	0.9x	0.77	x	4.7	x	110.23	x	0.85	x	0.7	=	213.63	(78)
South	0.9x	0.77	x	4.7	x	114.87	x	0.85	x	0.7	=	222.62	(78)
South	0.9x	0.77	x	4.7	x	110.55	x	0.85	x	0.7	=	214.24	(78)
South	0.9x	0.77	x	4.7	x	108.01	x	0.85	x	0.7	=	209.32	(78)
South	0.9x	0.77	x	4.7	x	104.89	x	0.85	x	0.7	=	203.28	(78)
South	0.9x	0.77	x	4.7	x	101.89	x	0.85	x	0.7	=	197.45	(78)
South	0.9x	0.77	x	4.7	x	82.59	x	0.85	x	0.7	=	160.05	(78)
South	0.9x	0.77	x	4.7	x	55.42	x	0.85	x	0.7	=	107.4	(78)
South	0.9x	0.77	x	4.7	x	40.4	x	0.85	x	0.7	=	78.29	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	114.68	194.39	267.18	339.19	391.75	395.3	378.37	337.4	291.43	214.81	137.09	98.36	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	601.32	678.28	733.53	777.35	800.97	777.3	743.21	709.28	678.31	630.1	584.79	570.67	(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	1	1	1	0.99	0.97	0.98	1	1	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.07	19.18	19.41	19.76	20.13	20.49	20.73	20.69	20.39	19.92	19.45	19.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.94	18.95	18.95	18.97	18.97	18.99	18.99	18.99	18.98	18.97	18.97	18.96	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	1	0.99	0.96	0.82	0.86	0.98	1	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.5	16.67	17.02	17.53	18.07	18.61	18.9	18.87	18.46	17.77	17.07	16.5	(90)

fLA = Living area ÷ (4) = 0.3 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.28	17.43	17.74	18.2	18.69	19.18	19.45	19.42	19.04	18.42	17.79	17.27	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	17.28	17.43	17.74	18.2	18.69	19.18	19.45	19.42	19.04	18.42	17.79	17.27	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	1	1	0.99	0.97	0.88	0.91	0.98	1	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	601.17	677.96	732.81	775.38	794.28	751.07	653.96	644.51	667.34	628.71	584.51	570.56	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	4240.35	4083.09	3653.59	2987.43	2240.76	1451.55	904.1	955.42	1573.7	2505.1	3440.8	4228.68	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	2707.55	2288.24	2173.06	1592.68	1076.19	0	0	0	0	1396.03	2056.52	2721.64	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 16011.93 (98)

Space heating requirement in kWh/m²/year 129.13 (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		16011.93	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	16812.52	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2264.22	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2377.43	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	191.9	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				536.46	(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			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	4605.59	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	99.6	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	4705.18	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			4705.18	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	278.42	(379)
Total CO2, kg/year	sum of (376)…(382) =			4983.61	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			40.19	(384)
EI rating (section 14)				60.38	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 10

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	79	(1a) x	2.6	(2a) =	205.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.4	(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) =	0.1	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.6	(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) =	0.55	(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

0.7	0.69	0.68	0.61	0.59	0.52	0.52	0.51	0.55	0.59	0.62	0.65

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=	0.75	0.74	0.73	0.68	0.68	0.64	0.64	0.63	0.65	0.68	0.69	0.71	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.75	0.74	0.73	0.68	0.68	0.64	0.64	0.63	0.65	0.68	0.69	0.71	(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			1.6	x	1.4	=	2.24			(26)
Windows Type 1			3.12	x1/[1/(4.8)+ 0.04]		=	12.56			(27)
Windows Type 2			3.66	x1/[1/(4.8)+ 0.04]		=	14.74			(27)
Walls Type1	89.2	6.78	82.42	x	1.27	=	104.83			(29)
Walls Type2	26.63	1.6	25.03	x	2.1	=	52.56			(29)
Roof	46.5	0	46.5	x	0.28	=	13.02			(30)
Total area of elements, m²			162.33							(31)
Party wall			5.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = | 199.96 | (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: High | 450 | (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 24.8 | (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = | 224.76 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	50.71	50.06	49.42	46.41	45.85	43.23	43.23	42.74	44.24	45.85	46.99	48.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	275.47	274.82	274.18	271.17	270.61	267.99	267.99	267.5	269	270.61	271.75	272.94	

Average = Sum(39)$_{1…12}$ /12= | 271.17 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	3.49	3.48	3.47	3.43	3.43	3.39	3.39	3.39	3.41	3.43	3.44	3.45

Average = Sum(40)$_{1...12}$ /12= 3.43 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.46	97.77	94.08	90.39	86.7	83.01	83.01	86.7	90.39	94.08	97.77	101.46	
										Total = Sum(44)$_{1...12}$ =		1106.83	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	150.46	131.59	135.79	118.39	113.6	98.02	90.83	104.23	105.48	122.93	134.18	145.71	
										Total = Sum(45)$_{1...12}$ =		1451.23	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.57	19.74	20.37	17.76	17.04	14.7	13.63	15.64	15.82	18.44	20.13	21.86	(46)

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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	205.74	181.52	191.07	171.88	168.87	151.52	146.11	159.51	158.97	178.2	187.68	200.99	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.74	181.52	191.07	171.88	168.87	151.52	146.11	159.51	158.97	178.2	187.68	200.99	

Output from water heater (annual)$_{1...12}$ 2102.07 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	68.64	60.56	63.76	57.37	56.38	50.6	48.81	53.27	53.08	59.48	62.63	67.06	(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=	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	22.54	20.02	16.28	12.32	9.21	7.78	8.4	10.92	14.66	18.62	21.73	23.16	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	217.34	219.59	213.91	201.81	186.54	172.18	162.59	160.34	166.02	178.12	193.39	207.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	(71)
Water heating gains (Table 5)													
(72)m=	92.26	90.13	85.7	79.69	75.78	70.28	65.61	71.6	73.72	79.95	86.98	90.13	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	391.79	389.39	375.54	353.48	331.19	309.9	296.26	302.51	314.06	336.34	361.76	380.7	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.66	x	10.63	x	0.85	x	0.7	=	16.05	(74)
North	0.9x	0.77	x	3.66	x	20.32	x	0.85	x	0.7	=	30.67	(74)
North	0.9x	0.77	x	3.66	x	34.53	x	0.85	x	0.7	=	52.11	(74)
North	0.9x	0.77	x	3.66	x	55.46	x	0.85	x	0.7	=	83.7	(74)
North	0.9x	0.77	x	3.66	x	74.72	x	0.85	x	0.7	=	112.76	(74)

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North	0.9x	0.77	x	3.66	x	79.99	x	0.85	x	0.7	=	120.71	(74)
North	0.9x	0.77	x	3.66	x	74.68	x	0.85	x	0.7	=	112.7	(74)
North	0.9x	0.77	x	3.66	x	59.25	x	0.85	x	0.7	=	89.41	(74)
North	0.9x	0.77	x	3.66	x	41.52	x	0.85	x	0.7	=	62.65	(74)
North	0.9x	0.77	x	3.66	x	24.19	x	0.85	x	0.7	=	36.51	(74)
North	0.9x	0.77	x	3.66	x	13.12	x	0.85	x	0.7	=	19.8	(74)
North	0.9x	0.77	x	3.66	x	8.86	x	0.85	x	0.7	=	13.38	(74)
South	0.9x	0.77	x	3.12	x	46.75	x	0.85	x	0.7	=	60.15	(78)
South	0.9x	0.77	x	3.12	x	76.57	x	0.85	x	0.7	=	98.5	(78)
South	0.9x	0.77	x	3.12	x	97.53	x	0.85	x	0.7	=	125.48	(78)
South	0.9x	0.77	x	3.12	x	110.23	x	0.85	x	0.7	=	141.81	(78)
South	0.9x	0.77	x	3.12	x	114.87	x	0.85	x	0.7	=	147.78	(78)
South	0.9x	0.77	x	3.12	x	110.55	x	0.85	x	0.7	=	142.22	(78)
South	0.9x	0.77	x	3.12	x	108.01	x	0.85	x	0.7	=	138.96	(78)
South	0.9x	0.77	x	3.12	x	104.89	x	0.85	x	0.7	=	134.95	(78)
South	0.9x	0.77	x	3.12	x	101.89	x	0.85	x	0.7	=	131.07	(78)
South	0.9x	0.77	x	3.12	x	82.59	x	0.85	x	0.7	=	106.25	(78)
South	0.9x	0.77	x	3.12	x	55.42	x	0.85	x	0.7	=	71.29	(78)
South	0.9x	0.77	x	3.12	x	40.4	x	0.85	x	0.7	=	51.97	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	76.19	129.17	177.59	225.52	260.54	262.93	251.65	224.36	193.73	142.75	91.09	65.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	467.98	518.56	553.13	578.99	591.72	572.83	547.91	526.87	507.79	479.09	452.85	446.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	1	0.99	0.98	0.96	0.97	0.99	1	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.61	18.74	19.02	19.43	19.88	20.33	20.62	20.58	20.21	19.64	19.07	18.6	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.53	18.53	18.53	18.55	18.55	18.57	18.57	18.57	18.56	18.55	18.55	18.54	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	1	0.99	0.94	0.76	0.81	0.97	1	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	15.61	15.8	16.21	16.81	17.47	18.12	18.47	18.44	17.96	17.13	16.29	15.6	(90)

fLA = Living area ÷ (4) = 0.28 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.44	16.61	16.98	17.54	18.14	18.73	19.07	19.03	18.58	17.82	17.06	16.43	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	16.44	16.61	16.98	17.54	18.14	18.73	19.07	19.03	18.58	17.82	17.06	16.43	(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=	1	1	1	0.99	0.98	0.95	0.84	0.87	0.97	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	467.47	517.68	551.49	575.36	582.04	542.87	461.32	459.76	492.54	476.19	452.02	445.65	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	3343.15	3218.05	2874	2342.05	1741.69	1106.73	660.6	703.52	1205.2	1954.26	2705.53	3337.08	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	2139.51	1814.65	1727.95	1272.01	862.78	0	0	0	0	1099.68	1622.53	2151.23	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	12690.34	(98)
Space heating requirement in kWh/m²/year	160.64	(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		12690.34	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	13324.86	(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		2102.07	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2207.17	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	155.32	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				398.03	(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			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	3727.69	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	80.61	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	3808.3	(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) =			3808.3	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	206.58	(379)
Total CO2, kg/year	sum of (376)…(382) =			4014.88	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			50.82	(384)
EI rating (section 14)				56.53	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 11

Address : , london

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	51	(1a)	x	1.9	(2a)	=	96.9	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			96.9	(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) =	0.21	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.71	(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) =	0.65	(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

0.83	0.82	0.8	0.72	0.7	0.62	0.62	0.6	0.65	0.7	0.74	0.77

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=	0.85	0.83	0.82	0.76	0.75	0.69	0.69	0.68	0.71	0.75	0.77	0.79	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.85	0.83	0.82	0.76	0.75	0.69	0.69	0.68	0.71	0.75	0.77	0.79	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			1.67	x1/[1/(4.8)+ 0.04]		=	6.72			(27)
Windows Type 2			0.84	x1/[1/(4.8)+ 0.04]		=	3.38			(27)
Walls Type1	45.3	2.51	42.79	x	2.1	=	89.86			(29)
Walls Type2	15.39	1.9	13.49	x	2.1	=	28.33			(29)
Roof	31.9	0	31.9	x	0.28	=	8.93			(30)
Total area of elements, m²			92.59							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 139.89 (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: High 450 (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 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 153.89 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.09	26.65	26.23	24.25	23.88	22.15	22.15	21.83	22.81	23.88	24.63	25.41	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	180.97	180.54	180.12	178.14	177.76	176.04	176.04	175.72	176.7	177.76	178.52	179.3	

Average = Sum(39)$_{1…12}$ /12= 178.13 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	3.55	3.54	3.53	3.49	3.49	3.45	3.45	3.45	3.46	3.49	3.5	3.52

Average = Sum(40)$_{1...12}$ /12= 3.49 (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 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	
										Total = Sum(44)$_{1...12}$ =		900.48	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55	
										Total = Sum(45)$_{1...12}$ =		1180.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.13	15.21	12.37	9.36	7	5.91	6.39	8.3	11.14	14.15	16.51	17.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)

Water heating gains (Table 5)

(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	295.47	293.38	283.02	266.78	250.71	235.25	225.31	230.54	239.03	255.44	274.06	287.61	(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	1	x	1.67	x	19.64	x	0.85	x	0.7	=	13.52	(76)
East	0.9x	1	x	1.67	x	38.42	x	0.85	x	0.7	=	26.46	(76)
East	0.9x	1	x	1.67	x	63.27	x	0.85	x	0.7	=	43.57	(76)
East	0.9x	1	x	1.67	x	92.28	x	0.85	x	0.7	=	63.54	(76)
East	0.9x	1	x	1.67	x	113.09	x	0.85	x	0.7	=	77.88	(76)

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East	0.9x	1	x	1.67	x	115.77	x	0.85	x	0.7	=	79.72	(76)
East	0.9x	1	x	1.67	x	110.22	x	0.85	x	0.7	=	75.9	(76)
East	0.9x	1	x	1.67	x	94.68	x	0.85	x	0.7	=	65.19	(76)
East	0.9x	1	x	1.67	x	73.59	x	0.85	x	0.7	=	50.67	(76)
East	0.9x	1	x	1.67	x	45.59	x	0.85	x	0.7	=	31.39	(76)
East	0.9x	1	x	1.67	x	24.49	x	0.85	x	0.7	=	16.86	(76)
East	0.9x	1	x	1.67	x	16.15	x	0.85	x	0.7	=	11.12	(76)
West	0.9x	0.77	x	0.84	x	19.64	x	0.85	x	0.7	=	6.8	(80)
West	0.9x	0.77	x	0.84	x	38.42	x	0.85	x	0.7	=	13.31	(80)
West	0.9x	0.77	x	0.84	x	63.27	x	0.85	x	0.7	=	21.92	(80)
West	0.9x	0.77	x	0.84	x	92.28	x	0.85	x	0.7	=	31.96	(80)
West	0.9x	0.77	x	0.84	x	113.09	x	0.85	x	0.7	=	39.17	(80)
West	0.9x	0.77	x	0.84	x	115.77	x	0.85	x	0.7	=	40.1	(80)
West	0.9x	0.77	x	0.84	x	110.22	x	0.85	x	0.7	=	38.18	(80)
West	0.9x	0.77	x	0.84	x	94.68	x	0.85	x	0.7	=	32.79	(80)
West	0.9x	0.77	x	0.84	x	73.59	x	0.85	x	0.7	=	25.49	(80)
West	0.9x	0.77	x	0.84	x	45.59	x	0.85	x	0.7	=	15.79	(80)
West	0.9x	0.77	x	0.84	x	24.49	x	0.85	x	0.7	=	8.48	(80)
West	0.9x	0.77	x	0.84	x	16.15	x	0.85	x	0.7	=	5.59	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	20.33	39.76	65.49	95.51	117.05	119.82	114.07	97.99	76.16	47.18	25.35	16.72	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	315.8	333.14	348.5	362.28	367.75	355.07	339.38	328.53	315.19	302.63	299.4	304.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	1	1	0.99	0.97	0.97	0.99	1	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.59	18.71	18.98	19.4	19.85	20.3	20.6	20.56	20.19	19.62	19.05	18.58	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.5	18.5	18.51	18.52	18.53	18.54	18.54	18.54	18.54	18.53	18.52	18.51	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	1	0.99	0.95	0.78	0.82	0.97	1	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	15.56	15.73	16.14	16.75	17.41	18.07	18.44	18.4	17.91	17.07	16.24	15.56	(90)

fLA = Living area ÷ (4) = | 0.56 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.27	17.41	17.74	18.24	18.79	19.33	19.66	19.62	19.2	18.51	17.83	17.27	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.27	17.41	17.74	18.24	18.79	19.33	19.66	19.62	19.2	18.51	17.83	17.27	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	1	1	0.99	0.97	0.91	0.93	0.98	1	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	315.47	332.68	347.72	360.66	363.73	343.72	309.53	304.95	309.39	301.33	298.92	304.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2347.74	2259.23	2025.38	1664.58	1259.97	832.96	538.38	566.18	900.41	1406.09	1915.15	2342.71	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1512.01	1294.65	1248.18	938.83	666.8	0	0	0	0	821.95	1163.68	1516.76	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 9162.85 (98)

Space heating requirement in kWh/m²/year 179.66 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community 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		9162.85	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	9620.99	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1923.08	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	115.44	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				302.44	(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			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	2770.58	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	59.91	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	2830.49	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			2830.49	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	156.96	(379)
Total CO2, kg/year	sum of (376)…(382) =			2987.46	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			58.58	(384)
EI rating (section 14)				58.16	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 12

Address : , London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	55	(1a) x	2.17	(2a) =	119.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	119.35	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.67	(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) =	0.57	(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

0.72	0.71	0.7	0.62	0.61	0.54	0.54	0.52	0.57	0.61	0.64	0.67

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=	0.76	0.75	0.74	0.69	0.69	0.65	0.65	0.64	0.66	0.69	0.7	0.72	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.76	0.75	0.74	0.69	0.69	0.65	0.65	0.64	0.66	0.69	0.7	0.72	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.59	x1/[1/(1.6)+ 0.04]		=	6.9			(27)
Windows Type 2			1.87	x1/[1/(4.8)+ 0.04]		=	7.53			(27)
Windows Type 3			0.65	x1/[1/(4.8)+ 0.04]		=	2.62			(27)
Windows Type 4			1.87	x1/[1/(1.6)+ 0.04]		=	2.81			(27)
Floor			55	x	0.93	=	51.15			(28)
Walls Type1	28.9	8.33	20.57	x	2.1	=	43.2			(29)
Walls Type2	7.81	2.55	5.26	x	2.1	=	11.05			(29)
Total area of elements, m²			91.71							(31)
Party wall			27.9	x	0	=	0			(32)
Party wall			1.13	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	127.91	(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: High	450	(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		14.4	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	142.31	(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=	30	29.6	29.21	27.37	27.02	25.42	25.42	25.12	26.03	27.02	27.72	28.45	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	172.32	171.92	171.52	169.68	169.34	167.73	167.73	167.43	168.35	169.34	170.03	170.76	

Average = Sum(39)$_{1...12}$ /12= 169.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	3.13	3.13	3.12	3.09	3.08	3.05	3.05	3.04	3.06	3.08	3.09	3.1	

Average = Sum(40)$_{1...12}$ /12= 3.09 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.84 (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 77.84 (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=	85.62	82.51	79.39	76.28	73.17	70.05	70.05	73.17	76.28	79.39	82.51	85.62	

Total = Sum(44)$_{1...12}$ = 934.05 (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=	126.97	111.05	114.6	99.91	95.86	82.72	76.65	87.96	89.01	103.74	113.24	122.97	

Total = Sum(45)$_{1...12}$ = 1224.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.05	16.66	17.19	14.99	14.38	12.41	11.5	13.19	13.35	15.56	16.99	18.45	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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)

DER WorkSheet: New dwelling design stage

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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24	(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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24

Output from water heater (annual)$_{1...12}$ — 1875.52 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	60.83	53.73	56.71	51.23	50.48	45.51	44.1	47.86	47.61	53.1	55.66	59.5	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.74	13.1	10.65	8.06	6.03	5.09	5.5	7.15	9.59	12.18	14.22	15.15	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	160.19	161.85	157.66	148.74	137.49	126.91	119.84	118.18	122.36	131.28	142.54	153.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	(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=	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	(71)

Water heating gains (Table 5)

(72)m=	81.76	79.96	76.23	71.15	67.86	63.22	59.27	64.32	66.12	71.37	77.31	79.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	307.25	305.46	295.1	278.52	261.93	245.77	235.17	240.21	248.64	265.4	284.62	298.8	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	1.87	x	10.63	x	0.85	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	0.65	x	10.63	x	0.85	x	0.7	=	2.85	(74)
North	0.9x	0.77	x	1.87	x	20.32	x	0.85	x	0.7	=	15.67	(74)
North	0.9x	0.77	x	0.65	x	20.32	x	0.85	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	1.87	x	34.53	x	0.85	x	0.7	=	26.63	(74)
North	0.9x	0.77	x	0.65	x	34.53	x	0.85	x	0.7	=	9.25	(74)
North	0.9x	0.77	x	1.87	x	55.46	x	0.85	x	0.7	=	42.77	(74)
North	0.9x	0.77	x	0.65	x	55.46	x	0.85	x	0.7	=	14.87	(74)
North	0.9x	0.77	x	1.87	x	74.72	x	0.85	x	0.7	=	57.61	(74)
North	0.9x	0.77	x	0.65	x	74.72	x	0.85	x	0.7	=	20.03	(74)
North	0.9x	0.77	x	1.87	x	79.99	x	0.85	x	0.7	=	61.67	(74)
North	0.9x	0.77	x	0.65	x	79.99	x	0.85	x	0.7	=	21.44	(74)
North	0.9x	0.77	x	1.87	x	74.68	x	0.85	x	0.7	=	57.58	(74)
North	0.9x	0.77	x	0.65	x	74.68	x	0.85	x	0.7	=	20.01	(74)
North	0.9x	0.77	x	1.87	x	59.25	x	0.85	x	0.7	=	45.68	(74)
North	0.9x	0.77	x	0.65	x	59.25	x	0.85	x	0.7	=	15.88	(74)
North	0.9x	0.77	x	1.87	x	41.52	x	0.85	x	0.7	=	32.01	(74)
North	0.9x	0.77	x	0.65	x	41.52	x	0.85	x	0.7	=	11.13	(74)
North	0.9x	0.77	x	1.87	x	24.19	x	0.85	x	0.7	=	18.65	(74)
North	0.9x	0.77	x	0.65	x	24.19	x	0.85	x	0.7	=	6.48	(74)
North	0.9x	0.77	x	1.87	x	13.12	x	0.85	x	0.7	=	10.11	(74)
North	0.9x	0.77	x	0.65	x	13.12	x	0.85	x	0.7	=	3.52	(74)
North	0.9x	0.77	x	1.87	x	8.86	x	0.85	x	0.7	=	6.84	(74)
North	0.9x	0.77	x	0.65	x	8.86	x	0.85	x	0.7	=	2.38	(74)
East	0.9x	1	x	1.87	x	19.64	x	0.76	x	0.7	=	13.54	(76)
East	0.9x	1	x	1.87	x	38.42	x	0.76	x	0.7	=	26.49	(76)
East	0.9x	1	x	1.87	x	63.27	x	0.76	x	0.7	=	43.62	(76)
East	0.9x	1	x	1.87	x	92.28	x	0.76	x	0.7	=	63.62	(76)
East	0.9x	1	x	1.87	x	113.09	x	0.76	x	0.7	=	77.97	(76)
East	0.9x	1	x	1.87	x	115.77	x	0.76	x	0.7	=	79.81	(76)
East	0.9x	1	x	1.87	x	110.22	x	0.76	x	0.7	=	75.99	(76)
East	0.9x	1	x	1.87	x	94.68	x	0.76	x	0.7	=	65.27	(76)
East	0.9x	1	x	1.87	x	73.59	x	0.76	x	0.7	=	50.73	(76)
East	0.9x	1	x	1.87	x	45.59	x	0.76	x	0.7	=	31.43	(76)
East	0.9x	1	x	1.87	x	24.49	x	0.76	x	0.7	=	16.88	(76)
East	0.9x	1	x	1.87	x	16.15	x	0.76	x	0.7	=	11.14	(76)
South	0.9x	0.77	x	4.59	x	46.75	x	0.76	x	0.7	=	79.11	(78)
South	0.9x	0.77	x	4.59	x	76.57	x	0.76	x	0.7	=	129.57	(78)
South	0.9x	0.77	x	4.59	x	97.53	x	0.76	x	0.7	=	165.05	(78)
South	0.9x	0.77	x	4.59	x	110.23	x	0.76	x	0.7	=	186.54	(78)
South	0.9x	0.77	x	4.59	x	114.87	x	0.76	x	0.7	=	194.39	(78)

South	0.9x	0.77	x	4.59	x	110.55	x	0.76	x	0.7	=	187.07	(78)
South	0.9x	0.77	x	4.59	x	108.01	x	0.76	x	0.7	=	182.78	(78)
South	0.9x	0.77	x	4.59	x	104.89	x	0.76	x	0.7	=	177.5	(78)
South	0.9x	0.77	x	4.59	x	101.89	x	0.76	x	0.7	=	172.41	(78)
South	0.9x	0.77	x	4.59	x	82.59	x	0.76	x	0.7	=	139.75	(78)
South	0.9x	0.77	x	4.59	x	55.42	x	0.76	x	0.7	=	93.78	(78)
South	0.9x	0.77	x	4.59	x	40.4	x	0.76	x	0.7	=	68.36	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	103.7	177.17	244.55	307.79	349.99	350	336.36	304.34	266.29	196.32	124.29	88.71	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	410.95	482.64	539.65	586.31	611.92	595.77	571.53	544.55	514.92	461.71	408.91	387.51	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.98	0.95	0.88	0.9	0.97	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.89	19.04	19.33	19.73	20.16	20.56	20.8	20.76	20.43	19.88	19.32	18.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.68	18.69	18.69	18.71	18.71	18.73	18.73	18.73	18.72	18.71	18.7	18.7	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.99	0.96	0.84	0.58	0.64	0.92	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.09	16.32	16.74	17.34	17.95	18.49	18.69	18.68	18.33	17.55	16.73	16.07	(90)

fLA = Living area ÷ (4) = 0.55 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.63	17.81	18.16	18.65	19.17	19.63	19.85	19.82	19.48	18.83	18.15	17.61	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.63	17.81	18.16	18.65	19.17	19.63	19.85	19.82	19.48	18.83	18.15	17.61	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.96	0.9	0.77	0.81	0.94	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.33	481.23	536.43	578.12	589.75	536.45	439.68	440.15	485.81	456.54	407.77	387.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2296.27	2219.89	2000.14	1655.19	1264.13	842.86	544.66	572.64	906.46	1393.84	1879.44	2289.52	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1403.13	1168.38	1089	775.49	501.74	0	0	0	0	697.35	1059.6	1415.44	

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	8110.13	(98)
Space heating requirement in kWh/m²/year		147.46	(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		8110.13	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	8515.63	(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		1875.52	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1969.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	104.85	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		260.39	(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				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	2516.38	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	54.42	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	2570.8	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			2570.8	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	135.14	(379)
Total CO2, kg/year	sum of (376)…(382) =			2705.94	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			49.2	(384)
EI rating (section 14)				63.74	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 13

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.17	(2a) =	110.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		110.67	(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) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			10	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.68	(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) =	0.53	(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

0.67	0.66	0.65	0.58	0.57	0.5	0.5	0.49	0.53	0.57	0.59	0.62

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=	0.73	0.72	0.71	0.67	0.66	0.63	0.63	0.62	0.64	0.66	0.68	0.69	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.73	0.72	0.71	0.67	0.66	0.63	0.63	0.62	0.64	0.66	0.68	0.69	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.59	x1/[1/(1.6)+ 0.04]		=	6.9			(27)
Windows Type 2			4.64	x1/[1/(4.8)+ 0.04]		=	18.68			(27)
Floor			51	x	0.99	=	50.49			(28)
Walls Type1	16.14	4.59	11.55	x	2.1	=	24.25			(29)
Walls Type2	16.1	6.54	9.56	x	2.1	=	20.08			(29)
Total area of elements, m²			83.24							(31)
Party wall			33.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 123.07 (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: High 450 (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 12.8 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 135.87 (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=	26.52	26.2	25.89	24.41	24.13	22.85	22.85	22.61	23.34	24.13	24.69	25.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	162.39	162.07	161.75	160.28	160	158.72	158.72	158.48	159.21	160	160.56	161.14	

Average = Sum(39)$_{1…12}$ /12= 160.28 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	3.18	3.18	3.17	3.14	3.14	3.11	3.11	3.11	3.12	3.14	3.15	3.16	

Average = Sum(40)$_{1...12}$ /12= 3.14 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	

Total = Sum(44)$_{1...12}$ = 900.48 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55	

Total = Sum(45)$_{1...12}$ = 1180.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.51	12	9.76	7.39	5.52	4.66	5.04	6.55	8.79	11.16	13.03	13.89	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)
Water heating gains (Table 5)													
(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	291.86	290.17	280.41	264.8	249.23	234	223.96	228.79	236.68	252.46	270.57	283.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.64	x	10.63	x	0.85	x	0.7	=	20.34	(74)
North	0.9x	0.77	x	4.64	x	20.32	x	0.85	x	0.7	=	38.88	(74)
North	0.9x	0.77	x	4.64	x	34.53	x	0.85	x	0.7	=	66.06	(74)
North	0.9x	0.77	x	4.64	x	55.46	x	0.85	x	0.7	=	106.12	(74)
North	0.9x	0.77	x	4.64	x	74.72	x	0.85	x	0.7	=	142.95	(74)

North	0.9x	0.77	x	4.64	x	79.99	x	0.85	x	0.7	=	153.03	(74)
North	0.9x	0.77	x	4.64	x	74.68	x	0.85	x	0.7	=	142.87	(74)
North	0.9x	0.77	x	4.64	x	59.25	x	0.85	x	0.7	=	113.35	(74)
North	0.9x	0.77	x	4.64	x	41.52	x	0.85	x	0.7	=	79.43	(74)
North	0.9x	0.77	x	4.64	x	24.19	x	0.85	x	0.7	=	46.28	(74)
North	0.9x	0.77	x	4.64	x	13.12	x	0.85	x	0.7	=	25.1	(74)
North	0.9x	0.77	x	4.64	x	8.86	x	0.85	x	0.7	=	16.96	(74)
South	0.9x	0.77	x	4.59	x	46.75	x	0.76	x	0.7	=	79.11	(78)
South	0.9x	0.77	x	4.59	x	76.57	x	0.76	x	0.7	=	129.57	(78)
South	0.9x	0.77	x	4.59	x	97.53	x	0.76	x	0.7	=	165.05	(78)
South	0.9x	0.77	x	4.59	x	110.23	x	0.76	x	0.7	=	186.54	(78)
South	0.9x	0.77	x	4.59	x	114.87	x	0.76	x	0.7	=	194.39	(78)
South	0.9x	0.77	x	4.59	x	110.55	x	0.76	x	0.7	=	187.07	(78)
South	0.9x	0.77	x	4.59	x	108.01	x	0.76	x	0.7	=	182.78	(78)
South	0.9x	0.77	x	4.59	x	104.89	x	0.76	x	0.7	=	177.5	(78)
South	0.9x	0.77	x	4.59	x	101.89	x	0.76	x	0.7	=	172.41	(78)
South	0.9x	0.77	x	4.59	x	82.59	x	0.76	x	0.7	=	139.75	(78)
South	0.9x	0.77	x	4.59	x	55.42	x	0.76	x	0.7	=	93.78	(78)
South	0.9x	0.77	x	4.59	x	40.4	x	0.76	x	0.7	=	68.36	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	99.46	168.45	231.11	292.66	337.34	340.1	325.65	290.86	251.84	186.03	118.88	85.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	391.32	458.62	511.52	557.46	586.57	574.1	549.62	519.65	488.53	438.49	389.45	369.22	(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	1	0.99	0.98	0.94	0.87	0.9	0.97	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.87	19.02	19.31	19.72	20.16	20.56	20.8	20.76	20.42	19.87	19.3	18.85	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.66	18.66	18.67	18.68	18.68	18.7	18.7	18.7	18.69	18.68	18.68	18.67	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.99	0.95	0.83	0.56	0.63	0.91	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.05	16.27	16.7	17.3	17.93	18.46	18.66	18.65	18.3	17.52	16.69	16.02	(90)

fLA = Living area ÷ (4) = | 0.55 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.61	17.8	18.15	18.64	19.16	19.63	19.85	19.82	19.48	18.82	18.14	17.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.61	17.8	18.15	18.64	19.16	19.63	19.85	19.82	19.48	18.82	18.14	17.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.96	0.89	0.76	0.8	0.94	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	390.65	457.14	508.22	549.06	563.55	512.99	417.82	416.97	459.68	433.2	388.24	368.72	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2161.61	2090.45	1884.16	1561.9	1194.33	797.77	515.33	541.66	856.45	1315.47	1772.4	2157.57	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1317.59	1097.58	1023.7	729.25	469.3	0	0	0	0	656.41	996.6	1330.91	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	7621.33	(98)
Space heating requirement in kWh/m²/year	149.44	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community 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		7621.33	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	8002.39	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1923.08	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	99.25	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

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warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		0	(331)
Energy for lighting (calculated in Appendix L)			238.64	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	2382.11	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	51.51	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	2433.63	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			2433.63	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	123.85	(379)
Total CO2, kg/year	sum of (376)…(382) =			2557.48	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			50.15	(384)
EI rating (section 14)				64.3	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.15

Property Address: Unit 14

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.18	(2a) =	111.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	111.18	(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) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.68	(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) =	0.58	(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

0.74	0.72	0.71	0.64	0.62	0.55	0.55	0.53	0.58	0.62	0.65	0.68

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=	0.77	0.76	0.75	0.7	0.69	0.65	0.65	0.64	0.67	0.69	0.71	0.73	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.77	0.76	0.75	0.7	0.69	0.65	0.65	0.64	0.67	0.69	0.71	0.73	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.42	x1/[1/(1.6)+ 0.04]		=	6.65			(27)
Windows Type 2			4.96	x1/[1/(4.8)+ 0.04]		=	19.97			(27)
Floor			51	x	0.97	=	49.47			(28)
Walls Type1	39.2	4.96	34.24	x	2.1	=	71.9			(29)
Walls Type2	10.99	6.32	4.67	x	2.1	=	9.81			(29)
Total area of elements, m²			101.19							(31)
Party wall			16.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 160.46 (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: High 450 (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 15.2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 175.66 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.3	27.92	27.54	25.76	25.42	23.87	23.87	23.59	24.47	25.42	26.1	26.8	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	203.97	203.58	203.2	201.42	201.09	199.53	199.53	199.25	200.13	201.09	201.76	202.46	

Average = Sum(39)$_{1…12}$ /12= 201.42 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	4	3.99	3.98	3.95	3.94	3.91	3.91	3.91	3.92	3.94	3.96	3.97

Average = Sum(40)$_{1...12}$ /12= 3.95 (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 — 1.72 (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 — 75.04 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 900.48 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55

Total = Sum(45)$_{1...12}$ = 1180.67 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 160 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01

(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)1…12 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.48	11.97	9.74	7.37	5.51	4.65	5.03	6.53	8.77	11.14	13	13.86	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)
Water heating gains (Table 5)													
(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	291.82	290.14	280.39	264.79	249.22	233.99	223.95	228.78	236.66	252.43	270.54	283.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.96	x	10.63	x	0.85	x	0.7	=	21.75	(74)
North	0.9x	0.77	x	4.96	x	20.32	x	0.85	x	0.7	=	41.56	(74)
North	0.9x	0.77	x	4.96	x	34.53	x	0.85	x	0.7	=	70.62	(74)
North	0.9x	0.77	x	4.96	x	55.46	x	0.85	x	0.7	=	113.43	(74)
North	0.9x	0.77	x	4.96	x	74.72	x	0.85	x	0.7	=	152.81	(74)

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North	0.9x	0.77	x	4.96	x	79.99	x	0.85	x	0.7	=	163.58	(74)
North	0.9x	0.77	x	4.96	x	74.68	x	0.85	x	0.7	=	152.73	(74)
North	0.9x	0.77	x	4.96	x	59.25	x	0.85	x	0.7	=	121.17	(74)
North	0.9x	0.77	x	4.96	x	41.52	x	0.85	x	0.7	=	84.91	(74)
North	0.9x	0.77	x	4.96	x	24.19	x	0.85	x	0.7	=	49.47	(74)
North	0.9x	0.77	x	4.96	x	13.12	x	0.85	x	0.7	=	26.83	(74)
North	0.9x	0.77	x	4.96	x	8.86	x	0.85	x	0.7	=	18.13	(74)
South	0.9x	0.77	x	4.42	x	46.75	x	0.76	x	0.7	=	76.18	(78)
South	0.9x	0.77	x	4.42	x	76.57	x	0.76	x	0.7	=	124.77	(78)
South	0.9x	0.77	x	4.42	x	97.53	x	0.76	x	0.7	=	158.94	(78)
South	0.9x	0.77	x	4.42	x	110.23	x	0.76	x	0.7	=	179.63	(78)
South	0.9x	0.77	x	4.42	x	114.87	x	0.76	x	0.7	=	187.19	(78)
South	0.9x	0.77	x	4.42	x	110.55	x	0.76	x	0.7	=	180.14	(78)
South	0.9x	0.77	x	4.42	x	108.01	x	0.76	x	0.7	=	176.01	(78)
South	0.9x	0.77	x	4.42	x	104.89	x	0.76	x	0.7	=	170.93	(78)
South	0.9x	0.77	x	4.42	x	101.89	x	0.76	x	0.7	=	166.03	(78)
South	0.9x	0.77	x	4.42	x	82.59	x	0.76	x	0.7	=	134.58	(78)
South	0.9x	0.77	x	4.42	x	55.42	x	0.76	x	0.7	=	90.3	(78)
South	0.9x	0.77	x	4.42	x	40.4	x	0.76	x	0.7	=	65.83	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	97.93	166.33	229.56	293.07	340	343.73	328.74	292.1	250.94	184.05	117.13	83.96	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	389.76	456.47	509.94	557.85	589.21	577.72	552.69	520.88	487.6	436.48	387.68	367.82	(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	1	0.99	0.98	0.95	0.9	0.92	0.97	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.42	18.58	18.91	19.38	19.89	20.37	20.67	20.62	20.22	19.57	18.92	18.4	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.33	18.34	18.34	18.35	18.35	18.36	18.36	18.37	18.36	18.35	18.35	18.34	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.95	0.85	0.57	0.64	0.92	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	15.23	15.48	15.95	16.65	17.38	18.03	18.32	18.29	17.85	16.93	15.98	15.21	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.74	16.94	17.35	17.94	18.56	19.14	19.43	19.39	18.97	18.18	17.37	16.71	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	16.74	16.94	17.35	17.94	18.56	19.14	19.43	19.39	18.97	18.18	17.37	16.71	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.96	0.89	0.77	0.81	0.94	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	388.73	454.4	505.69	548	564.62	517.01	423.26	420.18	457.86	430.1	385.95	367.03	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2536.89	2451.88	2205.01	1820.41	1380.16	905.61	564.51	596.43	974.38	1524.28	2072.09	2533.6	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1598.23	1342.31	1264.29	916.14	606.76	0	0	0	0	814.07	1214.03	1611.93	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 9367.75 (98)

Space heating requirement in kWh/m²/year 183.68 (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		9367.75	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	9836.14	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1923.08	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	117.59	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				238.08	(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			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	2822.21	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	61.03	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	2883.24	(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) =			2883.24	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	123.56	(379)
Total CO2, kg/year	sum of (376)…(382) =			3006.81	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			58.96	(384)
EI rating (section 14)				57.9	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 15

Address : , London

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	55	(1a) x	2.17	(2a) =	119.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	119.35	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(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		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.67	(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) =	0.57	(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

0.72	0.71	0.7	0.62	0.61	0.54	0.54	0.52	0.57	0.61	0.64	0.67

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=	0.76	0.75	0.74	0.69	0.69	0.65	0.65	0.64	0.66	0.69	0.7	0.72	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.76	0.75	0.74	0.69	0.69	0.65	0.65	0.64	0.66	0.69	0.7	0.72	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m^2)	Openings m^2	Net Area A ,m^2		U-value W/m2K		A X U (W/K)	k-value kJ/m^2·K	A X k kJ/K	
Doors			1.9	x	1.4	=	2.66			(26)
Windows Type 1			3	x1/[1/(1.6)+ 0.04]		=	4.51			(27)
Windows Type 2			1.76	x1/[1/(4.8)+ 0.04]		=	7.09			(27)
Windows Type 3			0.64	x1/[1/(4.8)+ 0.04]		=	2.58			(27)
Windows Type 4			3.84	x1/[1/(1.6)+ 0.04]		=	5.77			(27)
Floor			55	x	0.93	=	51.15			(28)
Walls Type1	28.9	8.6	20.3	x	2.1	=	42.63			(29)
Walls Type2	7.81	2.54	5.27	x	2.1	=	11.07			(29)
Total area of elements, m^2			91.71							(31)
Party wall			27.9	x	0	=	0			(32)
Party wall			1.13	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 127.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m^2K Indicative Value: High 450 (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 14.4 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 141.86 (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=	30	29.6	29.21	27.37	27.02	25.42	25.42	25.12	26.03	27.02	27.72	28.45	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	171.86	171.46	171.07	169.22	168.88	167.27	167.27	166.98	167.89	168.88	169.57	170.3	

Average = Sum(39)$_{1…12}$ /12= 169.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	3.12	3.12	3.11	3.08	3.07	3.04	3.04	3.04	3.05	3.07	3.08	3.1	

Average = Sum(40)$_{1…12}$ /12= 3.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.84 (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 77.84 (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)

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	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=	85.62	82.51	79.39	76.28	73.17	70.05	70.05	73.17	76.28	79.39	82.51	85.62	

Total = Sum(44)$_{1…12}$ = 934.05 (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=	126.97	111.05	114.6	99.91	95.86	82.72	76.65	87.96	89.01	103.74	113.24	122.97	

Total = Sum(45)$_{1…12}$ = 1224.68 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.05	16.66	17.19	14.99	14.38	12.41	11.5	13.19	13.35	15.56	16.99	18.45	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24	(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=	182.25	160.98	169.87	153.4	151.14	136.22	131.93	143.24	142.51	159.01	166.73	178.24

Output from water heater (annual)$_{1...12}$ — 1875.52 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	60.83	53.73	56.71	51.23	50.48	45.51	44.1	47.86	47.61	53.1	55.66	59.5	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	91.87	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.68	13.04	10.6	8.03	6	5.06	5.47	7.11	9.55	12.12	14.15	15.08	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	160.19	161.85	157.66	148.74	137.49	126.91	119.84	118.18	122.36	131.28	142.54	153.12	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	32.19	(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=	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	-73.49	(71)

Water heating gains (Table 5)

(72)m=	81.76	79.96	76.23	71.15	67.86	63.22	59.27	64.32	66.12	71.37	77.31	79.97	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	307.18	305.4	295.05	278.48	261.9	245.75	235.14	240.17	248.59	265.34	284.55	298.73	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	1.76	x	10.63	x	0.85	x	0.7	=	7.72	(74)
North	0.9x	0.77	x	0.64	x	10.63	x	0.85	x	0.7	=	2.81	(74)
North	0.9x	0.77	x	1.76	x	20.32	x	0.85	x	0.7	=	14.75	(74)
North	0.9x	0.77	x	0.64	x	20.32	x	0.85	x	0.7	=	5.36	(74)
North	0.9x	0.77	x	1.76	x	34.53	x	0.85	x	0.7	=	25.06	(74)
North	0.9x	0.77	x	0.64	x	34.53	x	0.85	x	0.7	=	9.11	(74)
North	0.9x	0.77	x	1.76	x	55.46	x	0.85	x	0.7	=	40.25	(74)
North	0.9x	0.77	x	0.64	x	55.46	x	0.85	x	0.7	=	14.64	(74)
North	0.9x	0.77	x	1.76	x	74.72	x	0.85	x	0.7	=	54.22	(74)
North	0.9x	0.77	x	0.64	x	74.72	x	0.85	x	0.7	=	19.72	(74)
North	0.9x	0.77	x	1.76	x	79.99	x	0.85	x	0.7	=	58.05	(74)
North	0.9x	0.77	x	0.64	x	79.99	x	0.85	x	0.7	=	21.11	(74)
North	0.9x	0.77	x	1.76	x	74.68	x	0.85	x	0.7	=	54.19	(74)
North	0.9x	0.77	x	0.64	x	74.68	x	0.85	x	0.7	=	19.71	(74)
North	0.9x	0.77	x	1.76	x	59.25	x	0.85	x	0.7	=	43	(74)
North	0.9x	0.77	x	0.64	x	59.25	x	0.85	x	0.7	=	15.63	(74)
North	0.9x	0.77	x	1.76	x	41.52	x	0.85	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	0.64	x	41.52	x	0.85	x	0.7	=	10.96	(74)
North	0.9x	0.77	x	1.76	x	24.19	x	0.85	x	0.7	=	17.55	(74)
North	0.9x	0.77	x	0.64	x	24.19	x	0.85	x	0.7	=	6.38	(74)
North	0.9x	0.77	x	1.76	x	13.12	x	0.85	x	0.7	=	9.52	(74)
North	0.9x	0.77	x	0.64	x	13.12	x	0.85	x	0.7	=	3.46	(74)
North	0.9x	0.77	x	1.76	x	8.86	x	0.85	x	0.7	=	6.43	(74)
North	0.9x	0.77	x	0.64	x	8.86	x	0.85	x	0.7	=	2.34	(74)
East	0.9x	1	x	3.84	x	19.64	x	0.76	x	0.7	=	27.81	(76)
East	0.9x	1	x	3.84	x	38.42	x	0.76	x	0.7	=	54.39	(76)
East	0.9x	1	x	3.84	x	63.27	x	0.76	x	0.7	=	89.58	(76)
East	0.9x	1	x	3.84	x	92.28	x	0.76	x	0.7	=	130.64	(76)
East	0.9x	1	x	3.84	x	113.09	x	0.76	x	0.7	=	160.11	(76)
East	0.9x	1	x	3.84	x	115.77	x	0.76	x	0.7	=	163.9	(76)
East	0.9x	1	x	3.84	x	110.22	x	0.76	x	0.7	=	156.04	(76)
East	0.9x	1	x	3.84	x	94.68	x	0.76	x	0.7	=	134.03	(76)
East	0.9x	1	x	3.84	x	73.59	x	0.76	x	0.7	=	104.18	(76)
East	0.9x	1	x	3.84	x	45.59	x	0.76	x	0.7	=	64.54	(76)
East	0.9x	1	x	3.84	x	24.49	x	0.76	x	0.7	=	34.67	(76)
East	0.9x	1	x	3.84	x	16.15	x	0.76	x	0.7	=	22.87	(76)
South	0.9x	0.77	x	3	x	46.75	x	0.76	x	0.7	=	51.71	(78)
South	0.9x	0.77	x	3	x	76.57	x	0.76	x	0.7	=	84.69	(78)
South	0.9x	0.77	x	3	x	97.53	x	0.76	x	0.7	=	107.88	(78)
South	0.9x	0.77	x	3	x	110.23	x	0.76	x	0.7	=	121.92	(78)
South	0.9x	0.77	x	3	x	114.87	x	0.76	x	0.7	=	127.05	(78)

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South	0.9x	0.77	x	3	x	110.55	x	0.76	x	0.7	=	122.27	(78)
South	0.9x	0.77	x	3	x	108.01	x	0.76	x	0.7	=	119.46	(78)
South	0.9x	0.77	x	3	x	104.89	x	0.76	x	0.7	=	116.02	(78)
South	0.9x	0.77	x	3	x	101.89	x	0.76	x	0.7	=	112.69	(78)
South	0.9x	0.77	x	3	x	82.59	x	0.76	x	0.7	=	91.34	(78)
South	0.9x	0.77	x	3	x	55.42	x	0.76	x	0.7	=	61.29	(78)
South	0.9x	0.77	x	3	x	40.4	x	0.76	x	0.7	=	44.68	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	90.04	159.19	231.62	307.45	361.1	365.32	349.4	308.68	257.95	179.82	108.94	76.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	397.22	464.59	526.67	585.93	623	611.07	584.54	548.85	506.55	445.16	393.5	375.05	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.98	0.94	0.87	0.9	0.97	1	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.88	19.03	19.32	19.74	20.17	20.57	20.8	20.76	20.43	19.87	19.31	18.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.69	18.69	18.7	18.71	18.72	18.73	18.73	18.73	18.72	18.72	18.71	18.7	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.99	0.95	0.83	0.57	0.64	0.92	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.08	16.3	16.73	17.35	17.97	18.5	18.7	18.68	18.33	17.54	16.72	16.07	(90)

fLA = Living area ÷ (4) = | 0.55 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.62	17.8	18.15	18.66	19.18	19.64	19.85	19.82	19.48	18.82	18.14	17.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.62	17.8	18.15	18.66	19.18	19.64	19.85	19.82	19.48	18.82	18.14	17.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.96	0.89	0.76	0.81	0.95	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	396.68	463.4	523.77	577.77	599.28	546.54	444.29	441.9	479.06	440.71	392.53	374.65	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2288.92	2211.97	1993.62	1651.6	1263.19	842.84	544.36	571.83	903.47	1388.09	1872.71	2282.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1407.83	1175.04	1093.56	773.16	493.95	0	0	0	0	704.85	1065.72	1419.35	

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	8133.46	(98)
Space heating requirement in kWh/m²/year		147.88	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community 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		8133.46	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	8540.14	(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		1875.52	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1969.3	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	105.09	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0	(331)
Energy for lighting (calculated in Appendix L)		259.19	(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			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0 =	2522.27	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	54.54	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	2576.81	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)

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CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			2576.81	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	134.52	(379)
Total CO2, kg/year	sum of (376)…(382) =			2711.33	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			49.3	(384)
EI rating (section 14)				63.67	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 16

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.17	(2a) =	110.67	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	110.67	(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)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.18	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.68	(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) =	0.53	(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

0.67	0.66	0.65	0.58	0.57	0.5	0.5	0.49	0.53	0.57	0.59	0.62

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=	0.73	0.72	0.71	0.67	0.66	0.63	0.63	0.62	0.64	0.66	0.68	0.69	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.73	0.72	0.71	0.67	0.66	0.63	0.63	0.62	0.64	0.66	0.68	0.69	(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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.8	x1/[1/(1.6)+ 0.04]		=	7.22			(27)
Windows Type 2			4.16	x1/[1/(4.8)+ 0.04]		=	16.75			(27)
Floor			51	x	0.99	=	50.49			(28)
Walls Type1	16.14	4.8	11.34	x	2.1	=	23.81			(29)
Walls Type2	16.1	6.06	10.04	x	2.1	=	21.08			(29)
Total area of elements, m²			83.24							(31)
Party wall			33.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 122.02 (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: High 450 (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 12.8 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 134.82 (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=	26.52	26.2	25.89	24.41	24.13	22.85	22.85	22.61	23.34	24.13	24.69	25.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	161.34	161.02	160.7	159.23	158.95	157.66	157.66	157.43	158.16	158.95	159.51	160.09

Average = Sum(39)$_{1…12}$ /12= 159.23 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	3.16	3.16	3.15	3.12	3.12	3.09	3.09	3.09	3.1	3.12	3.13	3.14

Average = Sum(40)$_{1…12}$ /12= 3.12 (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 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	
										Total = Sum(44)$_{1…12}$ =		900.48	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55	
										Total = Sum(45)$_{1…12}$ =		1180.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	

Output from water heater (annual)$_{1…12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.58	12.06	9.81	7.42	5.55	4.69	5.06	6.58	8.83	11.21	13.09	13.95	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)
Water heating gains (Table 5)													
(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	291.92	290.22	280.45	264.84	249.26	234.02	223.99	228.82	236.72	252.51	270.63	283.96	(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)	
North	0.9x	0.77	x	4.16	x	10.63	x	0.85	x	0.7	=	18.24	(74)
North	0.9x	0.77	x	4.16	x	20.32	x	0.85	x	0.7	=	34.86	(74)
North	0.9x	0.77	x	4.16	x	34.53	x	0.85	x	0.7	=	59.23	(74)
North	0.9x	0.77	x	4.16	x	55.46	x	0.85	x	0.7	=	95.14	(74)
North	0.9x	0.77	x	4.16	x	74.72	x	0.85	x	0.7	=	128.16	(74)

North	0.9x	0.77	x	4.16	x	79.99	x	0.85	x	0.7	=	137.2	(74)
North	0.9x	0.77	x	4.16	x	74.68	x	0.85	x	0.7	=	128.09	(74)
North	0.9x	0.77	x	4.16	x	59.25	x	0.85	x	0.7	=	101.63	(74)
North	0.9x	0.77	x	4.16	x	41.52	x	0.85	x	0.7	=	71.21	(74)
North	0.9x	0.77	x	4.16	x	24.19	x	0.85	x	0.7	=	41.49	(74)
North	0.9x	0.77	x	4.16	x	13.12	x	0.85	x	0.7	=	22.5	(74)
North	0.9x	0.77	x	4.16	x	8.86	x	0.85	x	0.7	=	15.21	(74)
South	0.9x	0.77	x	4.8	x	46.75	x	0.76	x	0.7	=	82.73	(78)
South	0.9x	0.77	x	4.8	x	76.57	x	0.76	x	0.7	=	135.5	(78)
South	0.9x	0.77	x	4.8	x	97.53	x	0.76	x	0.7	=	172.6	(78)
South	0.9x	0.77	x	4.8	x	110.23	x	0.76	x	0.7	=	195.08	(78)
South	0.9x	0.77	x	4.8	x	114.87	x	0.76	x	0.7	=	203.28	(78)
South	0.9x	0.77	x	4.8	x	110.55	x	0.76	x	0.7	=	195.63	(78)
South	0.9x	0.77	x	4.8	x	108.01	x	0.76	x	0.7	=	191.14	(78)
South	0.9x	0.77	x	4.8	x	104.89	x	0.76	x	0.7	=	185.63	(78)
South	0.9x	0.77	x	4.8	x	101.89	x	0.76	x	0.7	=	180.3	(78)
South	0.9x	0.77	x	4.8	x	82.59	x	0.76	x	0.7	=	146.15	(78)
South	0.9x	0.77	x	4.8	x	55.42	x	0.76	x	0.7	=	98.07	(78)
South	0.9x	0.77	x	4.8	x	40.4	x	0.76	x	0.7	=	71.49	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	100.97	170.35	231.83	290.21	331.44	332.83	319.24	287.25	251.52	187.64	120.57	86.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	392.89	460.58	512.28	555.05	580.7	566.85	543.22	516.07	488.24	440.15	391.2	370.66	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.98	0.94	0.87	0.9	0.97	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.88	19.03	19.32	19.73	20.16	20.56	20.8	20.76	20.43	19.88	19.31	18.86	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.67	18.67	18.68	18.69	18.69	18.7	18.7	18.71	18.7	18.69	18.69	18.68	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.99	0.95	0.84	0.57	0.63	0.91	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.07	16.3	16.72	17.32	17.94	18.47	18.67	18.66	18.32	17.54	16.71	16.05	(90)

fLA = Living area ÷ (4) = 0.55 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.63	17.82	18.16	18.66	19.17	19.63	19.85	19.82	19.49	18.84	18.16	17.61	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	17.63	17.82	18.16	18.66	19.17	19.63	19.85	19.82	19.49	18.84	18.16	17.61	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.96	0.9	0.76	0.8	0.94	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	392.23	459.09	508.98	546.81	558.48	507.93	414.81	414.87	459.38	434.79	389.98	370.16	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2150.66	2079.93	1874.55	1553.44	1187.39	793.04	512.58	538.88	852.2	1309.03	1763.48	2146.51	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1308.27	1089.21	1015.98	724.77	467.91	0	0	0	0	650.43	988.92	1321.61	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 7567.09 (98)

Space heating requirement in kWh/m²/year 148.37 (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		7567.09	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	7945.45	(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		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1923.08	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	98.69	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =		0	(331)
Energy for lighting (calculated in Appendix L)			239.76	(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			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	= 2368.45	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 51.22	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 2419.67	(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) =			2419.67	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 124.43	(379)
Total CO2, kg/year	sum of (376)…(382) =			2544.1	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			49.88	(384)
EI rating (section 14)				64.49	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.15

Property Address: Unit 17

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	51	(1a) x	2.18	(2a) =	111.18	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	111.18	(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) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.68	(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) =	0.58	(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

0.74	0.72	0.71	0.64	0.62	0.55	0.55	0.53	0.58	0.62	0.65	0.68

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=	0.77	0.76	0.75	0.7	0.69	0.65	0.65	0.64	0.67	0.69	0.71	0.73	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.77	0.76	0.75	0.7	0.69	0.65	0.65	0.64	0.67	0.69	0.71	0.73	(25)

3. Heat losses and heat loss parameter:

DRAFT

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			1.9	x	1.4	=	2.66			(26)
Windows Type 1			4.8	x1/[1/(1.6)+ 0.04]		=	7.22			(27)
Windows Type 2			4.32	x1/[1/(4.8)+ 0.04]		=	17.4			(27)
Floor			51	x	0.97	=	49.47			(28)
Walls Type1	39.2	4.32	34.88	x	2.1	=	73.25			(29)
Walls Type2	10.99	6.7	4.29	x	2.1	=	9.01			(29)
Total area of elements, m²			101.19							(31)
Party wall			16.1	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 159 (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: High 450 (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 15.2 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 174.2 (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=	28.3	27.92	27.54	25.76	25.42	23.87	23.87	23.59	24.47	25.42	26.1	26.8	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	202.51	202.12	201.74	199.96	199.63	198.08	198.08	197.79	198.67	199.63	200.3	201	

Average = Sum(39)$_{1…12}$ /12= 199.96 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	3.97	3.96	3.96	3.92	3.91	3.88	3.88	3.88	3.9	3.91	3.93	3.94

Average = Sum(40)$_{1...12}$ /12= 3.92 (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 1.72 (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 75.04 (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=	82.54	79.54	76.54	73.54	70.54	67.54	67.54	70.54	73.54	76.54	79.54	82.54	
										Total = Sum(44)$_{1...12}$ =		900.48	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.41	107.06	110.48	96.32	92.42	79.75	73.9	84.8	85.81	100.01	109.17	118.55	
										Total = Sum(45)$_{1...12}$ =		1180.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.36	16.06	16.57	14.45	13.86	11.96	11.08	12.72	12.87	15	16.37	17.78	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.69	156.99	165.75	149.81	147.69	133.24	129.18	140.08	139.31	155.28	162.66	173.82

Output from water heater (annual)$_{1...12}$ 1831.51 (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=	59.31	52.41	55.34	50.03	49.34	44.53	43.18	46.81	46.54	51.86	54.31	58.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	85.98	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.54	12.03	9.78	7.4	5.53	4.67	5.05	6.56	8.81	11.18	13.05	13.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.83	151.39	147.47	139.13	128.6	118.7	112.09	110.54	114.45	122.8	133.32	143.22	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	-68.78	(71)

Water heating gains (Table 5)

(72)m=	79.72	77.99	74.39	69.49	66.32	61.84	58.04	62.91	64.64	69.71	75.43	77.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	291.88	290.19	280.43	264.82	249.24	234.01	223.97	228.8	236.7	252.48	270.6	283.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.32	x	10.63	x	0.85	x	0.7	=	18.94	(74)
North	0.9x	0.77	x	4.32	x	20.32	x	0.85	x	0.7	=	36.2	(74)
North	0.9x	0.77	x	4.32	x	34.53	x	0.85	x	0.7	=	61.51	(74)
North	0.9x	0.77	x	4.32	x	55.46	x	0.85	x	0.7	=	98.8	(74)
North	0.9x	0.77	x	4.32	x	74.72	x	0.85	x	0.7	=	133.09	(74)

North	0.9x	0.77	x	4.32	x	79.99	x	0.85	x	0.7	=	142.48	(74)
North	0.9x	0.77	x	4.32	x	74.68	x	0.85	x	0.7	=	133.02	(74)
North	0.9x	0.77	x	4.32	x	59.25	x	0.85	x	0.7	=	105.53	(74)
North	0.9x	0.77	x	4.32	x	41.52	x	0.85	x	0.7	=	73.95	(74)
North	0.9x	0.77	x	4.32	x	24.19	x	0.85	x	0.7	=	43.09	(74)
North	0.9x	0.77	x	4.32	x	13.12	x	0.85	x	0.7	=	23.37	(74)
North	0.9x	0.77	x	4.32	x	8.86	x	0.85	x	0.7	=	15.79	(74)
South	0.9x	0.77	x	4.8	x	46.75	x	0.76	x	0.7	=	82.73	(78)
South	0.9x	0.77	x	4.8	x	76.57	x	0.76	x	0.7	=	135.5	(78)
South	0.9x	0.77	x	4.8	x	97.53	x	0.76	x	0.7	=	172.6	(78)
South	0.9x	0.77	x	4.8	x	110.23	x	0.76	x	0.7	=	195.08	(78)
South	0.9x	0.77	x	4.8	x	114.87	x	0.76	x	0.7	=	203.28	(78)
South	0.9x	0.77	x	4.8	x	110.55	x	0.76	x	0.7	=	195.63	(78)
South	0.9x	0.77	x	4.8	x	108.01	x	0.76	x	0.7	=	191.14	(78)
South	0.9x	0.77	x	4.8	x	104.89	x	0.76	x	0.7	=	185.63	(78)
South	0.9x	0.77	x	4.8	x	101.89	x	0.76	x	0.7	=	180.3	(78)
South	0.9x	0.77	x	4.8	x	82.59	x	0.76	x	0.7	=	146.15	(78)
South	0.9x	0.77	x	4.8	x	55.42	x	0.76	x	0.7	=	98.07	(78)
South	0.9x	0.77	x	4.8	x	40.4	x	0.76	x	0.7	=	71.49	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	101.68	171.7	234.11	293.87	336.37	338.11	324.16	291.16	254.25	189.24	121.43	87.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	393.56	461.89	514.54	558.69	585.61	572.12	548.14	519.97	490.95	441.72	392.03	371.2	(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	1	0.99	0.98	0.95	0.9	0.92	0.97	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.44	18.6	18.93	19.39	19.89	20.38	20.67	20.63	20.23	19.59	18.94	18.41	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.34	18.35	18.35	18.36	18.36	18.37	18.37	18.38	18.37	18.36	18.36	18.35	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.96	0.85	0.57	0.64	0.92	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	15.26	15.51	15.98	16.67	17.39	18.04	18.33	18.3	17.86	16.96	16.01	15.24	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.76	16.97	17.37	17.96	18.57	19.14	19.44	19.4	18.98	18.2	17.39	16.74	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	16.76	16.97	17.37	17.96	18.57	19.14	19.44	19.4	18.98	18.2	17.39	16.74	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.96	0.9	0.77	0.81	0.94	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	392.51	459.74	510.17	548.82	561.51	512.98	420.9	419.4	460.54	435.09	390.25	370.39	(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=	2523.66	2439.48	2193.86	1810.63	1372.12	900.2	561.56	593.54	969.94	1517.12	2061.56	2520.18	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1585.58	1330.38	1252.66	908.5	603.09	0	0	0	0	805.03	1203.34	1599.44	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 9288.03 (98)

Space heating requirement in kWh/m²/year 182.12 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.			
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.			
Fraction of heat from Community 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		9288.03	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	9752.44	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1831.51	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1923.08	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	116.76	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				239.12	(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			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	= 2802.12	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 60.6	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 2862.72	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			2862.72	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 124.11	(379)
Total CO2, kg/year	sum of (376)…(382) =			2986.83	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			58.57	(384)
EI rating (section 14)				58.17	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.15

Property Address: Unit 18

Address : , london

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	79	(1a) x	2.6	(2a) =	205.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.4	(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) =	0.1	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		10	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.6	(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) =	0.55	(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

0.7	0.69	0.68	0.61	0.59	0.52	0.52	0.51	0.55	0.59	0.62	0.65

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=	0.75	0.74	0.73	0.68	0.68	0.64	0.64	0.63	0.65	0.68	0.69	0.71	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.75	0.74	0.73	0.68	0.68	0.64	0.64	0.63	0.65	0.68	0.69	0.71	(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			1.6	x	1.4	=	2.24			(26)
Windows Type 1			11.64	x1/[1/(4.8)+ 0.04]		=	46.87			(27)
Windows Type 2			4.55	x1/[1/(4.8)+ 0.04]		=	18.32			(27)
Walls Type1	89.2	16.19	73.01	x	1.27	=	92.87			(29)
Walls Type2	26.63	1.6	25.03	x	2.1	=	52.56			(29)
Total area of elements, m²			115.83							(31)
Party wall			5.3	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	212.86	(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: High	450	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		24.8	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	237.66	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	50.71	50.06	49.42	46.41	45.85	43.23	43.23	42.74	44.24	45.85	46.99	48.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	288.38	287.72	287.08	284.08	283.51	280.89	280.89	280.41	281.9	283.51	284.65	285.84	

Average = Sum(39)$_{1…12}$ /12= 284.07 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	3.65	3.64	3.63	3.6	3.59	3.56	3.56	3.55	3.57	3.59	3.6	3.62

Average = Sum(40)$_{1…12}$ /12= 3.6 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.44 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 92.24 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	101.46	97.77	94.08	90.39	86.7	83.01	83.01	86.7	90.39	94.08	97.77	101.46

Total = Sum(44)$_{1…12}$ = 1106.83 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150.46	131.59	135.79	118.39	113.6	98.02	90.83	104.23	105.48	122.93	134.18	145.71

Total = Sum(45)$_{1…12}$ = 1451.23 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.57	19.74	20.37	17.76	17.04	14.7	13.63	15.64	15.82	18.44	20.13	21.86

(46)

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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 160 (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=	205.74	181.52	191.07	171.88	168.87	151.52	146.11	159.51	158.97	178.2	187.68	200.99	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	205.74	181.52	191.07	171.88	168.87	151.52	146.11	159.51	158.97	178.2	187.68	200.99	

Output from water heater (annual)$_{1...12}$ 2102.07 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	68.64	60.56	63.76	57.37	56.38	50.6	48.81	53.27	53.08	59.48	62.63	67.06	(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=	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	122.18	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.38	17.21	14	10.6	7.92	6.69	7.23	9.39	12.61	16.01	18.68	19.91	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	217.34	219.59	213.91	201.81	186.54	172.18	162.59	160.34	166.02	178.12	193.39	207.75	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	35.22	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	-97.74	(71)

Water heating gains (Table 5)

(72)m=	92.26	90.13	85.7	79.69	75.78	70.28	65.61	71.6	73.72	79.95	86.98	90.13	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	388.62	386.58	373.26	351.75	329.89	308.81	295.08	300.98	312.01	333.73	358.71	377.45	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.55	x	10.63	x	0.85	x	0.7	=	19.95	(74)
North	0.9x	0.77	x	4.55	x	20.32	x	0.85	x	0.7	=	38.12	(74)
North	0.9x	0.77	x	4.55	x	34.53	x	0.85	x	0.7	=	64.78	(74)
North	0.9x	0.77	x	4.55	x	55.46	x	0.85	x	0.7	=	104.06	(74)
North	0.9x	0.77	x	4.55	x	74.72	x	0.85	x	0.7	=	140.18	(74)

North	0.9x	0.77	x	4.55	x	79.99	x	0.85	x	0.7	=	150.06	(74)
North	0.9x	0.77	x	4.55	x	74.68	x	0.85	x	0.7	=	140.1	(74)
North	0.9x	0.77	x	4.55	x	59.25	x	0.85	x	0.7	=	111.15	(74)
North	0.9x	0.77	x	4.55	x	41.52	x	0.85	x	0.7	=	77.89	(74)
North	0.9x	0.77	x	4.55	x	24.19	x	0.85	x	0.7	=	45.38	(74)
North	0.9x	0.77	x	4.55	x	13.12	x	0.85	x	0.7	=	24.61	(74)
North	0.9x	0.77	x	4.55	x	8.86	x	0.85	x	0.7	=	16.63	(74)
South	0.9x	0.77	x	11.64	x	46.75	x	0.85	x	0.7	=	224.39	(78)
South	0.9x	0.77	x	11.64	x	76.57	x	0.85	x	0.7	=	367.49	(78)
South	0.9x	0.77	x	11.64	x	97.53	x	0.85	x	0.7	=	468.12	(78)
South	0.9x	0.77	x	11.64	x	110.23	x	0.85	x	0.7	=	529.08	(78)
South	0.9x	0.77	x	11.64	x	114.87	x	0.85	x	0.7	=	551.33	(78)
South	0.9x	0.77	x	11.64	x	110.55	x	0.85	x	0.7	=	530.58	(78)
South	0.9x	0.77	x	11.64	x	108.01	x	0.85	x	0.7	=	518.41	(78)
South	0.9x	0.77	x	11.64	x	104.89	x	0.85	x	0.7	=	503.45	(78)
South	0.9x	0.77	x	11.64	x	101.89	x	0.85	x	0.7	=	489.01	(78)
South	0.9x	0.77	x	11.64	x	82.59	x	0.85	x	0.7	=	396.38	(78)
South	0.9x	0.77	x	11.64	x	55.42	x	0.85	x	0.7	=	265.98	(78)
South	0.9x	0.77	x	11.64	x	40.4	x	0.85	x	0.7	=	193.89	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	244.34	405.62	532.9	633.14	691.51	680.65	658.51	614.6	566.9	441.76	290.59	210.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	632.96	792.2	906.16	984.88	1021.4	989.45	953.6	915.58	878.9	775.49	649.3	587.98	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.99	0.97	0.93	0.86	0.88	0.96	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.62	18.81	19.14	19.59	20.06	20.5	20.76	20.72	20.37	19.75	19.11	18.59	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.46	18.46	18.47	18.48	18.48	18.5	18.5	18.5	18.49	18.48	18.48	18.47	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.94	0.81	0.52	0.58	0.88	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	15.58	15.86	16.35	17.01	17.68	18.25	18.47	18.45	18.1	17.25	16.31	15.55	(90)

fLA = Living area ÷ (4) = | 0.28 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.42	16.68	17.12	17.72	18.33	18.87	19.1	19.08	18.73	17.94	17.08	16.39	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.42	16.68	17.12	17.72	18.33	18.87	19.1	19.08	18.73	17.94	17.08	16.39	(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	0.99	0.97	0.94	0.84	0.64	0.69	0.89	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	631.06	787.09	894.38	957.41	955.26	828.76	611.72	630.75	785.18	756.9	645.52	586.61	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	3494.95	3388.72	3048.26	2505.69	1880.69	1199.29	702.21	751.31	1304.59	2080.64	2841.02	3484.74	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	2130.73	1748.3	1602.48	1114.76	688.52	0	0	0	0	984.86	1580.76	2156.21	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 12006.63 (98)

Space heating requirement in kWh/m²/year 151.98 (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		12006.63	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	12606.96	(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		2102.07	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2207.17	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	148.14	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		0	(330a)

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warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =			0	(331)
Energy for lighting (calculated in Appendix L)				342.18	(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				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0	=	3555.39	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	76.89	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	3632.28	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				3632.28	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	0	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	177.59	(379)
Total CO2, kg/year	sum of (376)…(382) =				3809.87	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				48.23	(384)
EI rating (section 14)					58.69	(385)