Energy Statement

36 Lancaster Grove

For Nicholas Taylor and Associates

May 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 Road, 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 10 units of apartment accommodation. The existing 7 units of residential accommodation will not form part of this application.

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 7 no. existing residential accommodation, which do not form part of this application, has not been included in this assessment.

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 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 45.8% 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, high efficiency boilers where installed to provide space heating and hot water to each apartment.

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.

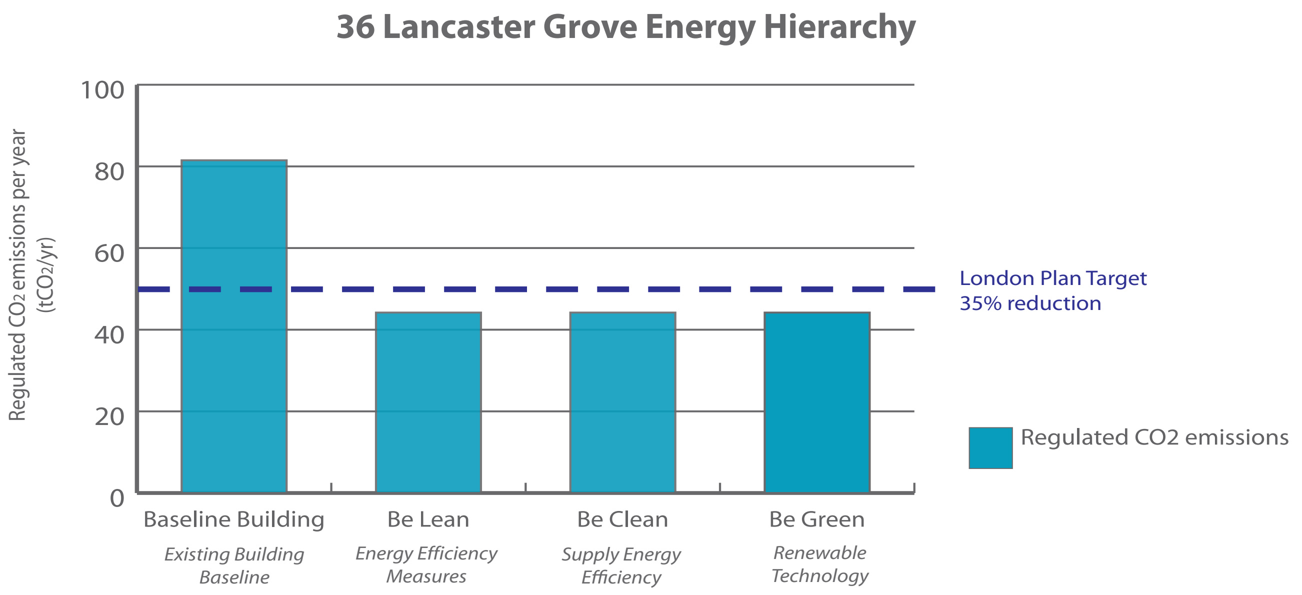
The analysis demonstrated that due to the conservation requirements of the existing Grade II listed building, it will not be feasible to install renewable technologies without considerable construction and alterations to the former Belsize Park Fire Station.

In total, the development is expected to reduce regulated CO_2 emissions by 45.8% 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	85.2	95.2
After energy demand reduction	44.2	57.8
After efficient energy supply	44.2	57.8
After renewable technologies	44.2	57.8

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	37.4	45.8%
Savings from efficient energy supply	0.0	0.0%
Savings from renewable energy	0.0	0.0%
Cumulative savings	37.4	45.8%

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 Road, 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 10 units of apartment accommodation. The existing 7 units of residential accommodation will not form part of this application.

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;*

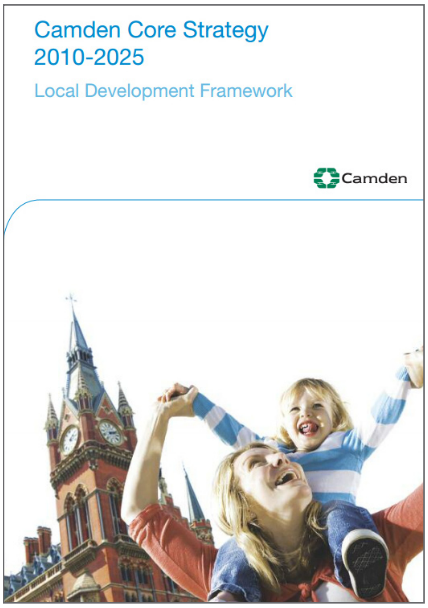
and other locations where land ownership would facilitate their implementation.

- *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.

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	76,030	16,420	22.1	42,180	9,110	12.3
Space Heating	282,710	61,070	82.2	150,090	32,420	45.6
Cooling	0	0	0.0	0	0	0.0
Auxiliary	2,010	1,040	1.4	1,650	860	1.2
Lighting	5,810	3,010	4.1	3,420	1,770	2.4
Equipment (not incl. in Part L)	26,310	13,650	18.4	26,310	13,650	18.4
Total Part L	366,560	81,540	109.7	197,340	44,160	59.4
Total (incl. Equip)	382,860	95,190	128.1	223,650	57,810	77.8

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	81.5	13.7	95.2
After energy demand reduction (Lean)	44.2	13.7	57.8

	Carbon dioxide savings (tonnes CO_2 per annum)		Carbon dioxide savings from baseline (%)	
	Regulated	Total	Regulated	Total
Savings from energy demand reduction	37.4	37.4	45.8%	39.3%

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

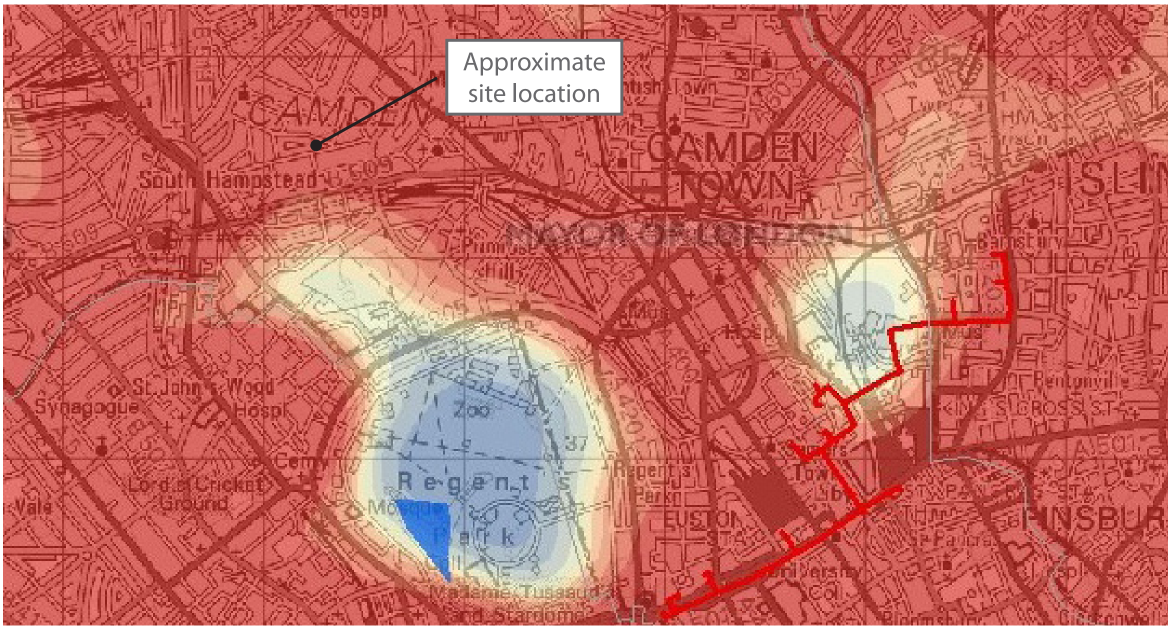
Local supply of heat and power minimise distribution losses, thereby achieving a greater efficiency and reducing CO_2 emissions, when compared to the individual systems.

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.

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	81.5	13.7	95.2
After energy demand reduction (Lean)	44.2	13.7	57.8
After district heating system (Clean)	44.2	13.7	57.8

	Carbon dioxide savings (tonnes CO_2 per annum)		Carbon dioxide savings from baseline (%)	
	Regulated	Total	Regulated	Total
Savings from energy demand reduction	37.4	37.4	45.8%	39.3%
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	81.5	13.7	95.2
After energy demand reduction (Lean)	44.2	13.7	57.8
After efficient technology (Clean)	44.2	13.7	57.8
After renewable technologies (Green)	44.2	13.7	57.8

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	37.4	37.4	45.8%	39.3%
Savings from clean technology	0.0	0.0	0.0%	0.0%
Savings from renewable energy	0.0	0.0	0.0%	0.0%
Cumulative savings	37.4	37.4	45.8%	39.3%

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 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 45.8% 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 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, high efficiency boilers where installed to provide space heating and hot water to each apartment.

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 construction and alterations to the former Belsize Park Fire Station.

In total, the development is expected to reduce regulated CO_2 emissions by 45.8% 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	81.5	13.7	95.2
After energy demand reduction (Lean)	44.2	13.7	57.8
After district heating system (Clean)	44.2	13.7	57.8
After renewable technologies (Green)	44.2	13.7	57.8

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	37.4	37.4	45.8%	39.3%
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	37.4	37.4	45.8%	39.3%

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: 1.0.3.4

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)

DRAFT

				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)

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

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

(44)m=	83.31	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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.05 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 5.85 (54)

Enter (50) or (54) in (55) 5.85 (55)

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

(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	433.17	387.71	421.12	396.84	402.9	297.8	299.14	310.14	303.92	410.56	409.81	429.27	(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=	433.17	387.71	421.12	396.84	402.9	297.8	299.14	310.14	303.92	410.56	409.81	429.27	

Output from water heater (annual)1…12 | 4502.4 | (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=	143.78	128.69	139.78	131.71	133.72	60.3	59.45	63.11	62.33	136.26	136.03	142.49	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	193.26	191.51	187.87	182.93	179.73	83.75	79.91	84.83	86.57	183.15	188.92	191.51	(72)

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

(73)m=	433.24	429.91	417.59	399.2	381.37	273.51	263.74	270.24	280.67	390.71	411.1	425.56	(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=	468.54	489.83	500.2	504.5	503.39	396.82	381.69	375.15	370.93	456.99	453.32	455.83	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.98	0.97	0.91	0.92	0.98	0.99	1	1	(86)

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

(87)m=	19.51	19.61	19.82	20.15	20.46	20.7	20.88	20.86	20.62	20.3	19.89	19.54	(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	0.99	0.98	0.95	0.81	0.84	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=	18.5	18.61	18.82	19.19	19.51	19.78	19.93	19.92	19.68	19.35	18.92	18.56	(90)

fLA = Living area ÷ (4) = 0.66 (91)

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

(92)m=	19.17	19.27	19.48	19.82	20.14	20.39	20.55	20.54	20.3	19.97	19.56	19.2	(92)

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

(93)m=	19.77	19.87	20.08	20.42	20.74	20.99	21.15	21.14	20.9	20.57	20.16	19.8	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	1	0.99	0.98	0.97	0.92	0.93	0.98	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	467.93	488.95	498.71	501.32	494.75	385.63	350.16	349.07	364.87	453.48	452.27	455.34	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1839.71	1766.58	1589.46	1293.28	1005.75	680.28	484.9	500.29	737.04	1110.09	1478.27	1796.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1020.6	858.57	811.52	570.21	380.18	0	0	0	0	488.52	738.72	997.72	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5866.04 (98)

Space heating requirement in kWh/m²/year 112.81 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1020.6	858.57	811.52	570.21	380.18	0	0	0	0	488.52	738.72	997.72	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1548.71	1302.83	1231.44	865.27	576.91	0	0	0	0	741.3	1120.97	1513.99	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 8901.43 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

433.17	387.71	421.12	396.84	402.9	297.8	299.14	310.14	303.92	410.56	409.81	429.27

Efficiency of water heater 55.8 (216)

(217)m=	62.53	62.39	62.06	61.34	60.29	55.8	55.8	55.8	55.8	60.87	61.9	62.5	(217)

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

(219)m=	692.76	621.46	678.55	646.92	668.31	533.7	536.1	555.81	544.66	674.49	662.04	686.86

Total = Sum(219a)$_{1...12}$ = 7501.67 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			8901.43	
Water heating fuel used			7501.67	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		156		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		201	(231)
Electricity for lighting			500.21	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1922.71	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	1620.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =				3543.07	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	104.32	(267)
Electricity for lighting	(232)	x	0.519	=	259.61	(268)
Total CO2, kg/year			sum of (265)…(271) =		3907	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		75.13	(273)
EI rating (section 14)					48	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.4

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

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

DER WorkSheet: New dwelling design stage

(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 = $\text{Sum}(39)_{1...12}$ /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 = $\text{Sum}(40)_{1...12}$ /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 = $\text{Sum}(44)_{1...12}$ = 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 = $\text{Sum}(45)_{1...12}$ = 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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.05 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 5.85 (54)

Enter (50) or (54) in (55) 5.85 (55)

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

(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	436.59	390.7	424.21	399.54	405.48	300.03	301.21	312.51	306.32	413.35	412.86	432.58	(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=	436.59	390.7	424.21	399.54	405.48	300.03	301.21	312.51	306.32	413.35	412.86	432.58

Output from water heater (annual)$_{1…12}$ | 4535.39 | (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=	144.92	129.69	140.8	132.61	134.58	61.04	60.14	63.9	63.13	137.19	137.04	143.59	(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=	24.29	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	194.79	192.99	189.25	184.18	180.88	84.78	80.83	85.88	87.68	184.4	190.33	193	(72)

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

(73)m=	439.82	436.97	425.02	406.76	388.86	280.62	270.29	276.39	286.41	396.31	416.85	431.64	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.82	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=	607.26	714.41	788.02	835.27	854.15	737.37	712.7	691.32	671.65	698.08	615.89	575.96	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	1	0.99	0.99	0.98	0.95	0.91	0.82	0.84	0.94	0.98	0.99	1	(86)

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

(87)m=	18.85	19.05	19.37	19.82	20.25	20.6	20.83	20.8	20.49	19.97	19.36	18.85	(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	0.99	0.99	0.97	0.92	0.83	0.62	0.67	0.89	0.97	0.99	1	(89)

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

(90)m=	17.39	17.59	17.92	18.39	18.82	19.18	19.34	19.33	19.07	18.56	17.93	17.42	(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	19.96	20.16	20.14	19.85	19.34	18.71	18.21	(92)

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

(93)m=	18.64	18.84	19.16	19.62	20.06	20.41	20.61	20.59	20.3	19.79	19.16	18.66	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.97	0.94	0.89	0.78	0.81	0.93	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	604.44	708.43	776.17	810.81	801.39	657.35	557.35	559.3	622.57	678.95	610.81	573.77	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2739.13	2648.18	2393.06	1974.42	1530.44	1036.1	714.2	742.88	1116.42	1682.11	2232.95	2703.87	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1588.21	1303.51	1202.97	837.8	542.41	0	0	0	0	746.35	1167.94	1584.79	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 8973.99 (98)

Space heating requirement in kWh/m²/year 163.16 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1588.21	1303.51	1202.97	837.8	542.41	0	0	0	0	746.35	1167.94	1584.79	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	2410.03	1978.02	1825.45	1271.32	823.08	0	0	0	0	1132.54	1772.3	2404.85	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 13617.58 (211)

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Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

436.59	390.7	424.21	399.54	405.48	300.03	301.21	312.51	306.32	413.35	412.86	432.58

Efficiency of water heater 55.8 (216)

(217)m=	63.42	63.26	62.93	62.26	61.16	55.8	55.8	55.8	55.8	61.91	62.93	63.44

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	688.36	617.62	674.1	641.71	662.94	537.69	539.8	560.06	548.96	667.71	656.12	681.9

Total = Sum(219a)$_{1...12}$ = 7476.95 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			13617.58	
Water heating fuel used			7476.95	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		156		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		201	(231)
Electricity for lighting			428.94	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	2941.4	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	1615.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4556.42	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	104.32	(267)
Electricity for lighting	(232)	x	0.519	=	222.62	(268)
Total CO2, kg/year			sum of (265)…(271) =		4883.36	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		88.79	(273)
EI rating (section 14)					40	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.4

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

	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	1.14	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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.05 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 5.85 (54)

Enter (50) or (54) in (55) 5.85 (55)

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

(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16	(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=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16	

Output from water heater (annual)$_{1...12}$ 4491.37 (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=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12	(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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02	(72)

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

(73)m=	424.08	421.36	410.08	392.86	376.02	268.73	258.95	264.81	274.22	383.08	402.46	416.37	(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=	592.39	700.48	775.93	825.94	847.47	732.08	707.53	684.62	662.89	686.85	602.59	561.43	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.97	0.94	0.9	0.79	0.81	0.93	0.98	0.99	1	(86)

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

(87)m=	18.93	19.13	19.45	19.9	20.32	20.65	20.86	20.83	20.53	20.04	19.42	18.93	(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	0.99	0.98	0.96	0.91	0.81	0.59	0.64	0.87	0.96	0.99	1	(89)

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

(90)m=	17.5	17.71	18.03	18.5	18.91	19.24	19.38	19.37	19.13	18.65	18.03	17.52	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	18.3	18.5	18.82	19.27	19.7	20.02	20.2	20.18	19.91	19.42	18.8	18.3	(92)

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

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(93)m=	18.75	18.95	19.27	19.72	20.15	20.47	20.65	20.63	20.36	19.87	19.25	18.75	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.97	0.93	0.87	0.75	0.78	0.91	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	589.27	693.69	762.21	797.14	785.27	639.01	532.69	535.97	606.28	664.74	596.85	559.01	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2491.39	2410.76	2180.86	1803.4	1400.02	950.76	655.47	682.1	1023	1536.73	2035.28	2461.08	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1415.17	1153.87	1055.48	724.5	457.37	0	0	0	0	648.75	1035.67	1415.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 7905.97 (98)

Space heating requirement in kWh/m²/year 155.02 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	1415.17	1153.87	1055.48	724.5	457.37	0	0	0	0	648.75	1035.67	1415.14		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	2147.46	1750.95	1601.64	1099.4	694.03	0	0	0	0	984.45	1571.58	2147.4		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													11996.92	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16		
Efficiency of water heater													55.8	(216)
(217)m=	63.22	63.04	62.67	61.94	60.76	55.8	55.8	55.8	55.8	61.59	62.69	63.24		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	683.33	613.48	670.32	639.26	661.72	532.36	534.86	554.4	543.23	665.13	652.1	677.03		
Total = Sum(219a)$_{1...12}$ =													7427.22	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		11996.92

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Water heating fuel used			7427.22	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		156		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		201	(231)
Electricity for lighting			401.03	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	2591.33	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	1604.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4195.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	104.32	(267)
Electricity for lighting	(232) x	0.519	=	208.13	(268)
Total CO2, kg/year		sum of (265)…(271) =		4508.06	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		88.39	(273)
EI rating (section 14)				41	(274)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.4

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		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			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)

(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)

	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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.05 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 5.85 (54)

Enter (50) or (54) in (55) 5.85 (55)

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

(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16	(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=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16	

Output from water heater (annual)$_{1...12}$ 4491.37 (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=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12	(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=	23.08	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	424.45	421.69	410.35	393.06	376.17	268.86	259.09	264.99	274.47	383.39	402.83	416.76	(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=	581.81	679.87	740.6	768.97	770.61	649.76	630.69	623.73	620.34	662.22	589.43	552.67	(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	0.99	0.99	0.98	0.96	0.94	0.87	0.88	0.95	0.98	0.99	1	(86)

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

(87)m=	18.51	18.71	19.05	19.53	20.01	20.43	20.72	20.69	20.32	19.74	19.06	18.5	(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=	0.99	0.99	0.98	0.97	0.93	0.86	0.65	0.69	0.9	0.97	0.99	1	(89)

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

(90)m=	16.81	17.01	17.36	17.87	18.34	18.77	18.98	18.97	18.66	18.09	17.4	16.83	(90)

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

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

(92)m=	17.61	17.81	18.16	18.65	19.13	19.55	19.8	19.78	19.44	18.87	18.18	17.62	(92)

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

(93)m=	18.06	18.26	18.61	19.1	19.58	20	20.25	20.23	19.89	19.32	18.63	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=	0.99	0.99	0.98	0.97	0.94	0.91	0.81	0.83	0.93	0.97	0.99	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	578.14	672.76	727.91	746.09	726.85	589.19	510.25	516.2	576.2	642.09	583.21	549.75		(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=	2904.1	2807.46	2532.45	2087.04	1605.46	1075.23	727.02	759.83	1163.49	1775.66	2370.29	2875.98		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	1730.51	1434.52	1342.58	965.48	653.69	0	0	0	0	843.37	1286.7	1730.72		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													9987.56	(98)
Space heating requirement in kWh/m²/year													195.83	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	1730.51	1434.52	1342.58	965.48	653.69	0	0	0	0	843.37	1286.7	1730.72		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	2625.97	2176.81	2037.29	1465.07	991.94	0	0	0	0	1279.78	1952.5	2626.28		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													15155.63	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16		
Efficiency of water heater													55.8	(216)
(217)m=	63.6	63.46	63.17	62.6	61.65	55.8	55.8	55.8	55.8	62.22	63.14	63.62		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	679.28	609.37	664.97	632.45	652.12	532.36	534.86	554.4	543.23	658.36	647.4	673.04		
Total = Sum(219a)$_{1...12}$ =													7381.84	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		15155.63

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Water heating fuel used			7381.84	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		156		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		201	(231)
Electricity for lighting			407.66	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	3273.62	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	1594.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4868.09	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	104.32	(267)
Electricity for lighting	(232) x	0.519	=	211.57	(268)
Total CO2, kg/year		sum of (265)…(271) =		5183.99	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		101.65	(273)
EI rating (section 14)				35	(274)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.4

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		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 = $\text{Sum}(39)_{1...12}$ /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 = $\text{Sum}(40)_{1...12}$ /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 = $\text{Sum}(44)_{1...12}$ = 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 = $\text{Sum}(45)_{1...12}$ = 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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.05 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 5.85 (54)

Enter (50) or (54) in (55) 5.85 (55)

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

(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	477.36	426.36	461	431.61	436.26	326.59	325.82	340.76	334.9	446.66	449.22	472.06	(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=	477.36	426.36	461	431.61	436.26	326.59	325.82	340.76	334.9	446.66	449.22	472.06	

Output from water heater (annual)1…12 | 4928.59 | (64)

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

(65)m=	158.48	141.54	153.04	143.27	144.81	69.87	68.32	73.29	72.63	148.27	149.13	156.72	(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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	213	210.63	205.7	198.99	194.64	97.04	91.83	98.51	100.88	199.29	207.12	210.64	(72)

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

(73)m=	630.16	625.76	605.55	574.42	543.03	423.04	406.06	414.76	432.41	555.24	590.11	616.03	(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=	986.49	1215.87	1374.02	1470.83	1503.08	1358.63	1315.23	1277.91	1244.77	1196.37	1013.71	923.13	(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	0.99	0.99	0.98	0.96	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=	17.71	17.92	18.32	18.91	19.51	20.09	20.47	20.43	19.94	19.19	18.38	17.72	(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	0.99	0.99	0.98	0.96	0.9	0.69	0.74	0.93	0.98	1	1	(89)

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

(90)m=	15.52	15.74	16.15	16.78	17.39	18	18.31	18.29	17.85	17.07	16.25	15.57	(90)

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

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

(92)m=	16.31	16.53	16.93	17.55	18.15	18.75	19.09	19.06	18.6	17.84	17.02	16.34	(92)

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

(93)m=	16.76	16.98	17.38	18	18.6	19.2	19.54	19.51	19.05	18.29	17.47	16.79	(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	0.93	0.85	0.87	0.95	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	982.85	1207.99	1359	1442.67	1447.35	1262.27	1113.71	1108.35	1181.78	1175.37	1007.69	920.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	8893.68	8572.23	7682.38	6247.56	4712.87	3060.62	1956.11	2060.92	3329.04	5249.41	7160.31	8794.12	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	5885.65	4948.76	4704.59	3459.52	2429.54	0	0	0	0	3031.09	4429.89	5858.08	

Total per year (kWh/year) = $\text{Sum}(98)_{1\ldots5,9\ldots12}$ = | 34747.13 | (98)

Space heating requirement in kWh/m²/year | 271.46 | (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	5885.65	4948.76	4704.59	3459.52	2429.54	0	0	0	0	3031.09	4429.89	5858.08		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	8931.19	7509.51	7138.99	5249.65	3686.71	0	0	0	0	4599.53	6722.14	8889.35		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													52727.06	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	477.36	426.36	461	431.61	436.26	326.59	325.82	340.76	334.9	446.66	449.22	472.06		
Efficiency of water heater													55.8	(216)
(217)m=	65.02	64.97	64.85	64.6	64.13	55.8	55.8	55.8	55.8	64.4	64.82	65.02		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	734.2	656.27	710.85	668.1	680.24	585.29	583.9	610.67	600.18	693.54	693.03	726		
Total = Sum(219a)$_{1...12}$ =													7942.27	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			52727.06	
Water heating fuel used			7942.27	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		156		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		201	(231)
Electricity for lighting			803.82	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	11389.04	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	1715.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =			13104.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	104.32	(267)
Electricity for lighting	(232) x	0.519	=	417.18	(268)
Total CO2, kg/year		sum of (265)…(271) =		13626.08	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		106.45	(273)
EI rating (section 14)				20	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.3.4

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)

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) =	160	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.05	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0.91	(52)
Temperature factor from Table 2b		0.78	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	5.85	(54)
Enter (50) or (54) in (55)		5.85	(55)

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

(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	462.25	413.15	447.37	419.73	424.85	316.75	316.7	330.29	324.31	434.32	435.75	457.43	(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=	462.25	413.15	447.37	419.73	424.85	316.75	316.7	330.29	324.31	434.32	435.75	457.43	

Output from water heater (annual)$_{1...12}$ | 4782.9 | (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=	153.45	137.15	148.51	139.32	141.02	66.6	65.29	69.81	69.11	144.16	144.65	151.85	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	206.25	204.09	199.6	193.5	189.54	92.5	87.75	93.83	95.99	193.77	200.9	204.1	(72)

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

(73)m=	536.25	532.39	516.1	491.24	466.61	352.51	338.91	346.68	360.64	477.18	504.98	525.23	(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=	608.61	673.16	749.68	840.32	905.54	807.61	769.75	708.68	634.54	644.34	594.98	584.94	(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	0.94	0.96	0.99	0.99	1	1	(86)

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

(87)m=	17.53	17.7	18.1	18.71	19.36	19.97	20.38	20.31	19.78	19	18.19	17.53	(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	0.99	0.99	0.96	0.9	0.69	0.76	0.95	0.99	1	1	(89)

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

(90)m=	15.2	15.37	15.77	16.42	17.07	17.7	18.04	18.01	17.51	16.72	15.9	15.22	(90)

fLA = Living area ÷ (4) = 0.53 (91)

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

(92)m=	16.44	16.61	17.01	17.64	18.29	18.9	19.28	19.24	18.72	17.93	17.12	16.45	(92)

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

(93)m=	16.89	17.06	17.46	18.09	18.74	19.35	19.73	19.69	19.17	18.38	17.57	16.9	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.97	0.95	0.89	0.91	0.97	0.99	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	606.45	669.92	743.89	828.04	877.96	763.89	686.12	647.73	616.24	636.79	591.98	583.11	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	6222.25	5987.33	5376.85	4419.66	3372.58	2236.89	1473.99	1540.12	2400.33	3729.75	5056.09	6180.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	4178.15	3573.3	3446.93	2585.97	1856	0	0	0	0	2301.17	3214.16	4164.53	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 25320.2 (98)

Space heating requirement in kWh/m²/year — 308.78 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	4178.15	3573.3	3446.93	2585.97	1856	0	0	0	0	2301.17	3214.16	4164.53		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	6340.14	5422.3	5230.54	3924.08	2816.39	0	0	0	0	3491.91	4877.33	6319.46		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													38422.15	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	462.25	413.15	447.37	419.73	424.85	316.75	316.7	330.29	324.31	434.32	435.75	457.43		
Efficiency of water heater													55.8	(216)
(217)m=	64.73	64.69	64.56	64.28	63.75	55.8	55.8	55.8	55.8	64.06	64.51	64.74		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	714.09	638.69	692.98	653.01	666.43	567.65	567.56	591.92	581.2	677.99	675.52	706.57		
Total = Sum(219a)$_{1...12}$ =													7733.61	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		38422.15	
Water heating fuel used		7733.61	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	156		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		201	(231)
Electricity for lighting		634.57	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	8299.18	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	1670.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9969.64	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	104.32	(267)
Electricity for lighting	(232)	x	0.519	=	329.34	(268)
Total CO2, kg/year			sum of (265)…(271) =		10403.3	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		126.87	(273)
EI rating (section 14)					18	(274)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.4

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

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

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

(44)m=	96.3	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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.05 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 5.85 (54)

Enter (50) or (54) in (55) 5.85 (55)

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

(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	452.43	404.56	438.5	412	417.44	310.35	310.77	323.49	317.42	426.29	426.99	447.92	(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=	452.43	404.56	438.5	412	417.44	310.35	310.77	323.49	317.42	426.29	426.99	447.92	

Output from water heater (annual)$_{1…12}$	4688.14	(64)

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

(65)m=	150.19	134.29	145.56	136.75	138.55	64.47	63.32	67.55	66.82	141.5	141.74	148.69	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	201.86	199.84	195.64	189.93	186.23	89.54	85.1	90.79	92.81	190.18	196.86	199.85	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	495.75	492.44	478.12	456.18	434.48	322.86	310.55	317.53	329.67	443.27	467.94	485.87	(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)

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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=	628.95	737.76	860.05	1002.47	1109.82	1020.36	971.82	878.96	768.25	727.15	630.9	597.6	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	1	0.99	0.99	0.98	0.97	0.94	0.91	0.93	0.97	0.99	0.99	1	(86)

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

(87)m=	16.72	16.94	17.44	18.18	18.97	19.72	20.22	20.14	19.49	18.52	17.52	16.71	(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=	0.99	0.99	0.99	0.97	0.94	0.85	0.61	0.69	0.92	0.98	0.99	0.99	(89)

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

(90)m=	14.54	14.76	15.25	15.98	16.77	17.48	17.89	17.85	17.27	16.32	15.33	14.52	(90)

fLA = Living area ÷ (4) = 0.81 (91)

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

(92)m=	16.3	16.52	17.02	17.75	18.55	19.3	19.78	19.7	19.06	18.1	17.1	16.29	(92)

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

(93)m=	16.75	16.97	17.47	18.2	19	19.75	20.23	20.15	19.51	18.55	17.55	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=	0.99	0.99	0.98	0.97	0.95	0.92	0.87	0.9	0.95	0.98	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	624.51	730.37	846.46	974.5	1053.65	939.84	849.96	788.7	733.51	712	624.76	593.84	(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=	7681.26	7420.99	6719.07	5606.86	4385.48	3038.91	2141.58	2208.32	3217.27	4773.77	6320.23	7633.26	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	5250.22	4496.1	4369.23	3335.3	2478.88	0	0	0	0	3021.96	4100.74	5237.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 32289.75 (98)

Space heating requirement in kWh/m²/year 461.28 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	5250.22	4496.1	4369.23	3335.3	2478.88	0	0	0	0	3021.96	4100.74	5237.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	7966.95	6822.61	6630.09	5061.16	3761.58	0	0	0	0	4585.67	6222.67	7947.38	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 48998.1 (211)

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Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

	452.43	404.56	438.5	412	417.44	310.35	310.77	323.49	317.42	426.29	426.99	447.92		
Efficiency of water heater													55.8	(216)
(217)m=	64.97	64.93	64.83	64.61	64.22	55.8	55.8	55.8	55.8	64.46	64.79	64.97		(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	696.39	623.07	676.39	637.62	649.96	556.18	556.93	579.72	568.86	661.35	658.99	689.39		
									Total = Sum(219a)$_{1...12}$ =				7554.86	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		48998.1	
Water heating fuel used		7554.86	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	156		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	201	(231)
Electricity for lighting		528.07	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	10583.59	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	1631.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =				12215.44	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	104.32	(267)
Electricity for lighting	(232)	x	0.519	=	274.07	(268)
Total CO2, kg/year			sum of (265)…(271) =		12593.83	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		179.91	(273)
EI rating (section 14)					6	(274)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.4

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		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)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.05 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 5.85 (54)

Enter (50) or (54) in (55) 5.85 (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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	476.89	425.95	460.58	431.24	435.9	326.29	325.54	340.43	334.57	446.28	448.8	471.61	(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=	476.89	425.95	460.58	431.24	435.9	326.29	325.54	340.43	334.57	446.28	448.8	471.61	

Output from water heater (annual)1…12 | 4924.08 | (64)

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

(65)m=	158.32	141.41	152.9	143.15	144.69	69.77	68.23	73.18	72.52	148.14	148.99	156.56	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	212.8	210.43	205.51	198.82	194.48	96.9	91.7	98.36	100.73	199.11	206.93	210.44	(72)

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

(73)m=	630.93	625.8	604.73	572.81	540.94	420.9	404.33	413.75	432.27	555.88	591.23	617.2	(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=	745.61	820.19	871.91	912	932.69	816.2	782.7	751.15	723.7	770.69	728.32	715.56	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	1	0.99	0.99	0.97	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=	18.27	18.41	18.72	19.2	19.7	20.18	20.51	20.47	20.06	19.45	18.81	18.28	(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	0.89	0.91	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=	16.56	16.71	17.03	17.54	18.04	18.56	18.87	18.84	18.42	17.8	17.14	16.59	(90)

fLA = Living area ÷ (4) = 0.3 (91)

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

(92)m=	17.07	17.22	17.54	18.04	18.54	19.05	19.36	19.33	18.92	18.3	17.64	17.1	(92)

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

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(93)m=	17.52	17.67	17.99	18.49	18.99	19.5	19.81	19.78	19.37	18.75	18.09	17.55	(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	1	1	1	0.99	0.98	0.94	0.95	0.99	1	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	744.75	818.82	869.58	907.45	922.05	797.09	734.88	714.29	713.65	766.91	727.03	714.86	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	6825.39	6561.1	5874.27	4788.1	3625.37	2377.56	1559.99	1633.97	2580.05	4049.26	5517.53	6764.07	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	4524	3858.82	3723.5	2794.07	2011.27	0	0	0	0	2442.07	3449.16	4500.61	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 27303.48 (98)

Space heating requirement in kWh/m²/year 220.19 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	4524	3858.82	3723.5	2794.07	2011.27	0	0	0	0	2442.07	3449.16	4500.61		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	6864.95	5855.56	5650.22	4239.86	3052	0	0	0	0	3705.71	5233.93	6829.45		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													41431.68	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	476.89	425.95	460.58	431.24	435.9	326.29	325.54	340.43	334.57	446.28	448.8	471.61		
Efficiency of water heater													55.8	(216)
(217)m=	64.78	64.74	64.61	64.34	63.84	55.8	55.8	55.8	55.8	64.11	64.55	64.79		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	736.14	657.99	712.84	670.23	682.79	584.74	583.4	610.09	599.59	696.14	695.23	727.93		
Total = Sum(219a)$_{1...12}$ =													7957.11	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		41431.68

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Water heating fuel used			7957.11	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		156		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		201	(231)
Electricity for lighting			911.99	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	8949.24	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	1718.74	(264)
Space and water heating	(261) + (262) + (263) + (264) =			10667.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	104.32	(267)
Electricity for lighting	(232) x	0.519	=	473.32	(268)
Total CO2, kg/year		sum of (265)…(271) =		11245.62	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		90.69	(273)
EI rating (section 14)				27	(274)

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User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.3.4

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		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			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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.05 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 5.85 (54)

Enter (50) or (54) in (55) 5.85 (55)

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

(56)m=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	460.08	411.25	445.41	418.02	423.21	315.33	315.39	328.79	322.79	432.54	433.81	455.33	(62)

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

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

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

Output from water heater

(64)m=	460.08	411.25	445.41	418.02	423.21	315.33	315.39	328.79	322.79	432.54	433.81	455.33	

Output from water heater (annual)$_{1...12}$ 4761.93 (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=	152.73	136.52	147.85	138.75	140.47	66.13	64.85	69.31	68.6	143.57	144	151.15	(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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	205.28	203.15	198.73	192.71	188.81	91.84	87.17	93.16	95.28	192.98	200.01	203.16	(72)

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

(73)m=	530.59	526.43	509.97	485.13	460.66	346.9	333.7	341.72	355.89	472.4	499.99	519.94	(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=	606.78	655.6	687.55	710.65	721.2	609.83	585.36	566.08	549.62	615.15	591.08	585.29	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.99	0.98	0.96	0.97	0.99	0.99	1	1	(86)

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

(87)m=	17.89	18.04	18.39	18.93	19.5	20.04	20.42	20.38	19.91	19.23	18.5	17.89	(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	0.99	0.99	0.98	0.95	0.82	0.85	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=	15.84	16	16.36	16.93	17.51	18.08	18.43	18.4	17.94	17.24	16.5	15.88	(90)

fLA = Living area ÷ (4) = 0.28 (91)

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

(92)m=	16.4	16.57	16.92	17.48	18.06	18.62	18.98	18.94	18.48	17.79	17.05	16.43	(92)

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

(93)m=	16.85	17.02	17.37	17.93	18.51	19.07	19.43	19.39	18.93	18.24	17.5	16.88	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	1	1	0.99	0.99	0.98	0.96	0.9	0.92	0.97	0.99	1	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	604.76	652.72	683.13	702.93	705.27	585.66	529.22	520.7	535.24	608.09	588.2	583.59		(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=	5102.49	4903.4	4381.16	3562.34	2673.24	1718.03	1085.42	1145.11	1871.57	2998.9	4118.89	5067		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	3346.31	2856.45	2751.33	2058.77	1464.17	0	0	0	0	1778.77	2542.1	3335.66		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				20133.56	(98)
Space heating requirement in kWh/m²/year													254.86	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	3346.31	2856.45	2751.33	2058.77	1464.17	0	0	0	0	1778.77	2542.1	3335.66		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	5077.86	4334.53	4175.01	3124.09	2221.8	0	0	0	0	2699.19	3857.51	5061.7		
									Total (kWh/year) =Sum(211)$_{1...5,10...12}$=				30551.68	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10...12}$=				0	(215)

Water heating

Output from water heater (calculated above)														
	460.08	411.25	445.41	418.02	423.21	315.33	315.39	328.79	322.79	432.54	433.81	455.33		
Efficiency of water heater													55.8	(216)
(217)m=	64.49	64.43	64.28	63.95	63.33	55.8	55.8	55.8	55.8	63.65	64.21	64.5		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	713.42	638.26	692.93	653.7	668.27	565.11	565.21	589.22	578.47	679.6	675.66	705.96		
									Total = Sum(219a)$_{1...12}$ =				7725.81	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		30551.68

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Water heating fuel used			7725.81	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		156		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		201	(231)
Electricity for lighting			676.65	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	6599.16	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	1668.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =			8267.94	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	104.32	(267)
Electricity for lighting	(232) x	0.519	=	351.18	(268)
Total CO2, kg/year		sum of (265)…(271) =		8723.44	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		110.42	(273)
EI rating (section 14)				25	(274)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.4

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 *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)	1.21	(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

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)

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

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) = — 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.05 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0.91 (52)

Temperature factor from Table 2b — 0.78 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 5.85 (54)

Enter (50) or (54) in (55) — 5.85 (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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	181.24	163.7	181.24	175.39	181.24	175.39	181.24	181.24	175.39	181.24	175.39	181.24	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16	(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=	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16	

Output from water heater (annual)$_{1...12}$ 4491.37 (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=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12	(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=	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	430.48	427.05	414.7	396.36	378.63	270.94	261.34	267.91	278.39	388.37	408.64	422.96	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	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=	450.81	466.81	480.19	491.87	495.68	390.76	375.41	365.9	354.55	435.55	433.98	439.67	(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	0.99	0.99	0.98	0.96	0.97	0.99	0.99	1	1	(86)

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

(87)m=	17.92	18.06	18.41	18.93	19.51	20.03	20.41	20.36	19.89	19.24	18.52	17.92	(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	0.99	0.99	0.97	0.95	0.81	0.85	0.97	0.99	0.99	1	(89)

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

(90)m=	15.86	16.01	16.36	16.92	17.49	18.04	18.38	18.36	17.9	17.23	16.5	15.89	(90)

fLA = Living area ÷ (4) = | 0.56 | (91)

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

(92)m=	17.03	17.17	17.52	18.06	18.63	19.16	19.53	19.49	19.02	18.36	17.64	17.04	(92)

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

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(93)m=	17.48	17.62	17.97	18.51	19.08	19.61	19.98	19.94	19.47	18.81	18.09	17.49	(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	0.98	0.97	0.93	0.94	0.98	0.99	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	448.91	464.49	476.89	486.4	485.2	379.05	350.94	345.41	347.35	430.3	431.42	437.99	(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=	3475.87	3344.55	3004.86	2474.53	1894.36	1263.47	851.67	889.76	1364.79	2108.49	2840.56	3457.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	2252.06	1935.4	1880.81	1431.45	1048.42	0	0	0	0	1248.58	1734.58	2246.74	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 13778.03 (98)

Space heating requirement in kWh/m²/year 270.16 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		65.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	2252.06	1935.4	1880.81	1431.45	1048.42	0	0	0	0	1248.58	1734.58	2246.74	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	3417.39	2936.88	2854.04	2172.16	1590.92	0	0	0	0	1894.65	2632.14	3409.32	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 20907.49 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	432.03	386.71	420.09	395.94	402.03	297.06	298.45	309.35	303.12	409.62	408.79	428.16	
Efficiency of water heater												55.8	(216)
(217)m=	64.03	63.97	63.79	63.41	62.75	55.8	55.8	55.8	55.8	63.08	63.7	64.04	(217)

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

(219)m=	674.68	604.51	658.54	624.39	640.67	532.36	534.86	554.4	543.23	649.38	641.74	668.54

Total = Sum(219a)$_{1...12}$ = 7327.28 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		20907.49

Water heating fuel used			7327.28	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		156		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		201	(231)
Electricity for lighting			514.14	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	4516.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	1582.69	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6098.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	104.32	(267)
Electricity for lighting	(232) x	0.519	=	266.84	(268)
Total CO2, kg/year		sum of (265)…(271) =		6469.87	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		126.86	(273)
EI rating (section 14)				26	(274)

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: 1.0.3.4

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		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

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

(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)$_{1\ldots12}$ /12= 96.07 (39)

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

(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)$_{1\ldots12}$ /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)$_{1\ldots12}$ = 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)$_{1\ldots12}$ = 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) =	160	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.03	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0.91	(52)
Temperature factor from Table 2b		0.78	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	2.84	(54)
Enter (50) or (54) in (55)		2.84	(55)

DER WorkSheet: New dwelling design stage

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

(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	339.97	303.53	327.92	306.65	309.69	207.61	205.94	216.94	213.73	317.35	319.62	336.07	(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=	339.97	303.53	327.92	306.65	309.69	207.61	205.94	216.94	213.73	317.35	319.62	336.07	

Output from water heater (annual)$_{1...12}$ | 3405.02 | (64)

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

(65)m=	143.78	128.69	139.78	131.71	133.72	60.3	59.45	63.11	62.33	136.26	136.03	142.49	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	193.26	191.51	187.87	182.93	179.73	83.75	79.91	84.83	86.57	183.15	188.92	191.51	(72)

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

(73)m=	421.58	419.55	409.17	392.82	376.6	269.49	259.39	264.59	273.08	381.07	399.86	413.58	(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.97	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=	456.88	479.47	491.78	498.13	498.63	392.79	377.34	369.49	363.34	447.36	442.07	443.84	(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	0.97	0.88	0.91	0.98	0.99	1	1	(86)

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

(87)m=	19.78	19.87	20.05	20.32	20.59	20.77	20.92	20.9	20.7	20.43	20.08	19.78	(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	0.99	0.96	0.91	0.68	0.73	0.95	0.99	1	1	(89)

DER WorkSheet: New dwelling design stage

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

(90)m=	17.85	17.98	18.25	18.66	19.05	19.31	19.45	19.44	19.21	18.83	18.31	17.87	(90)

fLA = Living area ÷ (4) = 0.66 (91)

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

(92)m=	19.12	19.23	19.43	19.75	20.06	20.28	20.42	20.4	20.19	19.89	19.47	19.13	(92)

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

(93)m=	19.12	19.23	19.43	19.75	20.06	20.28	20.42	20.4	20.19	19.89	19.47	19.13	(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	0.97	0.95	0.83	0.86	0.97	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	456.29	478.54	490	493.65	484.23	371.31	311.74	315.93	352.58	442.31	440.88	443.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1467.48	1412.1	1269.24	1042.43	800.35	532.86	358.41	374.66	576.12	888.84	1193.74	1452.27	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	752.33	627.35	579.76	395.13	235.19	0	0	0	0	332.22	542.06	750.63	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4214.65 (98)

Space heating requirement in kWh/m²/year 81.05 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		88.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	752.33	627.35	579.76	395.13	235.19	0	0	0	0	332.22	542.06	750.63	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	846.26	705.68	652.14	444.46	264.55	0	0	0	0	373.7	609.74	844.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4740.89 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

339.97	303.53	327.92	306.65	309.69	207.61	205.94	216.94	213.73	317.35	319.62	336.07

Efficiency of water heater 78.8 (216)

(217)m=	85.49	85.33	84.97	84.19	82.86	78.8	78.8	78.8	78.8	83.66	84.87	85.51	(217)

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

(219)m=	397.67	355.7	385.95	364.25	373.74	263.46	261.34	275.31	271.23	379.33	376.62	393.01

Total = Sum(219a)$_{1...12}$ = 4097.61 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4740.89	
Water heating fuel used			4097.61	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165	(231)
Electricity for lighting			294.24	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1024.03	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	885.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1909.12	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	85.64	(267)
Electricity for lighting	(232)	x	0.519	=	152.71	(268)
Total CO2, kg/year			sum of (265)…(271) =		2147.46	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		41.3	(273)
EI rating (section 14)					70	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.4

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

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			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

DER WorkSheet: New dwelling design stage

(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)

	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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.03 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 2.84 (54)

Enter (50) or (54) in (55) 2.84 (55)

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

(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	343.39	306.52	331.01	309.34	312.28	209.83	208	219.31	216.13	320.15	322.67	339.38	(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=	343.39	306.52	331.01	309.34	312.28	209.83	208	219.31	216.13	320.15	322.67	339.38

Output from water heater (annual)$_{1...12}$ 3438.01 (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=	144.92	129.69	140.8	132.61	134.58	61.04	60.14	63.9	63.13	137.19	137.04	143.59	(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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	194.79	192.99	189.25	184.18	180.88	84.78	80.83	85.88	87.68	184.4	190.33	193	(72)

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

(73)m=	429.82	428.09	417.79	401.29	384.77	277.17	266.56	271.55	279.9	388.04	407.21	421.36	(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=	597.26	705.53	780.8	829.8	850.06	733.92	708.97	686.47	665.14	689.81	606.25	565.68	(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	0.98	0.95	0.91	0.8	0.83	0.94	0.98	1	1	(86)

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

(87)m=	19.06	19.24	19.54	19.94	20.35	20.65	20.86	20.83	20.54	20.08	19.5	19.03	(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	0.99	0.98	0.96	0.9	0.76	0.48	0.54	0.84	0.96	0.99	1	(89)

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

(90)m=	16.35	16.62	17.05	17.64	18.19	18.57	18.72	18.71	18.46	17.83	17	16.32	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	17.84	18.06	18.42	18.9	19.38	19.72	19.89	19.88	19.61	19.06	18.37	17.81	(92)

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

(93)m=	17.84	18.06	18.42	18.9	19.38	19.72	19.89	19.88	19.61	19.06	18.37	17.81	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.96	0.92	0.84	0.68	0.72	0.9	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	594.22	698.72	766.51	798.51	778.94	619.49	481.21	492.22	595.48	665.08	600.32	563.34	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2316.15	2246.25	2030.12	1685.22	1290.55	851.97	548.45	577.76	920.23	1423.1	1902.92	2307.72	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1281.12	1039.94	940.12	638.43	380.63	0	0	0	0	563.97	937.87	1297.82	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 7079.9 (98)

Space heating requirement in kWh/m²/year 128.73 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		88.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1281.12	1039.94	940.12	638.43	380.63	0	0	0	0	563.97	937.87	1297.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1441.07	1169.79	1057.51	718.14	428.16	0	0	0	0	634.39	1054.97	1459.87	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 7963.89 (211)

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

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

Water heating

Output from water heater (calculated above)

	343.39	306.52	331.01	309.34	312.28	209.83	208	219.31	216.13	320.15	322.67	339.38		
Efficiency of water heater													78.8	(216)
(217)m=	86.55	86.38	86.03	85.33	84.05	78.8	78.8	78.8	78.8	84.96	86.08	86.6		(217)

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

(219)m=	396.73	354.85	384.77	362.52	371.56	266.29	263.96	278.31	274.27	376.84	374.86	391.9		
									Total = Sum(219a)$_{1...12}$ =				4096.86	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			7963.89	
Water heating fuel used			4096.86	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165	(231)
Electricity for lighting			252.32	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1720.2	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	884.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2605.12	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	85.64	(267)
Electricity for lighting	(232)	x	0.519	=	130.95	(268)
Total CO2, kg/year			sum of (265)…(271) =		2821.71	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		51.3	(273)
EI rating (section 14)					62	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.4

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)

			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)

** 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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.03 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 2.84 (54)

Enter (50) or (54) in (55) 2.84 (55)

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

(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96	(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=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96	

Output from water heater (annual)$_{1...12}$ 3393.99 (64)

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

(65)m=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12	(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=	13.36	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02	(72)

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

(73)m=	414.73	413.06	403.32	387.74	372.19	265.51	255.47	260.28	268.14	375.36	393.45	406.76	(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=	583.04	692.18	769.17	820.82	843.65	728.85	704.04	680.09	656.81	679.12	593.57	551.82	(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	0.99	0.99	0.97	0.94	0.89	0.77	0.8	0.93	0.98	0.99	1	(86)

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

(87)m=	19.11	19.3	19.61	20	20.4	20.69	20.88	20.85	20.58	20.12	19.55	19.09	(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	0.98	0.95	0.88	0.73	0.45	0.5	0.82	0.95	0.99	1	(89)

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

(90)m=	16.44	16.72	17.16	17.73	18.27	18.62	18.74	18.73	18.51	17.91	17.08	16.4	(90)

fLA = Living area ÷ (4) = 0.55 (91)

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

(92)m=	17.92	18.15	18.52	18.99	19.45	19.77	19.93	19.91	19.66	19.14	18.45	17.89	(92)

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

(93)m=	17.92	18.15	18.52	18.99	19.45	19.77	19.93	19.91	19.66	19.14	18.45	17.89	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.96	0.9	0.82	0.65	0.69	0.88	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	579.61	684.31	752.47	784	760.68	598.48	455.94	467.79	577.55	650.51	586.78	549.17	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2130.19	2067.97	1871.23	1556.9	1193.8	789.1	508.03	535.23	851.9	1314.84	1754	2123.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1153.63	929.82	832.36	556.49	322.24	0	0	0	0	494.26	840.39	1171.66	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6300.86 (98)

Space heating requirement in kWh/m²/year 123.55 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		88.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1153.63	929.82	832.36	556.49	322.24	0	0	0	0	494.26	840.39	1171.66	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1297.67	1045.92	936.29	625.97	362.48	0	0	0	0	555.98	945.33	1317.95	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 7087.58 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

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

Water heating

Output from water heater (calculated above)													
	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96	
Efficiency of water heater												78.8	(216)
(217)m=	86.39	86.19	85.8	85.04	83.65	78.8	78.8	78.8	78.8	84.66	85.87	86.44	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	392.22	351.01	381	359.56	369.18	262.52	260.47	274.3	270.21	373.74	371.01	387.52	

Total = Sum(219a)$_{1...12}$ = 4052.72 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		7087.58

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Water heating fuel used			4052.72	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165	(231)
Electricity for lighting			235.9	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1530.92	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	875.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2406.31	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	85.64	(267)
Electricity for lighting	(232) x	0.519	=	122.43	(268)
Total CO2, kg/year		sum of (265)…(271) =		2614.37	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		51.26	(273)
EI rating (section 14)				64	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.3.4

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		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			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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.03 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0.91 (52)

Temperature factor from Table 2b — 0.78 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 2.84 (54)

Enter (50) or (54) in (55) — 2.84 (55)

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

(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96	(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=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96	

Output from water heater (annual)1...12 | 3393.99 | (64)

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

(65)m=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12	(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	7.43	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02	(72)

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

(73)m=	414.95	413.25	403.48	387.87	372.28	265.58	255.55	260.38	268.28	375.54	393.66	406.99	(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=	572.3	671.43	733.74	763.77	766.72	646.48	627.14	619.12	614.15	654.37	580.26	542.91	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.98	0.96	0.93	0.86	0.87	0.95	0.98	0.99	1	(86)

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

(87)m=	18.69	18.88	19.21	19.64	20.1	20.47	20.75	20.72	20.37	19.83	19.19	18.67	(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=	0.99	0.99	0.98	0.96	0.91	0.81	0.51	0.56	0.86	0.96	0.99	1	(89)

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

(90)m=	15.67	15.95	16.42	17.05	17.69	18.19	18.41	18.4	18.07	17.33	16.4	15.64	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	17.1	17.33	17.74	18.28	18.83	19.27	19.52	19.5	19.16	18.52	17.72	17.07	(92)

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

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(93)m=	17.1	17.33	17.74	18.28	18.83	19.27	19.52	19.5	19.16	18.52	17.72	17.07	(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=	0.99	0.99	0.98	0.96	0.92	0.87	0.71	0.74	0.9	0.96	0.99	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	568.23	663.2	718.43	734.83	708.7	560.11	446.22	458.58	552.42	628.57	572.91	539.66		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	2462.63	2387.73	2153.26	1780.42	1351.65	877.31	548.23	581.12	953.55	1500.23	2019.78	2456.86		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	1409.44	1158.88	1067.51	752.83	478.35	0	0	0	0	648.52	1041.75	1426.4		
Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =													7983.67	(98)
Space heating requirement in kWh/m²/year													156.54	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		88.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	1409.44	1158.88	1067.51	752.83	478.35	0	0	0	0	648.52	1041.75	1426.4		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1585.42	1303.58	1200.8	846.82	538.08	0	0	0	0	729.49	1171.82	1604.5		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													8980.5	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96		
Efficiency of water heater													78.8	(216)
(217)m=	86.75	86.6	86.31	85.73	84.64	78.8	78.8	78.8	78.8	85.31	86.31	86.78		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	390.6	349.33	378.75	356.66	364.86	262.52	260.47	274.3	270.21	370.89	369.14	385.97		
Total = Sum(219a)$_{1...12}$ =													4033.69	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		8980.5

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Water heating fuel used			4033.69	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165	(231)
Electricity for lighting			239.8	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1939.79	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	871.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2811.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	85.64	(267)
Electricity for lighting	(232) x	0.519	=	124.46	(268)
Total CO2, kg/year		sum of (265)…(271) =		3021.16	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		59.24	(273)
EI rating (section 14)				58	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: **Stroma Number:**
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.3.4

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		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

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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]

(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=	0.68	0.68	0.67	0.64	0.63	0.6	0.6	0.6	0.61	0.63	0.64	0.65	(24d)

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

(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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.03 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 2.84 (54)

Enter (50) or (54) in (55) 2.84 (55)

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

(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	384.15	342.18	367.8	341.42	343.06	236.39	232.62	247.55	244.7	353.46	359.02	378.86	(62)

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

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

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

Output from water heater

(64)m=	384.15	342.18	367.8	341.42	343.06	236.39	232.62	247.55	244.7	353.46	359.02	378.86

Output from water heater (annual)$_{1...12}$ 3831.21 (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=	158.48	141.54	153.04	143.27	144.81	69.87	68.32	73.29	72.63	148.27	149.13	156.72	(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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	213	210.63	205.7	198.99	194.64	97.04	91.83	98.51	100.88	199.29	207.12	210.64	(72)

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

(73)m=	611.42	609.11	592.02	564.17	535.37	416.57	399.07	405.68	420.21	539.76	572.04	596.77	(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	2.48	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=	967.75	1199.22	1360.48	1460.58	1495.42	1352.16	1308.24	1268.82	1232.58	1180.89	995.64	903.87	(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	0.99	0.99	0.98	0.96	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=	17.84	18.04	18.42	18.96	19.54	20.1	20.48	20.43	19.96	19.23	18.45	17.81	(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	0.61	0.67	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=	14.31	14.6	15.16	15.95	16.79	17.57	17.99	17.95	17.39	16.34	15.2	14.28	(90)

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

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

(92)m=	15.59	15.84	16.34	17.04	17.79	18.48	18.88	18.85	18.32	17.38	16.37	15.55	(92)

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

(93)m=	15.59	15.84	16.34	17.04	17.79	18.48	18.88	18.85	18.32	17.38	16.37	15.55	(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	0.9	0.77	0.8	0.93	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	963.65	1190.02	1342.36	1425.02	1422.74	1218.44	1009.8	1018.96	1146.44	1154.06	988.4	900.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	7576.03	7332.79	6581.33	5396.14	4030.42	2550.04	1501.85	1605.81	2779.57	4490.92	6160.19	7567.62	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	4919.61	4127.94	3897.8	2859.21	1940.11	0	0	0	0	2482.62	3723.69	4960.19	

Total per year (kWh/year) = Sum(98)1...5,9...12 = | 28911.17 | (98)

Space heating requirement in kWh/m²/year | 225.87 | (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 | 88.9 | (206)

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

DER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	4919.61	4127.94	3897.8	2859.21	1940.11	0	0	0	0	2482.62	3723.69	4960.19		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	5533.87	4643.35	4384.47	3216.2	2182.36	0	0	0	0	2792.6	4188.63	5579.52		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													32521	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)
Water heating Output from water heater (calculated above)	384.15	342.18	367.8	341.42	343.06	236.39	232.62	247.55	244.7	353.46	359.02	378.86		
Efficiency of water heater													78.8	(216)
(217)m=	88.08	88.04	87.93	87.7	87.22	78.8	78.8	78.8	78.8	87.5	87.91	88.1		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	436.13	388.68	418.3	389.3	393.32	299.99	295.2	314.15	310.54	403.94	408.4	430.04		
Total = Sum(219a)$_{1...12}$ =													4487.99	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		32521	
Water heating fuel used		4487.99	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	120		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		165	(231)
Electricity for lighting		472.83	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	7024.54	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	969.41	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7993.94	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	85.64	(267)
Electricity for lighting	(232)	x	0.519	=	245.4	(268)
Total CO2, kg/year			sum of (265)…(271) =		8324.98	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		65.04	(273)
EI rating (section 14)					40	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.4

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		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)

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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	
(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	

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

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) =	160	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0.03	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0.91	(52)
Temperature factor from Table 2b		0.78	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	2.84	(54)
Enter (50) or (54) in (55)		2.84	(55)

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

(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	369.05	328.97	354.17	329.53	331.65	226.55	223.5	237.09	234.11	341.11	345.55	364.23	(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=	369.05	328.97	354.17	329.53	331.65	226.55	223.5	237.09	234.11	341.11	345.55	364.23	

Output from water heater (annual)1…12 | 3685.52 | (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=	153.45	137.15	148.51	139.32	141.02	66.6	65.29	69.81	69.11	144.16	144.65	151.85	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	206.25	204.09	199.6	193.5	189.54	92.5	87.75	93.83	95.99	193.77	200.9	204.1	(72)

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

(73)m=	521.46	519.25	505.41	483.15	460.56	347.41	333.39	339.51	351.02	464.95	490.71	510.03	(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=	593.82	660.02	738.99	832.23	899.49	802.5	764.23	701.51	624.92	632.11	580.71	569.73	(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	0.94	0.95	0.99	0.99	1	1	(86)

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

(87)m=	17.9	18.06	18.42	18.97	19.56	20.1	20.47	20.41	19.92	19.21	18.48	17.88	(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	0.99	0.99	0.96	0.89	0.64	0.72	0.95	0.99	1	1	(89)

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

(90)m=	14.4	14.63	15.17	15.96	16.82	17.58	18	17.96	17.34	16.32	15.25	14.38	(90)

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

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

(92)m=	16.26	16.46	16.9	17.56	18.28	18.92	19.31	19.26	18.71	17.86	16.97	16.24	(92)

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

(93)m=	16.26	16.46	16.9	17.56	18.28	18.92	19.31	19.26	18.71	17.86	16.97	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=	1	1	0.99	0.98	0.96	0.93	0.85	0.88	0.96	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	591.92	657.03	733.25	818.85	866.85	746.05	646.26	616.62	602.65	624.09	577.89	568.13	(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=	4970.3	4793.11	4307.25	3560.58	2701.36	1762.56	1107.85	1165.75	1885.98	2981.77	4063.47	4972.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	3257.52	2779.45	2659.05	1974.04	1364.87	0	0	0	0	1754.11	2509.62	3276.97	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 19575.64 | (98)

Space heating requirement in kWh/m²/year | 238.73 | (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		88.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	3257.52	2779.45	2659.05	1974.04	1364.87	0	0	0	0	1754.11	2509.62	3276.97		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	3664.25	3126.49	2991.06	2220.52	1535.29	0	0	0	0	1973.13	2822.97	3686.13		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													22019.84	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	369.05	328.97	354.17	329.53	331.65	226.55	223.5	237.09	234.11	341.11	345.55	364.23		
Efficiency of water heater													78.8	(216)
(217)m=	87.76	87.71	87.58	87.3	86.73	78.8	78.8	78.8	78.8	87.08	87.54	87.77		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	420.54	375.06	404.39	377.47	382.41	287.5	283.62	300.87	297.1	391.71	394.73	414.96		
Total = Sum(219a)$_{1...12}$ =													4330.38	(219)

Annual totals

		kWh/year	kWh/year	
Space heating fuel used, main system 1			22019.84	
Water heating fuel used			4330.38	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165	(231)
Electricity for lighting			373.27	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	4756.29	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	935.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5691.65	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	85.64	(267)
Electricity for lighting	(232)	x	0.519	=	193.73	(268)
Total CO2, kg/year			sum of (265)…(271) =		5971.01	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		72.82	(273)
EI rating (section 14)					41	(274)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.4

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)

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			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												
(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

0.69	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)

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

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

(44)m=	96.3	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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.03 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 2.84 (54)

Enter (50) or (54) in (55) 2.84 (55)

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

(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	359.22	320.37	345.3	321.8	324.23	220.15	217.56	230.28	227.23	333.09	336.79	354.72	(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=	359.22	320.37	345.3	321.8	324.23	220.15	217.56	230.28	227.23	333.09	336.79	354.72	

Output from water heater (annual)$_{1...12}$ 3590.76 (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=	150.19	134.29	145.56	136.75	138.55	64.47	63.32	67.55	66.82	141.5	141.74	148.69	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	201.86	199.84	195.64	189.93	186.23	89.54	85.1	90.79	92.81	190.18	196.86	199.85	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	483.44	481.5	469.22	449.44	429.44	318.61	305.96	311.56	321.66	433.1	456.07	473.21	(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=	616.64	726.83	851.15	995.74	1104.79	1016.11	967.23	873	760.24	716.98	619.03	584.95	(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

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(86)m=	1	1	0.99	0.98	0.97	0.94	0.89	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=	17.35	17.55	18	18.65	19.35	19.99	20.41	20.33	19.75	18.91	18.03	17.32	(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	0.97	0.93	0.83	0.54	0.63	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=	13.7	13.99	14.64	15.58	16.59	17.46	17.91	17.86	17.18	15.97	14.69	13.66	(90)

fLA = Living area ÷ (4) = 0.81 (91)

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

(92)m=	16.65	16.87	17.35	18.06	18.82	19.5	19.93	19.86	19.26	18.35	17.39	16.62	(92)

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

(93)m=	16.65	16.87	17.35	18.06	18.82	19.5	19.93	19.86	19.26	18.35	17.39	16.62	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.97	0.94	0.9	0.83	0.86	0.95	0.98	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	613.03	720.4	838.32	966.64	1040.82	916.99	805.14	754.98	720.19	701.82	613.68	581.94	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	5759.1	5572.48	5044.58	4226.07	3282.9	2244.54	1525.22	1581.5	2368.83	3570.03	4756.13	5756.78	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	3828.67	3260.6	3129.46	2346.79	1668.1	0	0	0	0	2133.95	2982.57	3850.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 23200.22 (98)

Space heating requirement in kWh/m²/year 331.43 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		88.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	3828.67	3260.6	3129.46	2346.79	1668.1	0	0	0	0	2133.95	2982.57	3850.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	4306.72	3667.72	3520.2	2639.81	1876.38	0	0	0	0	2400.39	3354.97	4330.8	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 26096.98 (211)

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Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

359.22	320.37	345.3	321.8	324.23	220.15	217.56	230.28	227.23	333.09	336.79	354.72

Efficiency of water heater 78.8 (216)

(217)m=	87.93	87.89	87.78	87.55	87.08	78.8	78.8	78.8	78.8	87.39	87.76	87.95	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	408.52	364.51	393.36	367.57	372.32	279.38	276.1	292.24	288.36	381.16	383.77	403.32

Total = Sum(219a)$_{1...12}$ = 4210.61 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		26096.98	
Water heating fuel used		4210.61	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	120		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	165	(231)
Electricity for lighting		310.63	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	5636.95	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	909.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6546.44	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	85.64	(267)
Electricity for lighting	(232) x	0.519	=	161.22	(268)
Total CO2, kg/year		sum of (265)…(271) =		6793.29	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		97.05	(273)
EI rating (section 14)				32	(274)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.4

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		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

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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)

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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=	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)

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=	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)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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) = — 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.03 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0.91 (52)

Temperature factor from Table 2b — 0.78 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 2.84 (54)

Enter (50) or (54) in (55) — 2.84 (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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	383.69	341.77	367.38	341.05	342.7	236.09	232.33	247.23	244.38	353.07	358.61	378.41	(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=	383.69	341.77	367.38	341.05	342.7	236.09	232.33	247.23	244.38	353.07	358.61	378.41	

Output from water heater (annual)$_{1...12}$ | 3826.7 | (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=	158.32	141.41	152.9	143.15	144.69	69.77	68.23	73.18	72.52	148.14	148.99	156.56	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	212.8	210.43	205.51	198.82	194.48	96.9	91.7	98.36	100.73	199.11	206.93	210.44	(72)

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

(73)m=	609.67	606.92	589.37	561.19	532.25	413.56	396.4	403.44	418.43	538.32	570.73	595.34	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area 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=	724.34	801.3	856.55	900.37	924	808.86	774.77	740.84	709.87	753.12	707.82	693.7	(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	0.96	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=	19.12	19.23	19.46	19.81	20.18	20.51	20.74	20.7	20.4	19.97	19.5	19.11	(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	0.8	0.85	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=	16.58	16.74	17.09	17.6	18.14	18.62	18.91	18.88	18.48	17.84	17.14	16.57	(90)

fLA = Living area ÷ (4) = 0.3 (91)

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

(92)m=	17.34	17.49	17.8	18.27	18.76	19.19	19.46	19.43	19.06	18.48	17.85	17.34	(92)

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

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(93)m=	17.34	17.49	17.8	18.27	18.76	19.19	19.46	19.43	19.06	18.48	17.85	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	1	1	0.99	0.96	0.87	0.9	0.98	1	1	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	723.97	800.59	855.06	896.47	911.42	778.06	672.23	665.33	696.54	749.93	707.11	693.41		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	4261.51	4104.2	3674.62	3008.13	2260.84	1456.08	906.78	958.58	1578.66	2525.77	3461.71	4249.7		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	2631.94	2220.02	2097.75	1520.39	1003.97	0	0	0	0	1321.22	1983.31	2645.88		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													15424.48	(98)
Space heating requirement in kWh/m²/year													124.39	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		88.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	2631.94	2220.02	2097.75	1520.39	1003.97	0	0	0	0	1321.22	1983.31	2645.88		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	2960.56	2497.21	2359.68	1710.23	1129.33	0	0	0	0	1486.19	2230.94	2976.24		
Total (kWh/year) =Sum(211)1...5,10...12=													17350.37	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)
Water heating														
Output from water heater (calculated above)														
	383.69	341.77	367.38	341.05	342.7	236.09	232.33	247.23	244.38	353.07	358.61	378.41		
Efficiency of water heater													78.8	(216)
(217)m=	87.47	87.41	87.23	86.86	86.09	78.8	78.8	78.8	78.8	86.56	87.19	87.5		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	438.63	391.01	421.14	392.64	398.07	299.61	294.84	313.74	310.12	407.89	411.3	432.48		
Total = Sum(219a)1...12 =													4511.48	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		17350.37

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Water heating fuel used			4511.48	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165	(231)
Electricity for lighting			536.46	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	3747.68	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	974.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =				4722.16	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	85.64	(267)
Electricity for lighting	(232)	x	0.519	=	278.42	(268)
Total CO2, kg/year			sum of (265)…(271) =		5086.22	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		41.02	(273)
EI rating (section 14)					60	(274)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.3.4

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 (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			1.6	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, m^2			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/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		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)

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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)

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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.03 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 2.84 (54)

Enter (50) or (54) in (55) 2.84 (55)

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

(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	366.87	327.06	352.21	327.82	330.01	225.14	222.18	235.58	232.59	339.34	343.61	362.13	(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=	366.87	327.06	352.21	327.82	330.01	225.14	222.18	235.58	232.59	339.34	343.61	362.13	

Output from water heater (annual)$_{1...12}$ 3664.55 (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=	152.73	136.52	147.85	138.75	140.47	66.13	64.85	69.31	68.6	143.57	144	151.15	(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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	205.28	203.15	198.73	192.71	188.81	91.84	87.17	93.16	95.28	192.98	200.01	203.16	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	514.81	512.42	498.57	476.5	454.21	341.46	327.82	334.07	345.62	459.37	484.78	503.73	(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	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=	591.01	641.59	676.16	702.02	714.75	604.39	579.47	558.43	539.35	602.12	575.87	569.08	(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	0.95	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=	18.68	18.81	19.09	19.5	19.95	20.35	20.64	20.6	20.23	19.71	19.14	18.67	(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	0.99	0.98	0.93	0.74	0.79	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=	15.71	15.9	16.31	16.92	17.57	18.14	18.48	18.45	17.98	17.23	16.39	15.7	(90)

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

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

(92)m=	16.53	16.7	17.08	17.63	18.23	18.75	19.08	19.04	18.6	17.91	17.15	16.52	(92)

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

(93)m=	16.53	16.7	17.08	17.63	18.23	18.75	19.08	19.04	18.6	17.91	17.15	16.52	(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	1	0.99	0.99	0.97	0.94	0.82	0.86	0.96	0.99	1	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	589.67	639.49	672.49	694.33	695.32	568.49	478.05	478.74	520.43	595.04	573.67	567.98		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	3369.21	3244.01	2899.81	2367.34	1765.89	1112.07	663.53	706.98	1211.09	1979.48	2731.27	3362.99		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	2067.98	1750.24	1657.13	1204.57	796.5	0	0	0	0	1030.02	1553.47	2079.49		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				12139.41	(98)
Space heating requirement in kWh/m²/year													153.66	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		88.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	2067.98	1750.24	1657.13	1204.57	796.5	0	0	0	0	1030.02	1553.47	2079.49		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	2326.19	1968.77	1864.04	1354.97	895.95	0	0	0	0	1158.63	1747.44	2339.14		
									Total (kWh/year) =Sum(211)$_{1...5,10...12}$=				13655.13	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10...12}$=				0	(215)
Water heating														
Output from water heater (calculated above)														
	366.87	327.06	352.21	327.82	330.01	225.14	222.18	235.58	232.59	339.34	343.61	362.13		
Efficiency of water heater													78.8	(216)
(217)m=	87.22	87.14	86.95	86.53	85.68	78.8	78.8	78.8	78.8	86.16	86.88	87.24		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	420.65	375.33	405.08	378.86	385.15	285.71	281.96	298.96	295.17	393.83	395.49	415.09		
									Total = Sum(219a)$_{1...12}$ =				4331.28	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		13655.13

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Water heating fuel used			4331.28	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165	(231)
Electricity for lighting			398.03	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	2949.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	935.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3885.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	85.64	(267)
Electricity for lighting	(232) x	0.519	=	206.58	(268)
Total CO2, kg/year		sum of (265)…(271) =		4177.28	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		52.88	(273)
EI rating (section 14)				55	(274)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.3.4

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 *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)	0.71	(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) = 160 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.03 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.91 (52)

Temperature factor from Table 2b 0.78 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 2.84 (54)

Enter (50) or (54) in (55) 2.84 (55)

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

(56)m=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	88.04	79.52	88.04	85.2	88.04	85.2	88.04	88.04	85.2	88.04	85.2	88.04	(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=	128.38	115.95	128.38	124.24	128.38	41.92	43.31	43.31	41.92	128.38	124.24	128.38	(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=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96	(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=	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96	

Output from water heater (annual) 1…12 | 3393.99 | (64)

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

(65)m=	143.4	128.36	139.44	131.41	133.43	60.05	59.22	62.85	62.07	135.95	135.69	142.12	(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=	10	10	10	10	10	10	10	10	10	10	10	10	(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=	192.75	191.01	187.41	182.52	179.34	83.4	79.6	84.47	86.2	182.73	188.45	191.02	(72)

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

(73)m=	418.5	416.4	406.04	389.8	373.73	266.81	256.87	262.1	270.59	378.47	397.08	410.63	(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=	438.82	456.17	471.53	485.31	490.78	386.63	370.94	360.09	346.75	425.65	422.43	427.35	(84)

7. Mean internal temperature (heating season)

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

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

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

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

(87)m=	18.7	18.82	19.09	19.5	19.95	20.33	20.62	20.59	20.21	19.72	19.16	18.69	(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	0.99	0.97	0.93	0.74	0.79	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=	15.72	15.89	16.3	16.91	17.56	18.1	18.45	18.42	17.95	17.23	16.4	15.72	(90)

fLA = Living area ÷ (4) = 0.56 (91)

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

(92)m=	17.4	17.54	17.88	18.37	18.91	19.36	19.68	19.64	19.23	18.64	17.96	17.4	(92)

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

(93)m=	17.4	17.54	17.88	18.37	18.91	19.36	19.68	19.64	19.23	18.64	17.96	17.4	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.99	0.98	0.96	0.89	0.91	0.98	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	437.56	454.52	468.92	480.21	478.93	371.28	331.46	328.34	338.5	420.71	420.51	426.26	(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=	2371.45	2282.87	2048.88	1687.65	1282.2	838.12	541.94	570.08	905.94	1429.07	1938.56	2366.27	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1438.81	1228.65	1175.49	869.36	597.63	0	0	0	0	750.22	1092.99	1443.37	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 8596.54 (98)

Space heating requirement in kWh/m²/year 168.56 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		88.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	1438.81	1228.65	1175.49	869.36	597.63	0	0	0	0	750.22	1092.99	1443.37		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1618.46	1382.06	1322.27	977.91	672.25	0	0	0	0	843.9	1229.46	1623.59		
Total (kWh/year) =Sum(211)1...5,10...12=													9669.9	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

Output from water heater (calculated above)														
	338.82	302.53	326.89	305.75	308.83	206.86	205.25	216.15	212.93	316.42	318.6	334.96		
Efficiency of water heater													78.8	(216)
(217)m=	86.78	86.7	86.49	86.03	85.18	78.8	78.8	78.8	78.8	85.64	86.4	86.8		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	390.44	348.92	377.96	355.39	362.56	262.52	260.47	274.3	270.21	369.46	368.75	385.88		
Total = Sum(219a)1...12 =													4026.86	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		9669.9

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Water heating fuel used			4026.86	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		120		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		165	(231)
Electricity for lighting			302.44	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	2088.7	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	869.8	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2958.5	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	85.64	(267)
Electricity for lighting	(232) x	0.519	=	156.96	(268)
Total CO2, kg/year		sum of (265)…(271) =		3201.1	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		62.77	(273)
EI rating (section 14)				55	(274)