39 Fitzjohn's Avenue
London
NW3 5JY

Energy and Sustainability Statement

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1. Executive Summary

In support of the planning application for the proposed development at 39 Fitzjohn's Avenue, and to comply with the London Plan and Camden Council's requirements on environmental sustainability and efficient energy design an Energy and Sustainability Statement has been produced.

The Energy Statement contained herein describes the recommended solution to service the proposed development in the most energy efficient and sustainable manner, following the Be Lean, Be Clean, Be Green hierarchy as stipulated by the Greater London Authority (GLA).

The conversion, extension, and refurbishment of the development will result in new and more efficient heating plant being installed, glazing being replaced with double glazed units, improvement fabric efficiency throughout, and water saving techniques to ensure the proposals are in line with Camden's policy requirements set out in Section 2 of this report.

The results of this study recommend the installation of a photovoltaic panel array with an installed capacity of 18.72 kWp to further reduce the carbon emissions from the proposed development.

In line with London Plan guidance, carbon emissions calculations have been produced for the existing unrefurbished condition of the development. The existing development will comprise of a refurbishment and will therefore be assessed against PartL1B of the building regulations, and will be required to provide 'consequential improvements' as part of the works in line with building regulations.

The table below shows the carbon emissions after each stage of the hierarchy.

	Carbon dioxide emissions for domestic buildings (Tonnes of CO2 per annum)	
	Regulated	**Unregulated**
Baseline: Existing Building	85.25	107.00
After energy demand reduction	42.68	107.00
After heat network / CHP	42.68	107.00
After renewable energy	36.37	107.00

Table 1 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings (existing floors)

The table below shows the different savings at each stage of the energy hierarchy.

	Regulated domestic carbon dioxide savings	
	(Tonnes of CO_2 per annum)	**(%)**
Savings from energy demand reduction	42.56	49.9%
Savings from heat network / CHP	0.00	0.0%
Savings from renewable energy	6.31	7.4%
Cumulative on site savings	**48.88**	**57.33%**

Table 2 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

Through energy efficiency techniques as well as the implementation of renewable technologies as mentioned above, the refurbishment of the existing floors of the proposed development will reduce annual carbon emissions by 48.88 tons of CO_2. This accounts for a reduction of approximately 57.33% of the building's expected regulated energy carbon emissions.

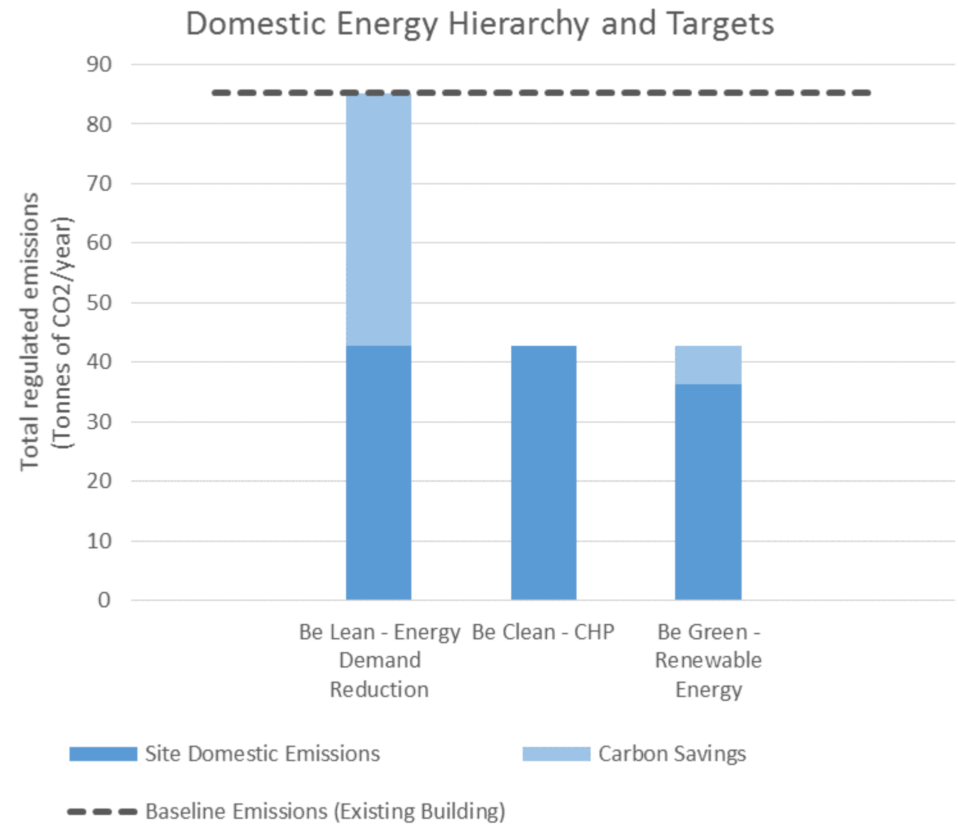


Figure 1 The Domestic Energy Hierarchy

2. Introduction

In support of the planning application, an Energy and Sustainability Statement study that examines the potential for reduction of carbon emissions for the proposed development at 39 Fitzjohn's Avenue, Hampstead NW3, has been compiled on request of the Applicant.

The existing house is a detached part 2 and part 3 storey private dwelling with accommodation at basement, ground, first, and second floors with additional accommodation in the roof space which will be converted into 20 apartments.

In addition there is an existing standalone dwelling that will be refurbished internally, but will remain as a single family dwelling.

In accordance with Part L of the Building Regulation the existing floors which will be refurbished will be assessed against Part L1B (existing dwellings), and have been modelled to show carbon emissions for reference only.

Camden Council has specific requirements with regards to reductions on carbon emissions for all work to existing building as listed in the Local Plans Policies CC1 and CC2 on Sustainability, this includes:

- Improvements to the buildings overall efficiency that should constitute approximately 10% of the overall project cost.
- All developments are expected to provide a 20% reduction in carbon dioxide emissions from on-site renewable energy
- Developments involving the conversion of 5 or more dwellings will be expected to be designed in line with BREEAM Domestic Refurbishment
- Developments are encouraged to achieve at least 60% of the unweighted credits in the Energy and Water categories, as well as 40% of the Materials category.

This report demonstrates how this development will strive to comply with the Camden Council guidance on energy and sustainability.

A separate BREEAM Pre-Assessment has been prepared demonstrating the development targeting a level of 'Excellent' and the minimum percentages for Energy, Water and Materials indicated above.

3. Establishing Baseline CO_2 Emissions for existing building

Part L 2013 calculations have been performed by using approved modelling SAP 2012 software (FSAP) in order to predict the carbon emissions of unrefurbished condition of the existing building.

To establish the baseline CO2 emissions for the existing development, estimates of the existing performance of the building elements and services have been assessed from the existing EPC for the building produced at the time the property was purchased. (See Appendix 4 for a copy of this EPC).

A sample of typical apartments have been selected and SAP 2012 calculations have been produced to obtain an area weighted average carbon emission rate for the whole development. (See Appendix 1 for SAP 2012 worksheets).

Table 6 below shows the carbon emission rate for the existing building.

Baseline Emission Rate for Domestic		
Baseline	35.11	kgCO2/m²

Table 3 Annual carbon emissions

4. Energy Efficiency Measures *"Be Lean" and Sustainability Strategies*

The energy efficiency measures for the refurbishment will be maximised through the use of passive design features.

Chapter 4 of Camden's CPG on Sustainability has been followed to ensure the energy efficiency of the existing building is improved in line with planning guidance. The features to improve energy efficiency proposed for this development are:

- Draught proofing (to improve the air tightness of the building)
- Energy efficient lighting
- Upgrading to double glazing
- Improved insulation to walls
- New roof with efficient u-values
- New heating plant and controls

Building fabric U-values

Improvements to the existing fabric elements of the building will be achieved wherever possible. Existing windows will be upgraded and replaced with new double glazed windows, and existing walls will have thermal insulation improved to reduce heat loss. A new roof will be provided with u-values better than Part L 2013 building regulations.

Although the majority of the building is existing, the thermal elements of the building will have significantly better u-values to help reduce the energy consumption of the building (except in cases where the new elements need to match the existing in appearance).

Below is a list of the building regulations, and the more stringent target U-values for this development:

Element	Building Regulations (W/m^2K)	Proposed for 39 Fitzjohn's Ave (W/m^2K)
Wall	0.30	0.25
Floor	0.25	0.20
Roof	0.20	0.18
Windows	2.0	1.8

Table 4 U-Values as proposed for the proposed development comparison to Part L 2013

Air permeability

The air permeability (i.e. the tightness to the outdoor elements) of a building affects the heating and cooling demand of the building (and thereby affects the demand for natural gas and electricity). This development will achieve an air permeability which will be significantly more energy efficient than that of the existing unrefurbished property. The target air permeability rate for this development is 10.0 $m^3/h/m^2$.

The limiting factors which could make it difficult to achieve this air permeability rate are the openings throughout the existing building. The developer and the design team will required the contractor to build an airtight building in order to achieve the target set above.

Natural Ventilation

All windows to the apartments will be openable to allow for purge ventilation.

Mechanical Ventilation

All apartment units will be provided with whole house ventilation with heat recovery, to reduce the heating loads required to heat the fresh air supply into the unit. The design has been based on NUAIRE MRXBOX95-WM1 units with a thermal heat recovery efficiency of 91% and a specific fan power of 0.8 W/l/s. The proposed fan has been selected with variable speed drives and will be controlled on a trickle/boost setting via a local light switch.

HVAC systems

The efficiency of the mechanical systems has a significant impact on the amount of energy which the building consumes in order to deliver the required heating and cooling loads. Highly efficient equipment will be specified for this development, and wherever practically possible equipment from the government's Energy Technology List will be selected.

New ultra-low NOx highly efficient condensing boilers will be installed to each flat to provide the space heating and domestic hot water for each of the apartments. These will be located within dedicated utility cupboards and will have flues to the closest external walls. The space heating will be delivered to the apartments through an underfloor heating system providing a more efficient and even distribution of heat.

Variable speed drives will be provided for all motors in fans, AHUs, pumps etc.

Lighting systems

Lighting represents a significant portion of the annual carbon emissions of this development. In order to maximise the natural light and reduce the energy consumed in order to generate artificial light, the following energy efficiency measures have been specified:

- Energy efficient lighting specified for all areas (LEDs);
- Sub-metering of lighting which automatically warns of "out of range" values;
- Manual On / Automatic off switching for lighting; and
- PIR sensors in relevant zones (e.g. BOH areas/corridors/plant rooms/stores).

The table below shows the savings on regulated carbon emissions after the 'Lean' stage of the energy hierarchy for the new build element of the development.

	Regulated domestic carbon dioxide savings	
	(Tonnes of CO_2 per annum)	(%)
Savings from energy demand reduction	42.56	49.9%

Table 5 Carbon emissions after the Be Lean Stage

5. Decentralised Energy (DE) Networks – Be Clean

5.1. District Heating

System Description

The London Plan's Energy Hierarchy and Camden Council's guidance encourages developments to connect to existing decentralised energy (DE) networks where these exist or are proposed in the vicinity of the scheme. These systems combine the energy demands and supplies of nearby developments to more efficiently serve the building service requirements of the community as a whole.

Technical Viability

The figure below is an excerpt from the London Heat Map highlighting any existing and proposed DE networks. The black dot in the indicates the location of the proposed development at 39 Fitzjohn's Avenue, and shows that the site currently sits outside the reach of any existing or proposed networks and also outside the catchment areas for zones of DH potential.

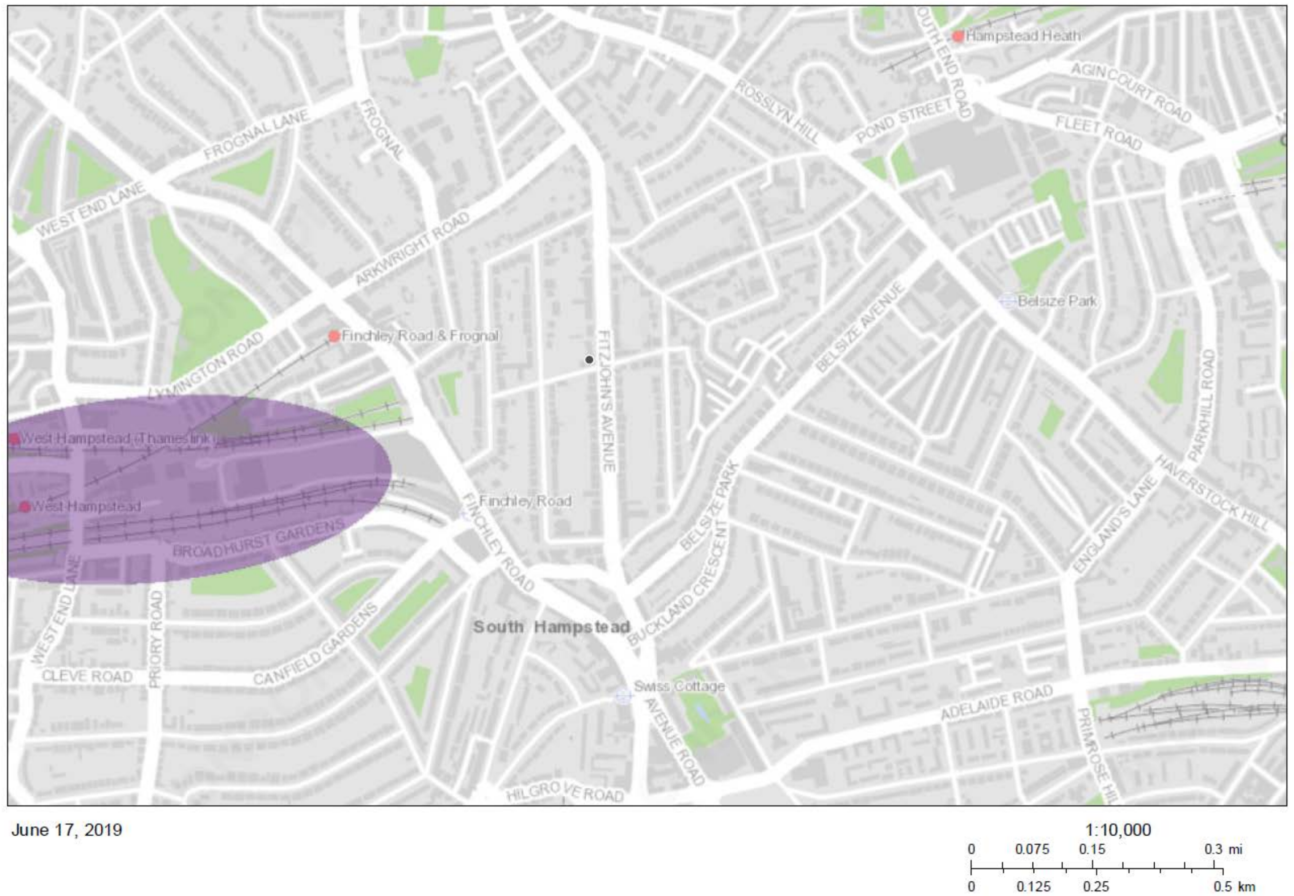


Figure 2 London Heat Map showing that there are no existing or proposed networks near the proposed development.

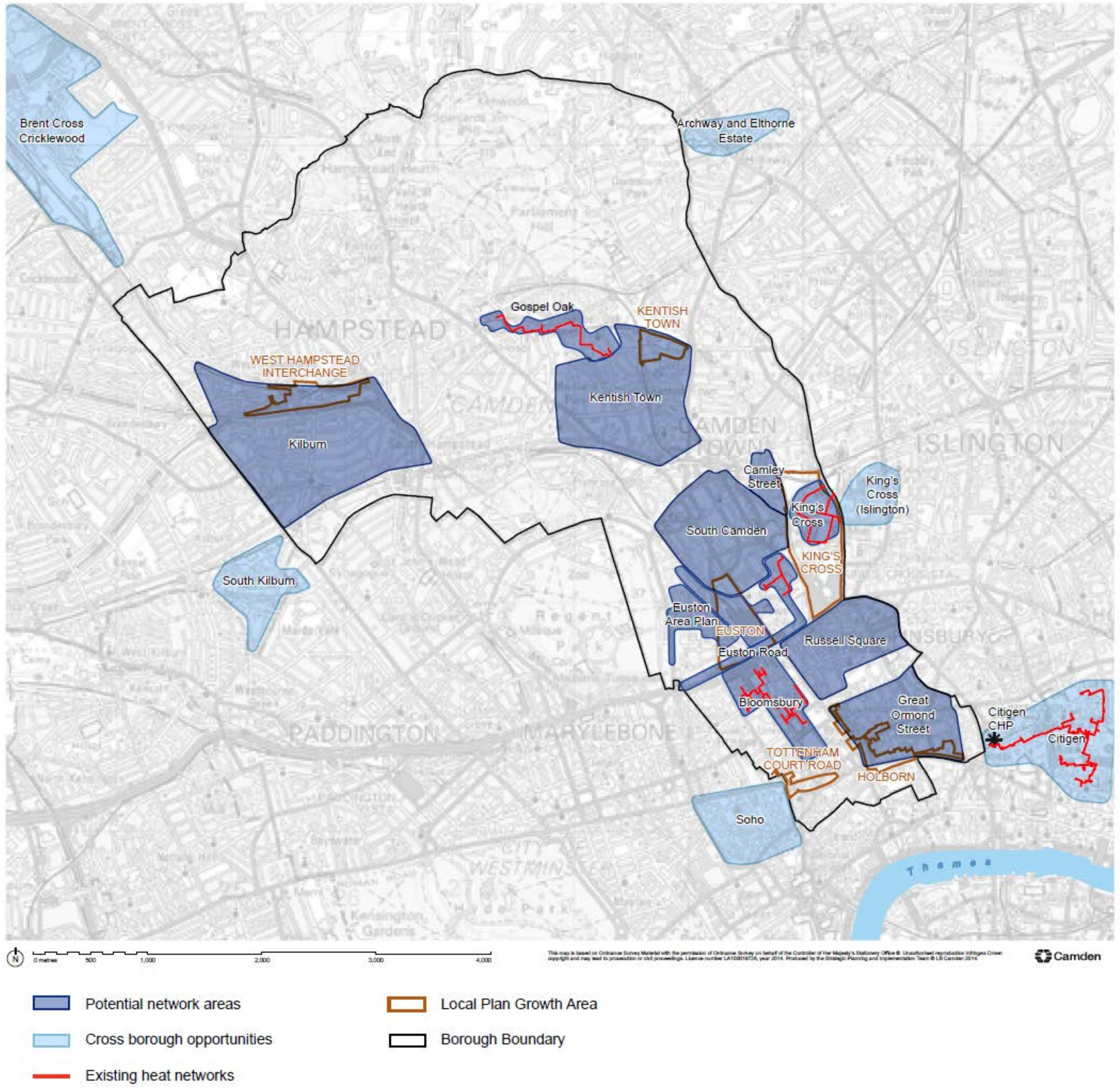


Figure 3 Camden Borough Wide District Energy Networks

Both the London Heat Map, and the Camden energy network map shows that the site sits outside the reach of any existing or proposed district energy centres. There is a new energy network cluster being studied close to the site, however the development site is outside this zone and outside the reach of the proposed and future energy network corridors.

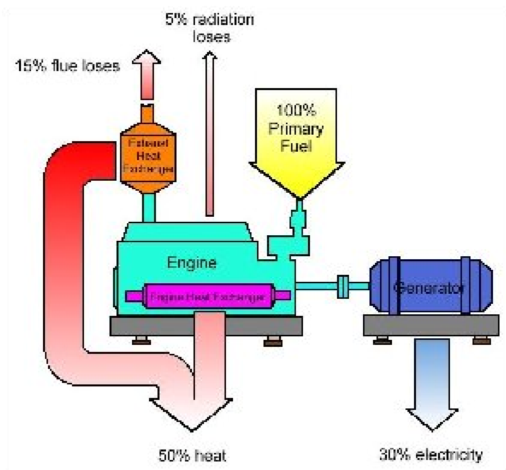
Therefore, connecting to an existing DE network is not a feasible solution for this development.

5.2. Combined Heat and Power (CHP)

CHP Description

Combined Heat and Power, or CHP as it is more commonly referred to, is the simultaneous generation of usable heat and power in a single process. In other words, it utilises the heat produced in electricity generation rather than releasing it wastefully into the atmosphere. In typical conventional power generation, much of the total energy input is wasted. CHP systems, where the heat produced in electricity generation is put to good use, can reach efficiencies up to 85%. A CHP can provide a secure and highly efficient method of generating electricity and heat at the point of use. Due to utilisation of heat from electricity generation and the avoidance of transmission losses because electricity is generated on site, CHP achieves a significant reduction in primary energy usage compared with power stations and heat only boilers. Typically a good CHP scheme can deliver an increase of around 20% in efficiency against the separate energy system it replaces and can result in savings of up to 50% of the annual CO_2 emissions from the site.

Bio-fuel CHP unit



Typical CHP process

Feasibility

For a CHP to be practical for a development there should be a steady demand for hot water and electricity. A CHP should be designed to cope with 100% of the heat base load of a building (i.e. a load that is continuous and steady all year round), with boilers to supply the peaks in demand during the colder months of the year. The only demand for heat that remains constant year round is domestic hot water.

The proposed development will comprise of residential units, which will have a constant demand for domestic hot water. In order for a CHP to be economically and technically viable there needs to be a significant number of dwellings to cover the capital costs, provide enough heat demand to justify the provision of a CHP, and allow for a plant room large enough required to house the CHP and centralised boiler system.

The proposed refurbishment of an existing building has a limited amount of central plant space. The provision of a central CHP and boiler system would require a large basement plantroom and flue risers to the roof.

The decarbonisation of the UK electrical grid will also reduce the benefits of carbon reduction of a gas fired CHP plant, whilst still coming at a premium in installation cost and plant space.

A CHP to provide the base load for the entire development is therefore not practical for this development.

The tables below shows the savings on regulated carbon emissions after the 'Be Clean' stage of the energy hierarchy for the new build element of the development.

	Regulated domestic carbon dioxide savings	
	(Tonnes of CO_2 per annum)	**(%)**
Savings from energy demand reduction	42.56	49.9%
Savings from heat network / CHP	0.00	0.0%

Table 6 Carbon emissions after the Be Clean Stage

6. Low & Zero Carbon Technologies Feasibility Study - Be Green

The definition of 'renewable energy' used in the National Planning Policy Framework is:

> *"those energy flows that occur naturally and repeatedly in the environment – from the wind, the fall of water, the movement of the oceans, from the sun and also from biomass and deep geothermal heat. Low carbon technologies are those that can help reduce emissions (compared to conventional use of fossil fuels)."*

This definition has been widened by the UK Government by the use of the term 'Low or Zero Carbon Energy Technologies" (LZCs) within the revised ADL documents. The carbon emissions reduction from applying these technologies when compared to the conventional technologies has also been accepted as 'renewable energy' under the GLA methodology.

In the following pages, the technical viability, indicative costs, and contribution towards the carbon emissions reduction are considered for the following systems:

1. Wind Turbines;
2. Ground Sourced Heating;
3. Air Sourced Heat Pumps;
4. Solar Photovoltaic (PV) panels; and
5. Solar Water Heating Systems.

6.1. Wind Turbines

System Description

Wind turbines are modern, high-technology descendants of the old technology windmills that have been around for centuries. The difference is that now the kinetic energy of the wind is used to turn a turbine to generate electricity as opposed to moving water or turning a grist mill wheel. There are two types of wind turbine, one being the horizontal-axis variety which faces up-stream or downstream of the wind and where the rotational movement of the blade is connected to a generator to create electricity. The other type is the vertical-axis design, which is the most flexible type of wind turbine and is best suited for the more urban sites as it operates in any wind direction.

Horizontal-axis wind turbine

Vertical Axis Wind Turbine

Technical Viability

One of the big issues with wind turbines is the available wind speed. Apart from the direction, approximately 4.0 m/s wind velocity is required as a minimum before the turbine will begin to generate electricity.

Additionally, if this option were used for this development, the building would need wind turbines installed to the rear garden protruding higher than the buildings roof. Wind turbines in urban centres can generate acoustic complaints from both the occupants and the surrounding commercial / residential units.

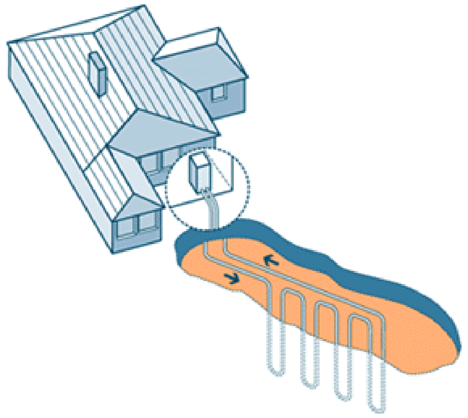
Wind turbines are therefore not recommended for this development.

Wind Turbines	
Land Use	Foundation unless building mounted
Planning Issues	Potentially a problem with gaining planning permission
Noise	Problematic
Tariffs	FiT 8.46 (4.91 for export) pence/kWh

6.2. Ground Source Heat Pump

System Description

Ground source heat pumps take advantage of the stable ground temperatures of 10-12ºC to provide energy efficient heating and cooling to a building. The energy flow is driven by the temperature difference between the ground and the circulating fluid which can be used to reject heat into the ground and deliver heating or cooling to the building.



System Schematic

Horizontal Pipe

Vertical Pipe Drilling Rig

Technical Viability

Proposals to install a Closed Loop Ground Source Heat Pump and/or a direct borehole system to satisfy a large percentage of the heating demand for the building could be a cost-effective option. This system also offers the option of providing "free-cooling" to its occupants via the use of the constant 12°C deep-earth temperature.

This technology can benefit from the Renewable Heat Incentive.

The development consists of refurbishing an existing building and therefore there are limited locations for the installation of a GSHP outside the building footprint. There is a garden to the rear of the property which could hold a number of boreholes.

An initial estimate of the peak capacity for a GSHP system has been carried out, and the peak capacity required for the proposed development is 145kW. A system of this size would require approximately 24 boreholes at 8-10 meter centres. An indicative layout for the available space in the rear garden shows that an array of approximately 15 (5x3) boreholes could be installed in the available space (taken into consideration root protection zones, etc), short of the 24 boreholes required.

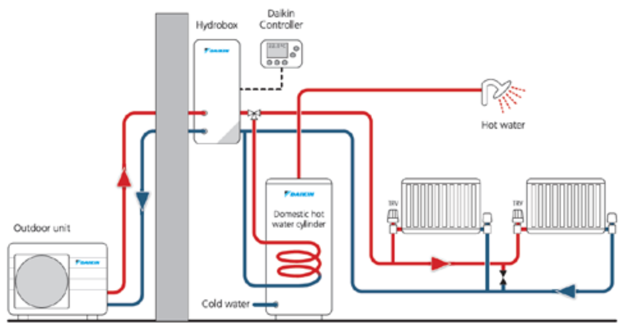
A GSHP system is therefore not a viable solution for the proposed development.

Ground Source Heat Pumps	
Land Use	Below ground, minimal impact on future use of land
Planning Issues	Minimal
Noise	Minimal noise in plant room
Tariffs	Renewable Heat Incentive 8.95/2.67 pence/kWh

6.3. Air Source Heat Pumps

System Description

Air source heat pumps use the atmosphere as a renewable source of heat to generate heating and cooling with a refrigeration machine. The heating and cooling is accomplished by moving refrigerant through the heat pump's various indoor and outdoor coils and components. A compressor, condenser, expansion valve and evaporator are used to change states of the refrigerant from liquid to hot gas and then back from gas to liquid. The refrigerant is used to heat or cool coils in a fan coil unit located in the conditioned space. An external heat exchanger is used to heat or cool the refrigerant by absorbing heat from or rejecting heat to the outside air. This use of outside air is considered renewable, and has lead to the term "Air Source" Heat Pump.



Integrated Heating, Cooling, and DHW ASHP Configuration

Combined 4-Pipe Heat Pump Unit

Technical Viability

The COPs achievable with modern ASHPs means that these units will produce about 80% of its energy output from the air, a renewable and clean energy source.

Air sourced heating could provide a large proportion of the development's annual energy demand without a large roof space requirement for mounting equipment. Heat rejection units can be located on the roof, however an internal basement plantroom holding buffer tanks, pressurisation units, and pumps would be required.

Internal central plant space in this refurbishment is limited, and any rooftop mounted equipment would exceed the proposed roof level and have be visible from neighbouring properties.

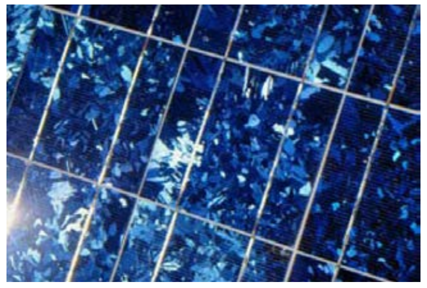
Air source heat pumps is therefore not a viable option for the Proposed Development.

Air Source Heat Pumps	
Land Use	Requires external plant area
Planning Issues	Potential issue if located in visible position.
Noise	Noise issues will be evident
Tariffs	Renewable Heat Incentive 2.57 pence/kWh

6.4. Solar Photovoltaic Panels

System Description

Solar photovoltaics (PVs) convert energy from daylight into electricity using a semiconductor material such as silicon. When light hits the semiconductor, the energy in the light is absorbed, 'exciting' the electrons in the semiconductor so that they break free from their atoms. This allows the electrons to flow through the semiconductor material producing electricity.


Rooftop Installation PV Cells Solar Glass

Technical Viability

Solar PV panels are best mounted at an incline with a southerly orientation, although orientations between south-east and south-west are viable.

This technology can benefit from the Feed in Tariff.

The development's south roof has been identified as a potential location for photovoltaic panels. The roof will be south facing and will not be shaded by any existing or proposed developments near or around the site.

Photovoltaics are therefore a viable solution for the Proposed Development.

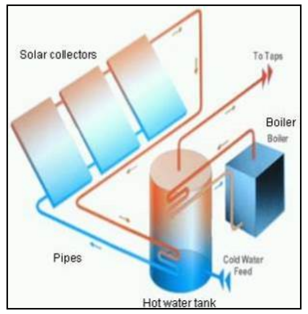
Photovoltaics	
Land Use	No land use (roof mounted)
Planning Issues	Potential issue if located in visible position. Can be located in discrete position.
Noise	None
Tariffs	FiT 2.38 (4.91 for export) pence/kWh

6.5. Solar Water Heating

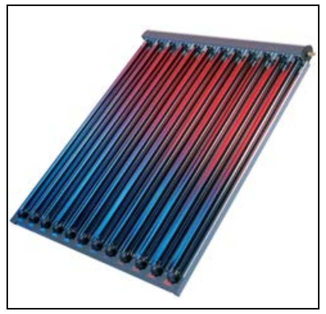
System Description

Solar Water Heating systems convert solar radiation to heat carried by water for use in space heating or the provision of domestic hot water. Solar water heating systems normally operate with a back-up source of heat, such as gas condensing boilers. The solar water heating pre-heats the incoming water, which is topped-up by the back-up heat source when there is insufficient solar energy to reach the target water temperature.

Solar collectors are best mounted at an incline with a southerly orientation, although orientations between south-east and south-west are acceptable. As solar radiation is greatest in the summer when demand is lowest, it is not possible to meet the entire annual demand by increasing the size of the system. It is therefore recommended that a solar hot water system meet no more than 75% of the domestic hot water demand.



System Diagram



Evacuated Tube Collector

Glazed Flat Panel Collector

Technical Viability

In order for a solar panel to perform efficiently, it should be positioned between a 15 and 60 degree incline. As solar radiation is greatest in the summer when demand is lowest, it is not efficient to try to meet the entire annual demand by increasing the size of the system. It is therefore recommended that a solar water heating system meet no more than 65% of the domestic hot water demand.

This technology can benefit from the Renewable Heat Incentive.

Solar hot water systems are more cost efficient on individual dwellings, and the roof of an apartment block would be better suited with photovoltaics. The distances from the roof to individual dwellings would result in losses reducing the efficiency of this system, and the pipe runs from the roof panels to each apartment would require riser space which is also very limited in this existing development.

Therefore the installation of Solar Thermal panels is not a viable solution.

Solar Hot Water	
Land Use	No land use
Planning Issues	Potential issue if visible. Can be located in discrete location
Noise	None
Tariffs	Renewable Heat Incentive 10.28 pence/kWh

6.6. Recommended Solution

DSA therefore recommends the following renewable energy strategy for the proposed development at 36 Fitzjohn's Avenue.

Photovoltaic Panels

A photovoltaic panel array of approximately 18.72kWp capacity will also be installed on the south roof of the development to further reduce the annual carbon emissions.

The figure below indicates that there is sufficient space for a photovoltaic array of 52 panels. These can be installed at a tilt of 10% to ensure they are not visually intrusive from neighbouring sites.

The table below is a feasibility calculation indicating the expected CO2 savings from the proposed photovoltaic panel array.

Photovoltaics		
Number of Panels	52	
Peak Output p/ Panel	0.36	kWp
Total Peak Capacity	18.72	kWp
Area of Panels	104	m^2
Predicted Solar Radiation	1,000	$kWh/m^2/year$
Efficiency of Panels	18.8%	
System Losses	20%	
Tilt of Panels	10%	
Carbon Factor for Electricity	0.519	$kgCO_2/kWh$
Annual Electricity Generated	15,642	kWh
Annual Carbon Savings	8.12	$tonnesCO_2$

Table 7 Feasibility Calculations for Photovoltaic Panels

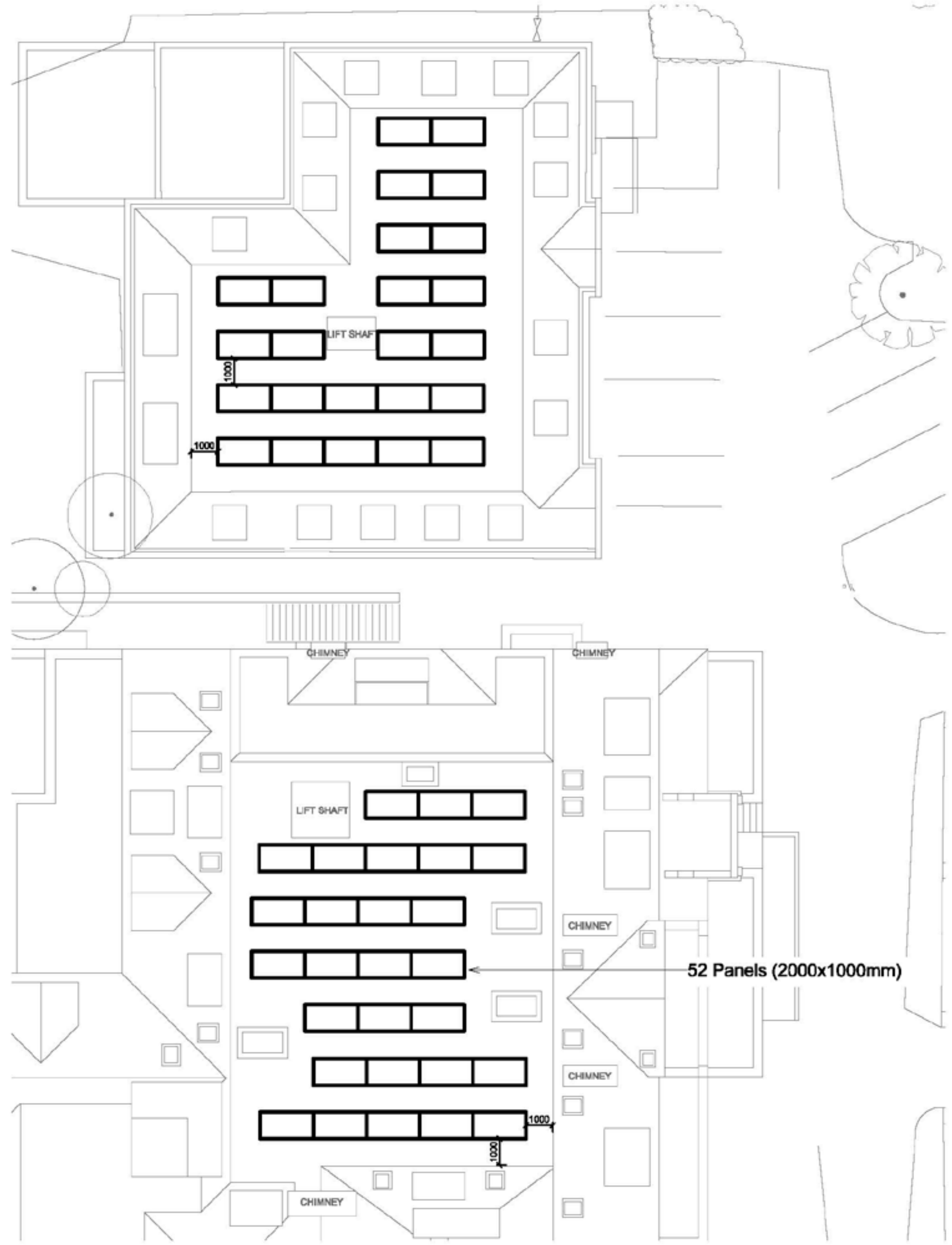


Figure 4 Roof layout showing proposed PV panels on the Roof (south facing)

The table below shows the savings on regulated carbon emissions after the 'Be Green' stage of the energy hierarchy for the new build elements.

	Regulated domestic carbon dioxide savings	
	(Tonnes of CO_2 per annum)	**(%)**
Savings from energy demand reduction	42.56	49.9%
Savings from heat network / CHP	0.00	0.0%
Savings from renewable energy	6.31	7.4%

Table 8 Carbon emissions after the Be Green Stage

The carbon savings (6.31 Tonnes of CO_2) for the BE GREEN stage of the Energy Hierarchy, can be attributed to the installation of photovoltaic panels.

7. Water Efficiency Measures

Water Efficiency

Low flow and flush sanitaryware will be installed throughout to reduce the need for potable water inside the apartments. The target of 105 l/person/day has been achieved (refer to Appendix 6 for water consumption calculations).

Rainwater Harvesting

A simple rainwater harvesting system will be installed to reduce the potable water required for the irrigation of the communal gardens. A number of different options have been investigated ranging from simple water butts to a centralised communal pumped system.

The localised water butt system would be gravity fed by individual downpipes located throughout the gardens to ensure adequate coverage.

Alternatively a centralised communal system would collect all rainwater from roof areas, and store this in an underground buried tank in the garden. This would then be pumped and used to feed a number of taps located throughout the gardens to serve for irrigation only.

Further development of the design will determine which system is the most appropriate option for the proposed development.

Figure 5 Examples of rainwater harvesting systems central vs localised.

8. Conclusion

In order for the development to achieve minimum requirements of energy carbon reductions in line with planning policies and to comply with minimum energy requirements for BREEAM the proposed development must demonstrate a carbon reduction.

In order to maximise carbon reductions, the design team has followed the "Be Lean, Be Clean, Be Green" energy hierarchy as advised by the London Plan. This included reducing the buildings energy demand through energy efficient techniques, exploring the possibility of using decentralised energy systems, and including renewable energy technologies on site.

The results of this study recommend the installation of a photovoltaic panel array with an installed capacity of 18.72 kWp.

This will result in the following carbon emissions following the Be Lean, Be Clean, Be Green energy hierarchy for both regulated and unregulated use. The table below shows the carbon emissions for the development after each stage of the energy hierarchy.

	Carbon dioxide emissions for domestic buildings (Tonnes of CO2 per annum)	
	Regulated	**Unregulated**
Baseline: Existing Building	85.25	107.00
After energy demand reduction	42.68	107.00
After heat network / CHP	42.68	107.00
After renewable energy	36.37	107.00

Table 9 Carbon Dioxide Emissions after each stage of the Energy Hierarchy

The table below shows the different savings at each stage of the energy hierarchy for the development.

	Regulated domestic carbon dioxide savings	
	(Tonnes of CO_2 per annum)	**(%)**
Savings from energy demand reduction	42.56	49.9%
Savings from heat network / CHP	0.00	0.0%
Savings from renewable energy	6.31	7.4%
Cumulative on site savings	**48.88**	**57.33%**

Table 10 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

Through energy efficiency techniques as well as the implementation of renewable technologies as mentioned above, the proposed development will reduce annual carbon emissions by 48.88 tons of CO_2. This account for a reduction of approximately 57.33% of the existing buildings expected regulated energy carbon emissions.

Although the development will provide a 7.4% reduction of carbon emissions from the installation of photovoltaic panels, due to specific restrictions on feasibility of installing renewable technologies and limited roof space, the proposed development will fall short of the expected 20% carbon reduction by renewable energy's expected by Camden.

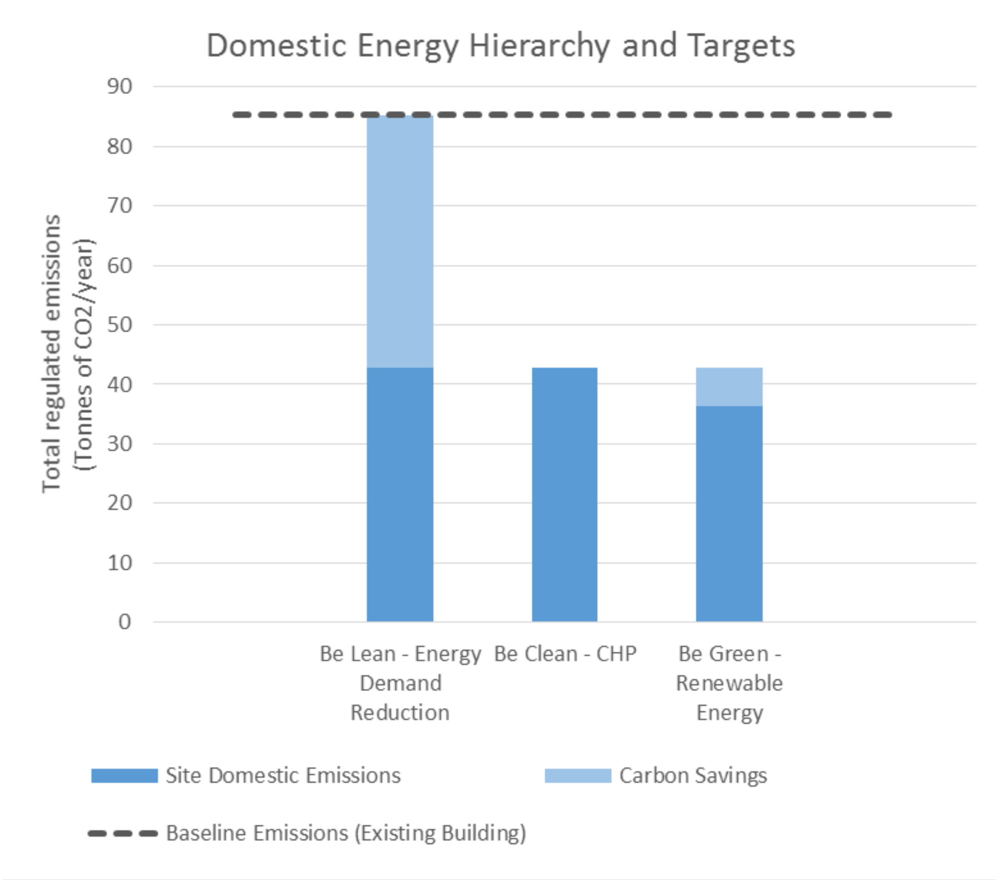


Figure 6 The Domestic Energy Hierarchy

9. Appendix

9.1. Appendix 1 – Baseline SAP Worksheets

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.18

Property Address: LG01

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	132	(1a)	x	3.2	(2a)	=	422.4	(3a)
Ground floor	132	(1b)	x	3.2	(2b)	=	422.4	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	264	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	844.8	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)		2	(9)
Additional infiltration	[(9)-1]x0.1 =	0.1	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.55	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.55	(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

SAP WorkSheet: Existing dwelling (SAP)

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.6	0.58	0.57	0.51	0.5	0.44	0.44	0.43	0.47	0.5	0.53	0.55

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

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

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

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

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

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

(24c)m=	0.85	0.83	0.82	0.76	0.75	0.69	0.69	0.68	0.72	0.75	0.78	0.8	(24c)

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

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

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

(25)m=	0.85	0.83	0.82	0.76	0.75	0.69	0.69	0.68	0.72	0.75	0.78	0.8	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			4.75	x1/[1/(2.8)+ 0.04]		=	11.96			(27)
Windows Type 2			2	x1/[1/(2.8)+ 0.04]		=	5.04			(27)
Windows Type 3			4.75	x1/[1/(2.8)+ 0.04]		=	11.96			(27)
Windows Type 4			2	x1/[1/(2.8)+ 0.04]		=	5.04			(27)
Windows Type 5			2	x1/[1/(2.8)+ 0.04]		=	5.04			(27)
Windows Type 6			2	x1/[1/(2.8)+ 0.04]		=	5.04			(27)
Floor			132	x	1.2	=	158.4			(28)
Walls Type1	32	16.25	15.75	x	1.7	=	26.78			(29)
Walls Type2	40	4	36	x	1.7	=	61.2			(29)
Walls Type3	32	16.25	15.75	x	1.7	=	26.78			(29)
Walls Type4	22	0	22	x	1.7	=	37.4			(29)
Walls Type5	18	4	14	x	1.7	=	23.8			(29)
Total area of elements, m²			276							(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) =	436.33	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	34185	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 41.4 (36)

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

Total fabric heat loss (33) + (36) = 477.73 (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=	235.87	232.61	229.35	213.06	209.8	193.51	193.51	190.25	200.03	209.8	216.32	222.84	(38)

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

(39)m=	713.6	710.34	707.08	690.79	687.53	671.24	671.24	667.98	677.76	687.53	694.05	700.56	

Average = Sum(39)1…12 /12= 689.97 (39)

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

(40)m=	2.7	2.69	2.68	2.62	2.6	2.54	2.54	2.53	2.57	2.6	2.63	2.65

Average = Sum(40)1…12 /12= 2.61 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 3.09 (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 — 107.47 (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=	118.22	113.92	109.62	105.32	101.02	96.72	96.72	101.02	105.32	109.62	113.92	118.22

Total = Sum(44)1…12 = 1289.66 (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=	175.32	153.33	158.22	137.94	132.36	114.22	105.84	121.45	122.9	143.23	156.35	169.78

Total = Sum(45)1…12 = 1690.95 (45)

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

(46)m=	26.3	23	23.73	20.69	19.85	17.13	15.88	18.22	18.44	21.48	23.45	25.47	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 300 (47)

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): — 1.69 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	226.87	199.9	209.78	187.83	183.91	164.11	157.39	173	172.79	194.78	206.24	221.34	(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=	226.87	199.9	209.78	187.83	183.91	164.11	157.39	173	172.79	194.78	206.24	221.34

Output from water heater (annual)$_{1...12}$ 2297.95 (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=	99.53	88.23	93.85	85.78	85.25	77.89	76.43	81.63	80.78	88.87	91.9	97.7	(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=	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	(66)

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

(67)m=	141.8	125.95	102.43	77.55	57.97	48.94	52.88	68.73	92.25	117.14	136.72	145.75	(67)

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

(68)m=	639.42	646.06	629.34	593.74	548.81	506.58	478.36	471.73	488.45	524.05	568.98	611.21	(68)

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

(69)m=	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	(71)

Water heating gains (Table 5)

(72)m=	133.78	131.3	126.15	119.14	114.59	108.18	102.73	109.71	112.19	119.44	127.64	131.31	(72)

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

(73)m=	1036.31	1024.61	979.21	911.72	842.66	784.99	755.27	771.47	814.19	881.93	954.63	1009.56	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	2	x	10.63	x	0.76	x	0.7	=	20.37	(74)
North	0.9x	1	x	2	x	10.63	x	0.76	x	0.7	=	20.37	(74)
North	0.9x	1	x	2	x	20.32	x	0.76	x	0.7	=	38.92	(74)
North	0.9x	1	x	2	x	20.32	x	0.76	x	0.7	=	38.92	(74)
North	0.9x	1	x	2	x	34.53	x	0.76	x	0.7	=	66.13	(74)
North	0.9x	1	x	2	x	34.53	x	0.76	x	0.7	=	66.13	(74)
North	0.9x	1	x	2	x	55.46	x	0.76	x	0.7	=	106.23	(74)
North	0.9x	1	x	2	x	55.46	x	0.76	x	0.7	=	106.23	(74)
North	0.9x	1	x	2	x	74.72	x	0.76	x	0.7	=	143.1	(74)
North	0.9x	1	x	2	x	74.72	x	0.76	x	0.7	=	143.1	(74)
North	0.9x	1	x	2	x	79.99	x	0.76	x	0.7	=	153.19	(74)
North	0.9x	1	x	2	x	79.99	x	0.76	x	0.7	=	153.19	(74)
North	0.9x	1	x	2	x	74.68	x	0.76	x	0.7	=	143.02	(74)
North	0.9x	1	x	2	x	74.68	x	0.76	x	0.7	=	143.02	(74)
North	0.9x	1	x	2	x	59.25	x	0.76	x	0.7	=	113.47	(74)
North	0.9x	1	x	2	x	59.25	x	0.76	x	0.7	=	113.47	(74)
North	0.9x	1	x	2	x	41.52	x	0.76	x	0.7	=	79.51	(74)
North	0.9x	1	x	2	x	41.52	x	0.76	x	0.7	=	79.51	(74)
North	0.9x	1	x	2	x	24.19	x	0.76	x	0.7	=	46.33	(74)
North	0.9x	1	x	2	x	24.19	x	0.76	x	0.7	=	46.33	(74)
North	0.9x	1	x	2	x	13.12	x	0.76	x	0.7	=	25.12	(74)
North	0.9x	1	x	2	x	13.12	x	0.76	x	0.7	=	25.12	(74)
North	0.9x	1	x	2	x	8.86	x	0.76	x	0.7	=	16.98	(74)
North	0.9x	1	x	2	x	8.86	x	0.76	x	0.7	=	16.98	(74)
West	0.9x	1	x	4.75	x	19.64	x	0.76	x	0.7	=	134	(80)
West	0.9x	1	x	2	x	19.64	x	0.76	x	0.7	=	18.81	(80)
West	0.9x	1	x	4.75	x	19.64	x	0.76	x	0.7	=	134	(80)
West	0.9x	1	x	2	x	19.64	x	0.76	x	0.7	=	18.81	(80)
West	0.9x	1	x	4.75	x	38.42	x	0.76	x	0.7	=	262.14	(80)
West	0.9x	1	x	2	x	38.42	x	0.76	x	0.7	=	36.79	(80)
West	0.9x	1	x	4.75	x	38.42	x	0.76	x	0.7	=	262.14	(80)
West	0.9x	1	x	2	x	38.42	x	0.76	x	0.7	=	36.79	(80)
West	0.9x	1	x	4.75	x	63.27	x	0.76	x	0.7	=	431.71	(80)
West	0.9x	1	x	2	x	63.27	x	0.76	x	0.7	=	60.59	(80)
West	0.9x	1	x	4.75	x	63.27	x	0.76	x	0.7	=	431.71	(80)
West	0.9x	1	x	2	x	63.27	x	0.76	x	0.7	=	60.59	(80)
West	0.9x	1	x	4.75	x	92.28	x	0.76	x	0.7	=	629.62	(80)
West	0.9x	1	x	2	x	92.28	x	0.76	x	0.7	=	88.37	(80)
West	0.9x	1	x	4.75	x	92.28	x	0.76	x	0.7	=	629.62	(80)

West	0.9x	1	x	2	x	92.28	x	0.76	x	0.7	=	88.37	(80)
West	0.9x	1	x	4.75	x	113.09	x	0.76	x	0.7	=	771.62	(80)
West	0.9x	1	x	2	x	113.09	x	0.76	x	0.7	=	108.3	(80)
West	0.9x	1	x	4.75	x	113.09	x	0.76	x	0.7	=	771.62	(80)
West	0.9x	1	x	2	x	113.09	x	0.76	x	0.7	=	108.3	(80)
West	0.9x	1	x	4.75	x	115.77	x	0.76	x	0.7	=	789.89	(80)
West	0.9x	1	x	2	x	115.77	x	0.76	x	0.7	=	110.86	(80)
West	0.9x	1	x	4.75	x	115.77	x	0.76	x	0.7	=	789.89	(80)
West	0.9x	1	x	2	x	115.77	x	0.76	x	0.7	=	110.86	(80)
West	0.9x	1	x	4.75	x	110.22	x	0.76	x	0.7	=	752.01	(80)
West	0.9x	1	x	2	x	110.22	x	0.76	x	0.7	=	105.55	(80)
West	0.9x	1	x	4.75	x	110.22	x	0.76	x	0.7	=	752.01	(80)
West	0.9x	1	x	2	x	110.22	x	0.76	x	0.7	=	105.55	(80)
West	0.9x	1	x	4.75	x	94.68	x	0.76	x	0.7	=	645.96	(80)
West	0.9x	1	x	2	x	94.68	x	0.76	x	0.7	=	90.66	(80)
West	0.9x	1	x	4.75	x	94.68	x	0.76	x	0.7	=	645.96	(80)
West	0.9x	1	x	2	x	94.68	x	0.76	x	0.7	=	90.66	(80)
West	0.9x	1	x	4.75	x	73.59	x	0.76	x	0.7	=	502.09	(80)
West	0.9x	1	x	2	x	73.59	x	0.76	x	0.7	=	70.47	(80)
West	0.9x	1	x	4.75	x	73.59	x	0.76	x	0.7	=	502.09	(80)
West	0.9x	1	x	2	x	73.59	x	0.76	x	0.7	=	70.47	(80)
West	0.9x	1	x	4.75	x	45.59	x	0.76	x	0.7	=	311.05	(80)
West	0.9x	1	x	2	x	45.59	x	0.76	x	0.7	=	43.66	(80)
West	0.9x	1	x	4.75	x	45.59	x	0.76	x	0.7	=	311.05	(80)
West	0.9x	1	x	2	x	45.59	x	0.76	x	0.7	=	43.66	(80)
West	0.9x	1	x	4.75	x	24.49	x	0.76	x	0.7	=	167.09	(80)
West	0.9x	1	x	2	x	24.49	x	0.76	x	0.7	=	23.45	(80)
West	0.9x	1	x	4.75	x	24.49	x	0.76	x	0.7	=	167.09	(80)
West	0.9x	1	x	2	x	24.49	x	0.76	x	0.7	=	23.45	(80)
West	0.9x	1	x	4.75	x	16.15	x	0.76	x	0.7	=	110.2	(80)
West	0.9x	1	x	2	x	16.15	x	0.76	x	0.7	=	15.47	(80)
West	0.9x	1	x	4.75	x	16.15	x	0.76	x	0.7	=	110.2	(80)
West	0.9x	1	x	2	x	16.15	x	0.76	x	0.7	=	15.47	(80)

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

(83)m=	346.35	675.7	1116.86	1648.42	2046.03	2107.88	2001.15	1700.19	1304.15	802.07	431.32	285.28	(83)

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

(84)m=	1382.66	1700.31	2096.07	2560.14	2888.69	2892.87	2756.42	2471.66	2118.34	1683.99	1385.95	1294.85	(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

SAP WorkSheet: Existing dwelling (SAP)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.98	0.97	0.94	0.9	0.84	0.75	0.66	0.7	0.84	0.93	0.97	0.98		(86)

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

(87)m=	16.45	16.77	17.42	18.34	19.25	20.05	20.48	20.4	19.71	18.54	17.36	16.42		(87)

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

(88)m=	18.91	18.91	18.92	18.95	18.96	19	19	19	18.98	18.96	18.95	18.93		(88)

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

(89)m=	0.97	0.96	0.93	0.88	0.79	0.64	0.46	0.52	0.76	0.91	0.96	0.97		(89)

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

(90)m=	13.38	13.82	14.73	16.02	17.26	18.29	18.78	18.71	17.91	16.32	14.66	13.34		(90)

fLA = Living area ÷ (4) = 0.5 (91)

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

(92)m=	14.91	15.3	16.07	17.18	18.25	19.17	19.63	19.55	18.81	17.43	16.01	14.88		(92)

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

(93)m=	14.91	15.3	16.07	17.18	18.25	19.17	19.63	19.55	18.81	17.43	16.01	14.88		(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.95	0.93	0.9	0.84	0.76	0.65	0.54	0.58	0.75	0.88	0.94	0.96		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	1317.64	1588.51	1888.01	2155.95	2196.84	1885.96	1474.96	1439.94	1595.14	1484.81	1300.39	1239.88		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	7574.38	7386.29	6769.78	5720.03	4505.43	3067.82	2034.7	2107.12	3192.18	4695.32	6183.13	7482.3		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	4655.01	3896.11	3632.04	2566.13	1717.59	0	0	0	0	2388.63	3515.57	4644.36		
												Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ =	27015.45	(98)
Space heating requirement in kWh/m²/year													102.33	(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		71	(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)														
	4655.01	3896.11	3632.04	2566.13	1717.59	0	0	0	0	2388.63	3515.57	4644.36		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	6556.36	5487.47	5115.55	3614.27	2419.14	0	0	0	0	3364.26	4951.51	6541.35		
												Total (kWh/year) =$Sum(211)_{1...5,10...12}$=	38049.93	(211)

SAP WorkSheet: Existing dwelling (SAP)

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)

	226.87	199.9	209.78	187.83	183.91	164.11	157.39	173	172.79	194.78	206.24	221.34		
Efficiency of water heater													60.3	(216)
(217)m=	70.42	70.39	70.32	70.15	69.8	60.3	60.3	60.3	60.3	70.06	70.31	70.43		(217)

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

(219)m=	322.17	283.98	298.32	267.76	263.48	272.15	261.02	286.91	286.55	278.01	293.33	314.26		
								Total = Sum(219a)$_{1...12}$ =					3427.94	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			38049.93	
Water heating fuel used			3427.94	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		297.54		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		327.54	(231)
Electricity for lighting			1001.72	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	1324.14	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	119.29	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	43.2	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	132.13	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	1738.76	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	2.36	(257)
SAP rating (Section 12)		67.03	(258)

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

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SAP WorkSheet: Existing dwelling (SAP)

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	8218.78	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	740.44	(264)
Space and water heating	(261) + (262) + (263) + (264) =				8959.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	169.99	(267)
Electricity for lighting	(232) x		0.519	=	519.89	(268)
Total CO2, kg/year		sum of (265)…(271) =			9649.11	(272)
CO2 emissions per m²		(272) ÷ (4) =			36.55	(273)
EI rating (section 14)					58	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		1.22	=	46420.91	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		1.22	=	4182.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =				50603	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	1005.55	(267)
Electricity for lighting	(232) x		0	=	3075.28	(268)
'Total Primary Energy		sum of (265)…(271) =			54683.83	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			207.14	(273)

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.18

Property Address: LG04

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77	(1a) x	3.2	(2a) =	246.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	246.4	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(21)

Infiltration rate modified for monthly wind speed

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

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

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

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

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

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

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

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

(24c)m=	0.74	0.73	0.72	0.67	0.66	0.61	0.61	0.6	0.63	0.66	0.68	0.7	(24c)

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

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

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

(25)m=	0.74	0.73	0.72	0.67	0.66	0.61	0.61	0.6	0.63	0.66	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	
Windows Type 1			1.3	x1/[1/(2.8)+ 0.04]		=	3.27			(27)
Windows Type 2			1.3	x1/[1/(2.8)+ 0.04]		=	3.27			(27)
Windows Type 3			1.3	x1/[1/(2.8)+ 0.04]		=	3.27			(27)
Windows Type 4			2.25	x1/[1/(2.8)+ 0.04]		=	5.67			(27)
Windows Type 5			2.25	x1/[1/(2.8)+ 0.04]		=	5.67			(27)
Windows Type 6			2.25	x1/[1/(2.8)+ 0.04]		=	5.67			(27)
Walls Type1	16.64	7.1	9.54	x	1.7	=	16.22			(29)
Walls Type2	19	4.85	14.15	x	1.7	=	24.06			(29)
Walls Type3	5.5	1.3	4.2	x	1.7	=	7.14			(29)
Walls Type4	15	2.25	12.75	x	1.7	=	21.68			(29)
Total area of elements, m²			56.14							(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) = 108.12 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7721.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.42 (36)

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

Total fabric heat loss (33) + (36) = 116.54 (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=	59.98	59.21	58.43	54.54	53.76	49.87	49.87	49.1	51.43	53.76	55.32	56.87	(38)

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

(39)m=	176.52	175.74	174.97	171.08	170.3	166.41	166.41	165.63	167.97	170.3	171.86	173.41	

Average = Sum(39)$_{1…12}$ /12= 170.88 (39)

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

(40)m=	2.29	2.28	2.27	2.22	2.21	2.16	2.16	2.15	2.18	2.21	2.23	2.25

Average = Sum(40)$_{1…12}$ /12= 2.22 (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 — 2.4 (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 — 91.28 (43)

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

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	100.41	96.76	93.11	89.46	85.81	82.15	82.15	85.81	89.46	93.11	96.76	100.41	

Total = Sum(44)$_{1…12}$ = 1095.39 (44)

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

(45)m=	148.91	130.23	134.39	117.16	112.42	97.01	89.9	103.16	104.39	121.65	132.8	144.21

Total = Sum(45)$_{1…12}$ = 1436.23 (45)

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

(46)m=	22.34	19.54	20.16	17.57	16.86	14.55	13.48	15.47	15.66	18.25	19.92	21.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 300 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.69 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	200.46	176.8	185.94	167.05	163.98	146.9	141.45	154.71	154.28	173.21	182.69	195.76	(62)

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

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

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

Output from water heater

(64)m=	200.46	176.8	185.94	167.05	163.98	146.9	141.45	154.71	154.28	173.21	182.69	195.76

Output from water heater (annual)$_{1…12}$ | 2043.22 | (64)

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

(65)m=	90.75	80.55	85.93	78.87	78.62	72.17	71.13	75.54	74.62	81.69	84.07	89.19	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	(66)

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

(67)m=	69.33	61.58	50.08	37.91	28.34	23.93	25.85	33.6	45.1	57.27	66.84	71.26	(67)

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

(68)m=	317.99	321.29	312.98	295.28	272.93	251.93	237.9	234.6	242.91	260.62	282.96	303.96	(68)

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

(69)m=	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	(71)

Water heating gains (Table 5)

(72)m=	121.98	119.87	115.49	109.54	105.68	100.23	95.61	101.53	103.64	109.8	116.76	119.88	(72)

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

(73)m=	612.2	605.64	581.44	545.62	509.84	478.98	462.25	472.63	494.55	530.58	569.46	597.99	(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)

SAP WorkSheet: Existing dwelling (SAP)

East	0.9x	1	x	1.3	x	19.64	x	0.76	x	0.7	=	24.45	(76)
East	0.9x	1	x	1.3	x	19.64	x	0.76	x	0.7	=	24.45	(76)
East	0.9x	1	x	2.25	x	19.64	x	0.76	x	0.7	=	42.32	(76)
East	0.9x	1	x	2.25	x	19.64	x	0.76	x	0.7	=	21.16	(76)
East	0.9x	1	x	1.3	x	38.42	x	0.76	x	0.7	=	47.83	(76)
East	0.9x	1	x	1.3	x	38.42	x	0.76	x	0.7	=	47.83	(76)
East	0.9x	1	x	2.25	x	38.42	x	0.76	x	0.7	=	82.78	(76)
East	0.9x	1	x	2.25	x	38.42	x	0.76	x	0.7	=	41.39	(76)
East	0.9x	1	x	1.3	x	63.27	x	0.76	x	0.7	=	78.77	(76)
East	0.9x	1	x	1.3	x	63.27	x	0.76	x	0.7	=	78.77	(76)
East	0.9x	1	x	2.25	x	63.27	x	0.76	x	0.7	=	136.33	(76)
East	0.9x	1	x	2.25	x	63.27	x	0.76	x	0.7	=	68.16	(76)
East	0.9x	1	x	1.3	x	92.28	x	0.76	x	0.7	=	114.88	(76)
East	0.9x	1	x	1.3	x	92.28	x	0.76	x	0.7	=	114.88	(76)
East	0.9x	1	x	2.25	x	92.28	x	0.76	x	0.7	=	198.83	(76)
East	0.9x	1	x	2.25	x	92.28	x	0.76	x	0.7	=	99.41	(76)
East	0.9x	1	x	1.3	x	113.09	x	0.76	x	0.7	=	140.79	(76)
East	0.9x	1	x	1.3	x	113.09	x	0.76	x	0.7	=	140.79	(76)
East	0.9x	1	x	2.25	x	113.09	x	0.76	x	0.7	=	243.67	(76)
East	0.9x	1	x	2.25	x	113.09	x	0.76	x	0.7	=	121.83	(76)
East	0.9x	1	x	1.3	x	115.77	x	0.76	x	0.7	=	144.12	(76)
East	0.9x	1	x	1.3	x	115.77	x	0.76	x	0.7	=	144.12	(76)
East	0.9x	1	x	2.25	x	115.77	x	0.76	x	0.7	=	249.44	(76)
East	0.9x	1	x	2.25	x	115.77	x	0.76	x	0.7	=	124.72	(76)
East	0.9x	1	x	1.3	x	110.22	x	0.76	x	0.7	=	137.21	(76)
East	0.9x	1	x	1.3	x	110.22	x	0.76	x	0.7	=	137.21	(76)
East	0.9x	1	x	2.25	x	110.22	x	0.76	x	0.7	=	237.48	(76)
East	0.9x	1	x	2.25	x	110.22	x	0.76	x	0.7	=	118.74	(76)
East	0.9x	1	x	1.3	x	94.68	x	0.76	x	0.7	=	117.86	(76)
East	0.9x	1	x	1.3	x	94.68	x	0.76	x	0.7	=	117.86	(76)
East	0.9x	1	x	2.25	x	94.68	x	0.76	x	0.7	=	203.99	(76)
East	0.9x	1	x	2.25	x	94.68	x	0.76	x	0.7	=	101.99	(76)
East	0.9x	1	x	1.3	x	73.59	x	0.76	x	0.7	=	91.61	(76)
East	0.9x	1	x	1.3	x	73.59	x	0.76	x	0.7	=	91.61	(76)
East	0.9x	1	x	2.25	x	73.59	x	0.76	x	0.7	=	158.56	(76)
East	0.9x	1	x	2.25	x	73.59	x	0.76	x	0.7	=	79.28	(76)
East	0.9x	1	x	1.3	x	45.59	x	0.76	x	0.7	=	56.75	(76)
East	0.9x	1	x	1.3	x	45.59	x	0.76	x	0.7	=	56.75	(76)
East	0.9x	1	x	2.25	x	45.59	x	0.76	x	0.7	=	98.23	(76)
East	0.9x	1	x	2.25	x	45.59	x	0.76	x	0.7	=	49.11	(76)
East	0.9x	1	x	1.3	x	24.49	x	0.76	x	0.7	=	30.49	(76)

East	0.9x	1	x	1.3	x	24.49	x	0.76	x	0.7	=	30.49	(76)
East	0.9x	1	x	2.25	x	24.49	x	0.76	x	0.7	=	52.76	(76)
East	0.9x	1	x	2.25	x	24.49	x	0.76	x	0.7	=	26.38	(76)
East	0.9x	1	x	1.3	x	16.15	x	0.76	x	0.7	=	20.11	(76)
East	0.9x	1	x	1.3	x	16.15	x	0.76	x	0.7	=	20.11	(76)
East	0.9x	1	x	2.25	x	16.15	x	0.76	x	0.7	=	34.8	(76)
East	0.9x	1	x	2.25	x	16.15	x	0.76	x	0.7	=	17.4	(76)
South	0.9x	1	x	1.3	x	46.75	x	0.76	x	0.7	=	29.1	(78)
South	0.9x	1	x	2.25	x	46.75	x	0.76	x	0.7	=	50.37	(78)
South	0.9x	1	x	1.3	x	76.57	x	0.76	x	0.7	=	47.66	(78)
South	0.9x	1	x	2.25	x	76.57	x	0.76	x	0.7	=	82.49	(78)
South	0.9x	1	x	1.3	x	97.53	x	0.76	x	0.7	=	60.71	(78)
South	0.9x	1	x	2.25	x	97.53	x	0.76	x	0.7	=	105.07	(78)
South	0.9x	1	x	1.3	x	110.23	x	0.76	x	0.7	=	68.61	(78)
South	0.9x	1	x	2.25	x	110.23	x	0.76	x	0.7	=	118.76	(78)
South	0.9x	1	x	1.3	x	114.87	x	0.76	x	0.7	=	71.5	(78)
South	0.9x	1	x	2.25	x	114.87	x	0.76	x	0.7	=	123.75	(78)
South	0.9x	1	x	1.3	x	110.55	x	0.76	x	0.7	=	68.81	(78)
South	0.9x	1	x	2.25	x	110.55	x	0.76	x	0.7	=	119.09	(78)
South	0.9x	1	x	1.3	x	108.01	x	0.76	x	0.7	=	67.23	(78)
South	0.9x	1	x	2.25	x	108.01	x	0.76	x	0.7	=	116.36	(78)
South	0.9x	1	x	1.3	x	104.89	x	0.76	x	0.7	=	65.29	(78)
South	0.9x	1	x	2.25	x	104.89	x	0.76	x	0.7	=	113	(78)
South	0.9x	1	x	1.3	x	101.89	x	0.76	x	0.7	=	63.42	(78)
South	0.9x	1	x	2.25	x	101.89	x	0.76	x	0.7	=	109.76	(78)
South	0.9x	1	x	1.3	x	82.59	x	0.76	x	0.7	=	51.4	(78)
South	0.9x	1	x	2.25	x	82.59	x	0.76	x	0.7	=	88.97	(78)
South	0.9x	1	x	1.3	x	55.42	x	0.76	x	0.7	=	34.49	(78)
South	0.9x	1	x	2.25	x	55.42	x	0.76	x	0.7	=	59.7	(78)
South	0.9x	1	x	1.3	x	40.4	x	0.76	x	0.7	=	25.15	(78)
South	0.9x	1	x	2.25	x	40.4	x	0.76	x	0.7	=	43.52	(78)

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

(83)m=	191.84	349.97	527.81	715.37	842.33	850.3	814.22	720	594.23	401.22	234.31	161.08	(83)

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

(84)m=	804.04	955.61	1109.25	1260.99	1352.17	1329.28	1276.48	1192.63	1088.78	931.8	803.77	759.07	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.9	0.86	0.79	0.7	0.58	0.46	0.5	0.67	0.83	0.91	0.93	(86)

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

(87)m=	17.38	17.75	18.38	19.2	19.92	20.49	20.76	20.72	20.27	19.31	18.22	17.33	(87)

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

(88)m=	19.15	19.15	19.16	19.19	19.2	19.23	19.23	19.23	19.22	19.2	19.18	19.17	(88)

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

(89)m=	0.92	0.88	0.83	0.75	0.63	0.47	0.31	0.35	0.57	0.78	0.88	0.92	(89)

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

(90)m=	14.71	15.23	16.1	17.23	18.17	18.86	19.13	19.1	18.63	17.42	15.91	14.65	(90)

fLA = Living area ÷ (4) = 0.39 (91)

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

(92)m=	15.75	16.22	16.99	17.99	18.85	19.5	19.76	19.73	19.27	18.16	16.81	15.7	(92)

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

(93)m=	15.75	16.22	16.99	17.99	18.85	19.5	19.76	19.73	19.27	18.16	16.81	15.7	(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=	0.88	0.84	0.79	0.71	0.61	0.49	0.36	0.4	0.57	0.75	0.84	0.89	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	705.11	804.77	877.07	898.65	829.18	646.07	461.57	472.34	624.91	695.02	678.43	672.5	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2020.87	1988.58	1835.62	1555.9	1217.77	814.88	526.47	551.73	868.66	1287.06	1668.48	1993.61	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	978.93	795.52	713.16	473.22	289.11	0	0	0	0	440.48	712.84	982.91	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 5386.17 (98)

Space heating requirement in kWh/m²/year 69.95 (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		71	(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)													
	978.93	795.52	713.16	473.22	289.11	0	0	0	0	440.48	712.84	982.91	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1378.77	1120.45	1004.45	666.51	407.2	0	0	0	0	620.39	1004	1384.38	

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 7586.16 (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)

SAP WorkSheet: Existing dwelling (SAP)

Water heating

Output from water heater (calculated above)

200.46	176.8	185.94	167.05	163.98	146.9	141.45	154.71	154.28	173.21	182.69	195.76

Efficiency of water heater 60.3 (216)

(217)m=	68.92	68.78	68.49	67.86	66.72	60.3	60.3	60.3	60.3	67.61	68.52	68.97

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	290.85	257.05	271.5	246.18	245.78	243.62	234.58	256.57	255.85	256.17	266.62	283.85

Total = Sum(219a)$_{1...12}$ = 3108.61 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		7586.16	
Water heating fuel used		3108.61	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	76		(230a)
central heating pump:	30		(230c)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		106	(231)
Electricity for lighting		489.75	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	3.48	x 0.01 =	264	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		3.48	x 0.01 =	108.18	(247)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	13.98	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)		13.19	x 0.01 =	64.6	(250)
Additional standing charges (Table 12)					120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 570.76 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.96	(257)
SAP rating (Section 12)		72.59	(258)

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	=	1638.61	(261)

SAP WorkSheet: Existing dwelling (SAP)

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	671.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2310.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	55.02	(267)
Electricity for lighting	(232) x	0.519	=	254.18	(268)
Total CO2, kg/year		sum of (265)…(271) =		2619.26	(272)
CO2 emissions per m²		(272) ÷ (4) =		34.02	(273)
EI rating (section 14)				71	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	9255.11	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3792.51	(264)
Space and water heating	(261) + (262) + (263) + (264) =			13047.62	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	325.43	(267)
Electricity for lighting	(232) x	0	=	1503.52	(268)
‘Total Primary Energy		sum of (265)…(271) =		14876.57	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		193.2	(273)

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.18

Property Address: GF03

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121	(1a) x	3.2	(2a) =	387.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	387.2	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

SAP WorkSheet: Existing dwelling (SAP)

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

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

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

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

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

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

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

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

(24c)m=	0.74	0.73	0.72	0.67	0.66	0.61	0.61	0.6	0.63	0.66	0.68	0.7	(24c)

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

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

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

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

(25)m=	0.74	0.73	0.72	0.67	0.66	0.61	0.61	0.6	0.63	0.66	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	
Windows Type 1			2.7	x1/[1/(2.8)+ 0.04]		=	6.8			(27)
Windows Type 2			1.8	x1/[1/(2.8)+ 0.04]		=	4.53			(27)
Windows Type 3			4.4	x1/[1/(2.8)+ 0.04]		=	11.08			(27)
Windows Type 4			2.16	x1/[1/(2.8)+ 0.04]		=	5.44			(27)
Windows Type 5			5.61	x1/[1/(2.8)+ 0.04]		=	14.13			(27)
Walls Type1	6	0	6	x	1.7	=	10.2			(29)
Walls Type2	14	2.7	11.3	x	1.7	=	19.21			(29)
Walls Type3	40.5	8	32.5	x	1.7	=	55.25			(29)
Walls Type4	22	9.93	12.07	x	1.7	=	20.52			(29)
Total area of elements, m²			82.5							(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) = 157.13 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11755.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 12.38 (36)

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

Total fabric heat loss (33) + (36) = 169.5 (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

SAP WorkSheet: Existing dwelling (SAP)

(38)m=	94.26	93.04	91.82	85.71	84.48	78.37	78.37	77.15	80.82	84.48	86.93	89.37	(38)

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

(39)m=	263.76	262.54	261.32	255.21	253.98	247.87	247.87	246.65	250.32	253.98	256.43	258.87	

Average = $Sum(39)_{1...12}$ /12= 254.9 (39)

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

(40)m=	2.18	2.17	2.16	2.11	2.1	2.05	2.05	2.04	2.07	2.1	2.12	2.14	

Average = $Sum(40)_{1...12}$ /12= 2.11 (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 2.87 (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) + 36 102.29 (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=	112.52	108.43	104.34	100.25	96.16	92.06	92.06	96.16	100.25	104.34	108.43	112.52	

Total = $Sum(44)_{1...12}$ = 1227.52 (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=	166.87	145.94	150.6	131.3	125.98	108.71	100.74	115.6	116.98	136.33	148.81	161.6	

Total = $Sum(45)_{1...12}$ = 1609.48 (45)

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

(46)m=	25.03	21.89	22.59	19.69	18.9	16.31	15.11	17.34	17.55	20.45	22.32	24.24	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	218.42	192.51	202.15	181.19	177.54	158.6	152.29	167.15	166.87	187.88	198.7	213.16	(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=	218.42	192.51	202.15	181.19	177.54	158.6	152.29	167.15	166.87	187.88	198.7	213.16

Output from water heater (annual)$_{1...12}$ | 2216.47 | (64)

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

(65)m=	96.73	85.78	91.32	83.57	83.13	76.06	74.74	79.68	78.81	86.57	89.39	94.98	(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=	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	(66)

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

(67)m=	93.65	83.18	67.64	51.21	38.28	32.32	34.92	45.39	60.92	77.36	90.29	96.25	(67)

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

(68)m=	427.63	432.06	420.88	397.08	367.03	338.78	319.91	315.48	326.66	350.46	380.52	408.76	(68)

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

(69)m=	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	(71)

Water heating gains (Table 5)

(72)m=	130.01	127.65	122.74	116.07	111.74	105.64	100.45	107.1	109.46	116.36	124.16	127.66	(72)

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

(73)m=	766.69	758.3	726.68	679.77	632.45	592.15	570.7	583.38	612.45	659.59	710.37	748.08	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	1	x	2.7	x	46.75	x	0.76	x	0.7	=	60.44	(78)
South	0.9x	1	x	1.8	x	46.75	x	0.76	x	0.7	=	80.59	(78)

South	0.9x	1	x	4.4	x	46.75	x	0.76	x	0.7	=	98.49	(78)
South	0.9x	1	x	2.7	x	76.57	x	0.76	x	0.7	=	98.98	(78)
South	0.9x	1	x	1.8	x	76.57	x	0.76	x	0.7	=	131.98	(78)
South	0.9x	1	x	4.4	x	76.57	x	0.76	x	0.7	=	161.31	(78)
South	0.9x	1	x	2.7	x	97.53	x	0.76	x	0.7	=	126.09	(78)
South	0.9x	1	x	1.8	x	97.53	x	0.76	x	0.7	=	168.12	(78)
South	0.9x	1	x	4.4	x	97.53	x	0.76	x	0.7	=	205.48	(78)
South	0.9x	1	x	2.7	x	110.23	x	0.76	x	0.7	=	142.51	(78)
South	0.9x	1	x	1.8	x	110.23	x	0.76	x	0.7	=	190.01	(78)
South	0.9x	1	x	4.4	x	110.23	x	0.76	x	0.7	=	232.23	(78)
South	0.9x	1	x	2.7	x	114.87	x	0.76	x	0.7	=	148.5	(78)
South	0.9x	1	x	1.8	x	114.87	x	0.76	x	0.7	=	198	(78)
South	0.9x	1	x	4.4	x	114.87	x	0.76	x	0.7	=	242	(78)
South	0.9x	1	x	2.7	x	110.55	x	0.76	x	0.7	=	142.91	(78)
South	0.9x	1	x	1.8	x	110.55	x	0.76	x	0.7	=	190.55	(78)
South	0.9x	1	x	4.4	x	110.55	x	0.76	x	0.7	=	232.89	(78)
South	0.9x	1	x	2.7	x	108.01	x	0.76	x	0.7	=	139.63	(78)
South	0.9x	1	x	1.8	x	108.01	x	0.76	x	0.7	=	186.18	(78)
South	0.9x	1	x	4.4	x	108.01	x	0.76	x	0.7	=	227.55	(78)
South	0.9x	1	x	2.7	x	104.89	x	0.76	x	0.7	=	135.6	(78)
South	0.9x	1	x	1.8	x	104.89	x	0.76	x	0.7	=	180.8	(78)
South	0.9x	1	x	4.4	x	104.89	x	0.76	x	0.7	=	220.98	(78)
South	0.9x	1	x	2.7	x	101.89	x	0.76	x	0.7	=	131.71	(78)
South	0.9x	1	x	1.8	x	101.89	x	0.76	x	0.7	=	175.62	(78)
South	0.9x	1	x	4.4	x	101.89	x	0.76	x	0.7	=	214.64	(78)
South	0.9x	1	x	2.7	x	82.59	x	0.76	x	0.7	=	106.76	(78)
South	0.9x	1	x	1.8	x	82.59	x	0.76	x	0.7	=	142.35	(78)
South	0.9x	1	x	4.4	x	82.59	x	0.76	x	0.7	=	173.98	(78)
South	0.9x	1	x	2.7	x	55.42	x	0.76	x	0.7	=	71.64	(78)
South	0.9x	1	x	1.8	x	55.42	x	0.76	x	0.7	=	95.52	(78)
South	0.9x	1	x	4.4	x	55.42	x	0.76	x	0.7	=	116.75	(78)
South	0.9x	1	x	2.7	x	40.4	x	0.76	x	0.7	=	52.23	(78)
South	0.9x	1	x	1.8	x	40.4	x	0.76	x	0.7	=	69.63	(78)
South	0.9x	1	x	4.4	x	40.4	x	0.76	x	0.7	=	85.11	(78)
West	0.9x	1	x	2.16	x	19.64	x	0.76	x	0.7	=	40.62	(80)
West	0.9x	1	x	5.61	x	19.64	x	0.76	x	0.7	=	52.76	(80)
West	0.9x	1	x	2.16	x	38.42	x	0.76	x	0.7	=	79.47	(80)
West	0.9x	1	x	5.61	x	38.42	x	0.76	x	0.7	=	103.2	(80)
West	0.9x	1	x	2.16	x	63.27	x	0.76	x	0.7	=	130.88	(80)
West	0.9x	1	x	5.61	x	63.27	x	0.76	x	0.7	=	169.96	(80)
West	0.9x	1	x	2.16	x	92.28	x	0.76	x	0.7	=	190.87	(80)

West	0.9x	1	x	5.61	x	92.28	x	0.76	x	0.7	=	247.87	(80)
West	0.9x	1	x	2.16	x	113.09	x	0.76	x	0.7	=	233.92	(80)
West	0.9x	1	x	5.61	x	113.09	x	0.76	x	0.7	=	303.77	(80)
West	0.9x	1	x	2.16	x	115.77	x	0.76	x	0.7	=	239.46	(80)
West	0.9x	1	x	5.61	x	115.77	x	0.76	x	0.7	=	310.97	(80)
West	0.9x	1	x	2.16	x	110.22	x	0.76	x	0.7	=	227.98	(80)
West	0.9x	1	x	5.61	x	110.22	x	0.76	x	0.7	=	296.05	(80)
West	0.9x	1	x	2.16	x	94.68	x	0.76	x	0.7	=	195.83	(80)
West	0.9x	1	x	5.61	x	94.68	x	0.76	x	0.7	=	254.31	(80)
West	0.9x	1	x	2.16	x	73.59	x	0.76	x	0.7	=	152.21	(80)
West	0.9x	1	x	5.61	x	73.59	x	0.76	x	0.7	=	197.67	(80)
West	0.9x	1	x	2.16	x	45.59	x	0.76	x	0.7	=	94.3	(80)
West	0.9x	1	x	5.61	x	45.59	x	0.76	x	0.7	=	122.46	(80)
West	0.9x	1	x	2.16	x	24.49	x	0.76	x	0.7	=	50.65	(80)
West	0.9x	1	x	5.61	x	24.49	x	0.76	x	0.7	=	65.78	(80)
West	0.9x	1	x	2.16	x	16.15	x	0.76	x	0.7	=	33.41	(80)
West	0.9x	1	x	5.61	x	16.15	x	0.76	x	0.7	=	43.38	(80)

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

(83)m=	332.9	574.94	800.51	1003.49	1126.2	1116.78	1077.39	987.53	871.86	639.85	400.34	283.76	(83)

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

(84)m=	1099.59	1333.24	1527.19	1683.26	1758.65	1708.93	1648.1	1570.9	1484.31	1299.45	1110.72	1031.83	(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=	0.94	0.92	0.88	0.82	0.74	0.63	0.52	0.55	0.7	0.85	0.92	0.95	(86)

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

(87)m=	17.36	17.74	18.34	19.12	19.83	20.43	20.73	20.69	20.24	19.3	18.2	17.31	(87)

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

(88)m=	19.22	19.22	19.23	19.26	19.27	19.3	19.3	19.31	19.29	19.27	19.26	19.24	(88)

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

(89)m=	0.93	0.9	0.86	0.79	0.68	0.53	0.36	0.39	0.61	0.81	0.9	0.94	(89)

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

(90)m=	14.7	15.24	16.08	17.17	18.12	18.87	19.18	19.15	18.66	17.43	15.91	14.65	(90)

fLA = Living area ÷ (4) = 0.29 (91)

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

(92)m=	15.48	15.98	16.75	17.74	18.62	19.33	19.63	19.6	19.12	17.98	16.59	15.43	(92)

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

(93)m=	15.48	15.98	16.75	17.74	18.62	19.33	19.63	19.6	19.12	17.98	16.59	15.43	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.89	0.86	0.81	0.74	0.65	0.53	0.39	0.42	0.6	0.76	0.86	0.9	(94)

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

(95)m=	981.27	1142.47	1237.74	1250.44	1148.27	902.18	649.49	667.46	889.13	992.68	955.46	930.22	(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=	2949.1	2907.65	2677.26	2256.43	1758.01	1172.01	751.63	789.68	1256.76	1874.09	2432.32	2906.85	(97)

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

(98)m=	1464.07	1186.2	1071	724.31	453.64	0	0	0	0	655.77	1063.33	1470.62

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 8088.95 (98)

Space heating requirement in kWh/m²/year 66.85 (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		71	(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)	1464.07	1186.2	1071	724.31	453.64	0	0	0	0	655.77	1063.33	1470.62	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	2062.07	1670.7	1508.45	1020.16	638.93	0	0	0	0	923.62	1497.65	2071.29	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 11392.89 (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)

218.42	192.51	202.15	181.19	177.54	158.6	152.29	167.15	166.87	187.88	198.7	213.16

Efficiency of water heater 60.3 (216)

(217)m=	69.4	69.28	69.05	68.57	67.62	60.3	60.3	60.3	60.3	68.3	69.07	69.44	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	314.72	277.86	292.75	264.25	262.53	263.02	252.56	277.2	276.73	275.08	287.68	306.96

Total = Sum(219a)$_{1...12}$ = 3351.36 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		11392.89
Water heating fuel used		3351.36
Electricity for pumps, fans and electric keep-hot		

mechanical ventilation - balanced, extract or positive input from outside		136.37		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		166.37	(231)
Electricity for lighting			661.54	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	396.47	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	116.63	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	21.94	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	87.26	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	742.3	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.88	(257)
SAP rating (Section 12)		73.8	(258)

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	=	2460.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	723.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3184.76	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	86.35	(267)
Electricity for lighting	(232) x	0.519	=	343.34	(268)
Total CO2, kg/year		sum of (265)…(271) =		3614.44	(272)
CO2 emissions per m²		(272) ÷ (4) =		29.87	(273)
EI rating (section 14)				71	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	13899.33	(261)

Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	4088.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			17987.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	510.76	(267)
Electricity for lighting	(232) x	0	=	2030.92	(268)
‘Total Primary Energy		sum of (265)…(271) =		20529.67	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		169.67	(273)

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.18

Property Address: FF01

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72	(1a) x	3.2	(2a) =	230.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	230.4	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(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

SAP WorkSheet: Existing dwelling (SAP)

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

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

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

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

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

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

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

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

(24c)m=	0.74	0.73	0.72	0.67	0.66	0.61	0.61	0.6	0.63	0.66	0.68	0.7	(24c)

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

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

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

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

(25)m=	0.74	0.73	0.72	0.67	0.66	0.61	0.61	0.6	0.63	0.66	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	
Windows Type 1			1.44	x1/[1/(2.8)+ 0.04]	=	3.63			(27)
Windows Type 2			5.4	x1/[1/(2.8)+ 0.04]	=	13.6			(27)
Windows Type 3			1.8	x1/[1/(2.8)+ 0.04]	=	4.53			(27)
Walls Type1	36	5.76	30.24	x 1.7	=	51.41			(29)
Walls Type2	30	12.6	17.4	x 1.7	=	29.58			(29)
Total area of elements, m²			66						(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) = 127.22 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7842 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.9 (36)

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

Total fabric heat loss (33) + (36) = 137.12 (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=	56.09	55.36	54.63	51	50.27	46.64	46.64	45.91	48.09	50.27	51.73	53.18	(38)

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

(39)m=	193.21	192.48	191.75	188.12	187.39	183.75	183.75	183.03	185.21	187.39	188.84	190.3	

Average = Sum(39)$_{1…12}$ /12= 187.93 (39)

SAP WorkSheet: Existing dwelling (SAP)

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

(40)m=	2.68	2.67	2.66	2.61	2.6	2.55	2.55	2.54	2.57	2.6	2.62	2.64

Average = Sum(40)$_{1…12}$ /12= 2.61 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (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 93.34 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	102.68	98.94	95.21	91.48	87.74	84.01	84.01	87.74	91.48	95.21	98.94	102.68

Total = Sum(44)$_{1…12}$ = 1120.11 (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=	152.27	133.17	137.42	119.81	114.96	99.2	91.92	105.48	106.74	124.4	135.79	147.46

Total = Sum(45)$_{1…12}$ = 1468.63 (45)

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

(46)m=	22.84	19.98	20.61	17.97	17.24	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

SAP WorkSheet: Existing dwelling (SAP)

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=	203.82	179.74	188.98	169.7	166.51	149.09	143.48	157.04	156.63	175.95	185.68	199.01	(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=	203.82	179.74	188.98	169.7	166.51	149.09	143.48	157.04	156.63	175.95	185.68	199.01	

Output from water heater (annual)$_{1...12}$ 2075.63 (64)

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

(65)m=	91.87	81.53	86.94	79.75	79.47	72.9	71.81	76.32	75.4	82.61	85.06	90.27	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	(66)

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

(67)m=	65.7	58.36	47.46	35.93	26.86	22.67	24.5	31.85	42.75	54.28	63.35	67.53	(67)

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

(68)m=	301.37	304.5	296.62	279.84	258.66	238.76	225.46	222.33	230.22	246.99	268.17	288.07	(68)

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

(69)m=	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	(71)

Water heating gains (Table 5)

(72)m=	123.48	121.33	116.85	110.76	106.81	101.24	96.51	102.58	104.73	111.03	118.14	121.34	(72)

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

(73)m=	590.49	584.11	560.86	526.46	492.26	462.61	446.41	456.69	477.62	512.23	549.59	576.87	(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	1	x	1.44	x	10.63	x	0.76	x	0.7	=	29.33	(74)
North	0.9x	1	x	1.44	x	20.32	x	0.76	x	0.7	=	56.04	(74)
North	0.9x	1	x	1.44	x	34.53	x	0.76	x	0.7	=	95.23	(74)
North	0.9x	1	x	1.44	x	55.46	x	0.76	x	0.7	=	152.96	(74)
North	0.9x	1	x	1.44	x	74.72	x	0.76	x	0.7	=	206.06	(74)

North	0.9x	1	x	1.44	x	79.99	x	0.76	x	0.7	=	220.59	(74)
North	0.9x	1	x	1.44	x	74.68	x	0.76	x	0.7	=	205.95	(74)
North	0.9x	1	x	1.44	x	59.25	x	0.76	x	0.7	=	163.39	(74)
North	0.9x	1	x	1.44	x	41.52	x	0.76	x	0.7	=	114.5	(74)
North	0.9x	1	x	1.44	x	24.19	x	0.76	x	0.7	=	66.71	(74)
North	0.9x	1	x	1.44	x	13.12	x	0.76	x	0.7	=	36.18	(74)
North	0.9x	1	x	1.44	x	8.86	x	0.76	x	0.7	=	24.45	(74)
West	0.9x	1	x	5.4	x	19.64	x	0.76	x	0.7	=	101.56	(80)
West	0.9x	1	x	1.8	x	19.64	x	0.76	x	0.7	=	16.93	(80)
West	0.9x	1	x	5.4	x	38.42	x	0.76	x	0.7	=	198.67	(80)
West	0.9x	1	x	1.8	x	38.42	x	0.76	x	0.7	=	33.11	(80)
West	0.9x	1	x	5.4	x	63.27	x	0.76	x	0.7	=	327.19	(80)
West	0.9x	1	x	1.8	x	63.27	x	0.76	x	0.7	=	54.53	(80)
West	0.9x	1	x	5.4	x	92.28	x	0.76	x	0.7	=	477.18	(80)
West	0.9x	1	x	1.8	x	92.28	x	0.76	x	0.7	=	79.53	(80)
West	0.9x	1	x	5.4	x	113.09	x	0.76	x	0.7	=	584.81	(80)
West	0.9x	1	x	1.8	x	113.09	x	0.76	x	0.7	=	97.47	(80)
West	0.9x	1	x	5.4	x	115.77	x	0.76	x	0.7	=	598.65	(80)
West	0.9x	1	x	1.8	x	115.77	x	0.76	x	0.7	=	99.78	(80)
West	0.9x	1	x	5.4	x	110.22	x	0.76	x	0.7	=	569.94	(80)
West	0.9x	1	x	1.8	x	110.22	x	0.76	x	0.7	=	94.99	(80)
West	0.9x	1	x	5.4	x	94.68	x	0.76	x	0.7	=	489.57	(80)
West	0.9x	1	x	1.8	x	94.68	x	0.76	x	0.7	=	81.6	(80)
West	0.9x	1	x	5.4	x	73.59	x	0.76	x	0.7	=	380.53	(80)
West	0.9x	1	x	1.8	x	73.59	x	0.76	x	0.7	=	63.42	(80)
West	0.9x	1	x	5.4	x	45.59	x	0.76	x	0.7	=	235.74	(80)
West	0.9x	1	x	1.8	x	45.59	x	0.76	x	0.7	=	39.29	(80)
West	0.9x	1	x	5.4	x	24.49	x	0.76	x	0.7	=	126.63	(80)
West	0.9x	1	x	1.8	x	24.49	x	0.76	x	0.7	=	21.11	(80)
West	0.9x	1	x	5.4	x	16.15	x	0.76	x	0.7	=	83.52	(80)
West	0.9x	1	x	1.8	x	16.15	x	0.76	x	0.7	=	13.92	(80)

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

(83)m=	147.81	287.83	476.95	709.68	888.33	919.02	870.88	734.56	558.45	341.75	183.92	121.89	(83)

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

(84)m=	738.3	871.94	1037.81	1236.14	1380.59	1381.63	1317.29	1191.25	1036.07	853.97	733.51	698.76	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.91	0.87	0.8	0.7	0.58	0.47	0.52	0.7	0.85	0.92	0.94	(86)

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

(87)m=	16.98	17.34	18.01	18.92	19.75	20.39	20.7	20.64	20.09	19.01	17.85	16.93	(87)

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

(88)m=	18.92	18.92	18.93	18.96	18.96	18.99	18.99	19	18.98	18.96	18.95	18.94	(88)

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

(89)m=	0.92	0.9	0.85	0.76	0.63	0.46	0.3	0.35	0.59	0.8	0.89	0.93	(89)

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

(90)m=	14.1	14.6	15.53	16.76	17.82	18.59	18.88	18.85	18.3	16.93	15.34	14.04	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	15.1	15.55	16.39	17.51	18.49	19.21	19.51	19.47	18.92	17.66	16.21	15.04	(92)

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

(93)m=	15.1	15.55	16.39	17.51	18.49	19.21	19.51	19.47	18.92	17.66	16.21	15.04	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.88	0.85	0.8	0.71	0.61	0.47	0.35	0.39	0.58	0.76	0.85	0.89	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	650.54	740.98	827.28	880.83	835.64	656.1	461.87	468.78	605.71	647.86	624.38	621.32	(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=	2086.86	2050.33	1896.57	1619.98	1272.62	847.73	535.39	561.65	892.87	1322.14	1720.55	2063.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1068.62	879.88	795.55	532.19	325.11	0	0	0	0	501.66	789.24	1073.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5965.31 (98)

Space heating requirement in kWh/m²/year 82.85 (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		71	(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)													
	1068.62	879.88	795.55	532.19	325.11	0	0	0	0	501.66	789.24	1073.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1505.1	1239.27	1120.5	749.56	457.9	0	0	0	0	706.57	1111.61	1511.33	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 8401.84 (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)

SAP WorkSheet: Existing dwelling (SAP)

Water heating

Output from water heater (calculated above)

203.82	179.74	188.98	169.7	166.51	149.09	143.48	157.04	156.63	175.95	185.68	199.01

Efficiency of water heater 60.3 (216)

(217)m=	69.04	68.93	68.66	68.08	66.97	60.3	60.3	60.3	60.3	67.87	68.68	69.08	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	295.23	260.77	275.23	249.27	248.62	247.25	237.94	260.43	259.76	259.24	270.36	288.08

Total = Sum(219a)$_{1...12}$ = 3152.17 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		8401.84	
Water heating fuel used		3152.17	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	81.15		(230a)
central heating pump:	30		(230c)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		111.15	(231)
Electricity for lighting		464.15	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x	3.48	x 0.01 =	292.38	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		3.48	x 0.01 =	109.7	(247)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	14.66	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	61.22	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 597.96 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	2.15	(257)
SAP rating (Section 12)		70.06	(258)

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	=	1814.8	(261)

SAP WorkSheet: Existing dwelling (SAP)

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	680.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2495.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	57.69	(267)
Electricity for lighting	(232) x	0.519	=	240.89	(268)
Total CO2, kg/year		sum of (265)…(271) =		2794.24	(272)
CO2 emissions per m²		(272) ÷ (4) =		38.81	(273)
EI rating (section 14)				68	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	10250.25	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3845.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =			14095.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	341.22	(267)
Electricity for lighting	(232) x	0	=	1424.93	(268)
'Total Primary Energy		sum of (265)…(271) =		15862.04	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		220.31	(273)

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.18

Property Address: SF03

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	156	(1a) x	3.2	(2a) =	499.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	156	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		499.2	(5)

2. Ventilation rate:

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

DRAFT

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(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

SAP WorkSheet: Existing dwelling (SAP)

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

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

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

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

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

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

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

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

(24c)m=	0.74	0.73	0.72	0.67	0.66	0.61	0.61	0.6	0.63	0.66	0.68	0.7	(24c)

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

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

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

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

(25)m=	0.74	0.73	0.72	0.67	0.66	0.61	0.61	0.6	0.63	0.66	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	
Windows Type 1			3.04	x1/[1/(2.8)+ 0.04] =	7.65			(27)
Windows Type 2			3.23	x1/[1/(2.8)+ 0.04] =	8.13			(27)
Windows Type 3			3.52	x1/[1/(2.8)+ 0.04] =	8.86			(27)
Windows Type 4			3.36	x1/[1/(2.8)+ 0.04] =	8.46			(27)
Windows Type 5			3.52	x1/[1/(2.8)+ 0.04] =	8.86			(27)
Walls Type1	15	3.04	11.96	x 1.7 =	20.33			(29)
Walls Type2	21	3.23	17.77	x 1.7 =	30.21			(29)
Walls Type3	27.5	6.88	20.62	x 1.7 =	35.05			(29)
Walls Type4	22.5	3.52	18.98	x 1.7 =	32.27			(29)
Total area of elements, m²			86					(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) = 159.84 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13172.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 12.9 (36)

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

Total fabric heat loss (33) + (36) = 172.74 (37)

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

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

(38)m=	121.52	119.95	118.37	110.5	108.92	101.04	101.04	99.47	104.2	108.92	112.07	115.22	(38)

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

(39)m=	294.26	292.68	291.11	283.23	281.66	273.78	273.78	272.21	276.93	281.66	284.81	287.96	

Average = Sum(39)$_{1\ldots12}$ /12= 282.84 (39)

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

(40)m=	1.89	1.88	1.87	1.82	1.81	1.76	1.76	1.74	1.78	1.81	1.83	1.85	

Average = Sum(40)$_{1\ldots12}$ /12= 1.81 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.94 (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) + 36 109.58 (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=	120.54	116.15	111.77	107.39	103.01	98.62	98.62	103.01	107.39	111.77	116.15	120.54	

Total = Sum(44)$_{1\ldots12}$ = 1314.96 (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=	178.75	156.34	161.33	140.65	134.96	116.46	107.92	123.83	125.31	146.04	159.41	173.11	

Total = Sum(45)$_{1\ldots12}$ = 1724.12 (45)

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

(46)m=	26.81	23.45	24.2	21.1	20.24	17.47	16.19	18.58	18.8	21.91	23.91	25.97	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

SAP WorkSheet: Existing dwelling (SAP)

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

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

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

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

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

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

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

(62)m=	230.31	202.9	212.88	190.54	186.51	166.35	159.47	175.39	175.2	197.59	209.3	224.67	(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=	230.31	202.9	212.88	190.54	186.51	166.35	159.47	175.39	175.2	197.59	209.3	224.67

Output from water heater (annual)$_{1…12}$ | 2331.11 | (64)

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

(65)m=	100.68	89.23	94.88	86.68	86.12	78.63	77.12	82.42	81.58	89.8	92.92	98.8	(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=	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	116.27	103.27	83.98	63.58	47.53	40.13	43.36	56.36	75.64	96.04	112.1	119.5	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	488.02	493.09	480.33	453.16	418.86	386.63	365.1	360.04	372.8	399.96	434.26	466.49	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	(71)
Water heating gains (Table 5)													
(72)m=	135.32	132.79	127.53	120.39	115.75	109.21	103.66	110.78	113.3	120.7	129.05	132.8	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	857.08	846.61	809.31	754.59	699.61	653.44	629.58	644.63	679.21	734.18	792.88	836.26	(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	3.04	x	19.64	x	0.76	x	0.7	=	28.59	(76)
East	0.9x	1	x	3.23	x	19.64	x	0.76	x	0.7	=	30.37	(76)

East	0.9x	1	x	3.04	x	38.42	x	0.76	x	0.7	=	55.92	(76)
East	0.9x	1	x	3.23	x	38.42	x	0.76	x	0.7	=	59.42	(76)
East	0.9x	1	x	3.04	x	63.27	x	0.76	x	0.7	=	92.1	(76)
East	0.9x	1	x	3.23	x	63.27	x	0.76	x	0.7	=	97.85	(76)
East	0.9x	1	x	3.04	x	92.28	x	0.76	x	0.7	=	134.32	(76)
East	0.9x	1	x	3.23	x	92.28	x	0.76	x	0.7	=	142.71	(76)
East	0.9x	1	x	3.04	x	113.09	x	0.76	x	0.7	=	164.61	(76)
East	0.9x	1	x	3.23	x	113.09	x	0.76	x	0.7	=	174.9	(76)
East	0.9x	1	x	3.04	x	115.77	x	0.76	x	0.7	=	168.51	(76)
East	0.9x	1	x	3.23	x	115.77	x	0.76	x	0.7	=	179.04	(76)
East	0.9x	1	x	3.04	x	110.22	x	0.76	x	0.7	=	160.43	(76)
East	0.9x	1	x	3.23	x	110.22	x	0.76	x	0.7	=	170.46	(76)
East	0.9x	1	x	3.04	x	94.68	x	0.76	x	0.7	=	137.81	(76)
East	0.9x	1	x	3.23	x	94.68	x	0.76	x	0.7	=	146.42	(76)
East	0.9x	1	x	3.04	x	73.59	x	0.76	x	0.7	=	107.11	(76)
East	0.9x	1	x	3.23	x	73.59	x	0.76	x	0.7	=	113.81	(76)
East	0.9x	1	x	3.04	x	45.59	x	0.76	x	0.7	=	66.36	(76)
East	0.9x	1	x	3.23	x	45.59	x	0.76	x	0.7	=	70.5	(76)
East	0.9x	1	x	3.04	x	24.49	x	0.76	x	0.7	=	35.65	(76)
East	0.9x	1	x	3.23	x	24.49	x	0.76	x	0.7	=	37.87	(76)
East	0.9x	1	x	3.04	x	16.15	x	0.76	x	0.7	=	23.51	(76)
East	0.9x	1	x	3.23	x	16.15	x	0.76	x	0.7	=	24.98	(76)
South	0.9x	1	x	3.52	x	46.75	x	0.76	x	0.7	=	78.79	(78)
South	0.9x	1	x	3.36	x	46.75	x	0.76	x	0.7	=	75.21	(78)
South	0.9x	1	x	3.52	x	46.75	x	0.76	x	0.7	=	78.79	(78)
South	0.9x	1	x	3.52	x	76.57	x	0.76	x	0.7	=	129.05	(78)
South	0.9x	1	x	3.36	x	76.57	x	0.76	x	0.7	=	123.18	(78)
South	0.9x	1	x	3.52	x	76.57	x	0.76	x	0.7	=	129.05	(78)
South	0.9x	1	x	3.52	x	97.53	x	0.76	x	0.7	=	164.38	(78)
South	0.9x	1	x	3.36	x	97.53	x	0.76	x	0.7	=	156.91	(78)
South	0.9x	1	x	3.52	x	97.53	x	0.76	x	0.7	=	164.38	(78)
South	0.9x	1	x	3.52	x	110.23	x	0.76	x	0.7	=	185.79	(78)
South	0.9x	1	x	3.36	x	110.23	x	0.76	x	0.7	=	177.34	(78)
South	0.9x	1	x	3.52	x	110.23	x	0.76	x	0.7	=	185.79	(78)
South	0.9x	1	x	3.52	x	114.87	x	0.76	x	0.7	=	193.6	(78)
South	0.9x	1	x	3.36	x	114.87	x	0.76	x	0.7	=	184.8	(78)
South	0.9x	1	x	3.52	x	114.87	x	0.76	x	0.7	=	193.6	(78)
South	0.9x	1	x	3.52	x	110.55	x	0.76	x	0.7	=	186.31	(78)
South	0.9x	1	x	3.36	x	110.55	x	0.76	x	0.7	=	177.85	(78)
South	0.9x	1	x	3.52	x	110.55	x	0.76	x	0.7	=	186.31	(78)
South	0.9x	1	x	3.52	x	108.01	x	0.76	x	0.7	=	182.04	(78)

South	0.9x	1	x	3.36	x	108.01	x	0.76	x	0.7	=	173.77	(78)
South	0.9x	1	x	3.52	x	108.01	x	0.76	x	0.7	=	182.04	(78)
South	0.9x	1	x	3.52	x	104.89	x	0.76	x	0.7	=	176.79	(78)
South	0.9x	1	x	3.36	x	104.89	x	0.76	x	0.7	=	168.75	(78)
South	0.9x	1	x	3.52	x	104.89	x	0.76	x	0.7	=	176.79	(78)
South	0.9x	1	x	3.52	x	101.89	x	0.76	x	0.7	=	171.72	(78)
South	0.9x	1	x	3.36	x	101.89	x	0.76	x	0.7	=	163.91	(78)
South	0.9x	1	x	3.52	x	101.89	x	0.76	x	0.7	=	171.72	(78)
South	0.9x	1	x	3.52	x	82.59	x	0.76	x	0.7	=	139.19	(78)
South	0.9x	1	x	3.36	x	82.59	x	0.76	x	0.7	=	132.86	(78)
South	0.9x	1	x	3.52	x	82.59	x	0.76	x	0.7	=	139.19	(78)
South	0.9x	1	x	3.52	x	55.42	x	0.76	x	0.7	=	93.4	(78)
South	0.9x	1	x	3.36	x	55.42	x	0.76	x	0.7	=	89.15	(78)
South	0.9x	1	x	3.52	x	55.42	x	0.76	x	0.7	=	93.4	(78)
South	0.9x	1	x	3.52	x	40.4	x	0.76	x	0.7	=	68.09	(78)
South	0.9x	1	x	3.36	x	40.4	x	0.76	x	0.7	=	64.99	(78)
South	0.9x	1	x	3.52	x	40.4	x	0.76	x	0.7	=	68.09	(78)

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

(83)m=	291.76	496.61	675.62	825.95	911.52	898.03	868.73	806.55	728.26	548.1	349.47	249.65	(83)

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

(84)m=	1148.84	1343.23	1484.93	1580.54	1611.12	1551.47	1498.32	1451.18	1407.47	1282.27	1142.34	1085.91	(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=	0.96	0.94	0.92	0.88	0.81	0.71	0.6	0.62	0.77	0.89	0.94	0.96	(86)

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

(87)m=	17.52	17.85	18.38	19.1	19.78	20.39	20.71	20.67	20.22	19.33	18.32	17.5	(87)

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

(88)m=	19.41	19.42	19.42	19.46	19.47	19.5	19.5	19.51	19.49	19.47	19.45	19.44	(88)

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

(89)m=	0.95	0.93	0.9	0.85	0.77	0.62	0.45	0.48	0.69	0.85	0.93	0.95	(89)

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

(90)m=	14.98	15.44	16.2	17.23	18.17	18.98	19.34	19.31	18.78	17.57	16.14	14.96	(90)

fLA = Living area ÷ (4) = | 0.25 | (91)

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

(92)m=	15.62	16.04	16.74	17.7	18.57	19.34	19.68	19.65	19.14	18.01	16.69	15.59	(92)

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

(93)m=	15.62	16.04	16.74	17.7	18.57	19.34	19.68	19.65	19.14	18.01	16.69	15.59	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.92	0.89	0.86	0.8	0.73	0.61	0.47	0.5	0.67	0.81	0.89	0.92	(94)

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

(95)m=	1053.53	1197.38	1272.76	1272.1	1174.13	947.54	706.63	725.1	940.72	1043.09	1018.59	1003.62	(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=	3329.92	3261.65	2982.13	2491.84	1936.26	1296.47	843.45	884.7	1394.9	2086.44	2731.14	3280.61	(97)

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

(98)m=	1693.64	1387.19	1271.77	878.22	567.03	0	0	0	0	776.25	1233.04	1694.08

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 9501.2 (98)

Space heating requirement in kWh/m²/year 60.91 (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		71	(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)	1693.64	1387.19	1271.77	878.22	567.03	0	0	0	0	776.25	1233.04	1694.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	2385.4	1953.78	1791.22	1236.93	798.63	0	0	0	0	1093.31	1736.68	2386.02	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 13381.98 (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)

230.31	202.9	212.88	190.54	186.51	166.35	159.47	175.39	175.2	197.59	209.3	224.67

Efficiency of water heater 60.3 (216)

(217)m=	69.52	69.43	69.24	68.82	68.01	60.3	60.3	60.3	60.3	68.53	69.22	69.55	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	331.27	292.25	307.46	276.86	274.23	275.87	264.46	290.86	290.55	288.32	302.39	323.01

Total = Sum(219a)$_{1...12}$ = 3517.51 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		13381.98
Water heating fuel used		3517.51
Electricity for pumps, fans and electric keep-hot		

mechanical ventilation - balanced, extract or positive input from outside		175.82		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		205.82	(231)
Electricity for lighting			821.35	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	465.69	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	122.41	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	27.15	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	108.34	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)…(254) =			843.59	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.76	(257)
SAP rating (Section 12)		75.41	(258)

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	=	2890.51	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	759.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3650.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	106.82	(267)
Electricity for lighting	(232) x	0.519	=	426.28	(268)
Total CO2, kg/year		sum of (265)…(271) =		4183.39	(272)
CO2 emissions per m²		(272) ÷ (4) =		26.82	(273)
EI rating (section 14)				72	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	16326.01	(261)

Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	4291.37	(264)
Space and water heating	(261) + (262) + (263) + (264) =			20617.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	631.86	(267)
Electricity for lighting	(232) x	0	=	2521.53	(268)
‘Total Primary Energy		sum of (265)…(271) =		23770.77	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		152.38	(273)

9.2. Appendix 2 – SAP Worksheets 'Be Lean'

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.18

Property Address: LG01

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	132	(1a)	x	3.2	(2a)	=	422.4	(3a)
Ground floor	132	(1b)	x	3.2	(2b)	=	422.4	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	264	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	844.8	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)		2	(9)
Additional infiltration	[(9)-1]x0.1 =	0.1	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.55	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.55	(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

SAP WorkSheet: Existing dwelling (SAP)

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.6	0.58	0.57	0.51	0.5	0.44	0.44	0.43	0.47	0.5	0.53	0.55

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.35 (23c)

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

(24a)m=	0.71	0.7	0.69	0.63	0.62	0.56	0.56	0.55	0.58	0.62	0.64	0.66	(24a)

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

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

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

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

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

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

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

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

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

(25)m=	0.71	0.7	0.69	0.63	0.62	0.56	0.56	0.55	0.58	0.62	0.64	0.66	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			4.75	x1/[1/(1.8)+ 0.04]		=	7.98			(27)
Windows Type 2			2	x1/[1/(1.8)+ 0.04]		=	3.36			(27)
Windows Type 3			4.75	x1/[1/(1.8)+ 0.04]		=	7.98			(27)
Windows Type 4			2	x1/[1/(1.8)+ 0.04]		=	3.36			(27)
Windows Type 5			2	x1/[1/(1.8)+ 0.04]		=	3.36			(27)
Windows Type 6			2	x1/[1/(1.8)+ 0.04]		=	3.36			(27)
Floor			132	x	0.2	=	26.4			(28)
Walls Type1	32	16.25	15.75	x	0.25	=	3.94			(29)
Walls Type2	40	4	36	x	0.25	=	9			(29)
Walls Type3	32	16.25	15.75	x	0.25	=	3.94			(29)
Walls Type4	22	0	22	x	0.25	=	5.5			(29)
Walls Type5	18	4	14	x	0.25	=	3.5			(29)
Total area of elements, m²			276							(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) = 120.28 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 34185 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

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

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 41.4 | (36)

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

Total fabric heat loss (33) + (36) = | 161.68 | (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=	197.74	194.49	191.23	174.94	171.68	155.39	155.39	152.13	161.9	171.68	178.2	184.71	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(39)m=	359.42	356.17	352.91	336.62	333.36	317.07	317.07	313.81	323.58	333.36	339.87	346.39

Average = Sum(39)$_{1…12}$ /12= | 335.8 | (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(40)m=	1.36	1.35	1.34	1.28	1.26	1.2	1.2	1.19	1.23	1.26	1.29	1.31

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 3.09 | (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 | 107.47 | (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=	118.22	113.92	109.62	105.32	101.02	96.72	96.72	101.02	105.32	109.62	113.92	118.22

Total = Sum(44)$_{1…12}$ = | 1289.66 | (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=	175.32	153.33	158.22	137.94	132.36	114.22	105.84	121.45	122.9	143.23	156.35	169.78

Total = Sum(45)$_{1…12}$ = | 1690.95 | (45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	26.3	23	23.73	20.69	19.85	17.13	15.88	18.22	18.44	21.48	23.45	25.47	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 300 | (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 1.69 | (48)

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

Energy lost from water storage, kWh/year (48) x (49) = | 0.91 | (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.91	(55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	226.87	199.9	209.78	187.83	183.91	164.11	157.39	173	172.79	194.78	206.24	221.34	(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=	226.87	199.9	209.78	187.83	183.91	164.11	157.39	173	172.79	194.78	206.24	221.34	

Output from water heater (annual)$_{1...12}$ — 2297.95 (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=	99.53	88.23	93.85	85.78	85.25	77.89	76.43	81.63	80.78	88.87	91.9	97.7	(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=	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	(66)

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

(67)m=	95.48	84.81	68.97	52.21	39.03	32.95	35.61	46.28	62.12	78.87	92.06	98.14	(67)

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

(68)m=	639.42	646.06	629.34	593.74	548.81	506.58	478.36	471.73	488.45	524.05	568.98	611.21	(68)

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

(69)m=	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	(71)

Water heating gains (Table 5)

(72)m=	133.78	131.3	126.15	119.14	114.59	108.18	102.73	109.71	112.19	119.44	127.64	131.31	(72)

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

(73)m=	989.99	983.46	945.75	886.39	823.72	769.01	738	749.02	784.06	843.66	909.97	961.96	(73)

6. Solar gains:

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

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	2	x	10.63	x	0.5	x	0.9	=	17.23	(74)
North	0.9x	1	x	2	x	10.63	x	0.5	x	0.9	=	17.23	(74)
North	0.9x	1	x	2	x	20.32	x	0.5	x	0.9	=	32.92	(74)
North	0.9x	1	x	2	x	20.32	x	0.5	x	0.9	=	32.92	(74)
North	0.9x	1	x	2	x	34.53	x	0.5	x	0.9	=	55.94	(74)
North	0.9x	1	x	2	x	34.53	x	0.5	x	0.9	=	55.94	(74)
North	0.9x	1	x	2	x	55.46	x	0.5	x	0.9	=	89.85	(74)
North	0.9x	1	x	2	x	55.46	x	0.5	x	0.9	=	89.85	(74)
North	0.9x	1	x	2	x	74.72	x	0.5	x	0.9	=	121.04	(74)
North	0.9x	1	x	2	x	74.72	x	0.5	x	0.9	=	121.04	(74)
North	0.9x	1	x	2	x	79.99	x	0.5	x	0.9	=	129.58	(74)
North	0.9x	1	x	2	x	79.99	x	0.5	x	0.9	=	129.58	(74)
North	0.9x	1	x	2	x	74.68	x	0.5	x	0.9	=	120.98	(74)
North	0.9x	1	x	2	x	74.68	x	0.5	x	0.9	=	120.98	(74)
North	0.9x	1	x	2	x	59.25	x	0.5	x	0.9	=	95.98	(74)
North	0.9x	1	x	2	x	59.25	x	0.5	x	0.9	=	95.98	(74)
North	0.9x	1	x	2	x	41.52	x	0.5	x	0.9	=	67.26	(74)
North	0.9x	1	x	2	x	41.52	x	0.5	x	0.9	=	67.26	(74)
North	0.9x	1	x	2	x	24.19	x	0.5	x	0.9	=	39.19	(74)
North	0.9x	1	x	2	x	24.19	x	0.5	x	0.9	=	39.19	(74)
North	0.9x	1	x	2	x	13.12	x	0.5	x	0.9	=	21.25	(74)
North	0.9x	1	x	2	x	13.12	x	0.5	x	0.9	=	21.25	(74)
North	0.9x	1	x	2	x	8.86	x	0.5	x	0.9	=	14.36	(74)
North	0.9x	1	x	2	x	8.86	x	0.5	x	0.9	=	14.36	(74)
West	0.9x	1	x	4.75	x	19.64	x	0.5	x	0.9	=	113.35	(80)
West	0.9x	1	x	2	x	19.64	x	0.5	x	0.9	=	15.91	(80)
West	0.9x	1	x	4.75	x	19.64	x	0.5	x	0.9	=	113.35	(80)
West	0.9x	1	x	2	x	19.64	x	0.5	x	0.9	=	15.91	(80)
West	0.9x	1	x	4.75	x	38.42	x	0.5	x	0.9	=	221.73	(80)
West	0.9x	1	x	2	x	38.42	x	0.5	x	0.9	=	31.12	(80)
West	0.9x	1	x	4.75	x	38.42	x	0.5	x	0.9	=	221.73	(80)
West	0.9x	1	x	2	x	38.42	x	0.5	x	0.9	=	31.12	(80)
West	0.9x	1	x	4.75	x	63.27	x	0.5	x	0.9	=	365.17	(80)
West	0.9x	1	x	2	x	63.27	x	0.5	x	0.9	=	51.25	(80)
West	0.9x	1	x	4.75	x	63.27	x	0.5	x	0.9	=	365.17	(80)
West	0.9x	1	x	2	x	63.27	x	0.5	x	0.9	=	51.25	(80)
West	0.9x	1	x	4.75	x	92.28	x	0.5	x	0.9	=	532.57	(80)
West	0.9x	1	x	2	x	92.28	x	0.5	x	0.9	=	74.75	(80)
West	0.9x	1	x	4.75	x	92.28	x	0.5	x	0.9	=	532.57	(80)

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West	0.9x	1	x	2	x	92.28	x	0.5	x	0.9	=	74.75	(80)
West	0.9x	1	x	4.75	x	113.09	x	0.5	x	0.9	=	652.69	(80)
West	0.9x	1	x	2	x	113.09	x	0.5	x	0.9	=	91.61	(80)
West	0.9x	1	x	4.75	x	113.09	x	0.5	x	0.9	=	652.69	(80)
West	0.9x	1	x	2	x	113.09	x	0.5	x	0.9	=	91.61	(80)
West	0.9x	1	x	4.75	x	115.77	x	0.5	x	0.9	=	668.14	(80)
West	0.9x	1	x	2	x	115.77	x	0.5	x	0.9	=	93.77	(80)
West	0.9x	1	x	4.75	x	115.77	x	0.5	x	0.9	=	668.14	(80)
West	0.9x	1	x	2	x	115.77	x	0.5	x	0.9	=	93.77	(80)
West	0.9x	1	x	4.75	x	110.22	x	0.5	x	0.9	=	636.1	(80)
West	0.9x	1	x	2	x	110.22	x	0.5	x	0.9	=	89.28	(80)
West	0.9x	1	x	4.75	x	110.22	x	0.5	x	0.9	=	636.1	(80)
West	0.9x	1	x	2	x	110.22	x	0.5	x	0.9	=	89.28	(80)
West	0.9x	1	x	4.75	x	94.68	x	0.5	x	0.9	=	546.4	(80)
West	0.9x	1	x	2	x	94.68	x	0.5	x	0.9	=	76.69	(80)
West	0.9x	1	x	4.75	x	94.68	x	0.5	x	0.9	=	546.4	(80)
West	0.9x	1	x	2	x	94.68	x	0.5	x	0.9	=	76.69	(80)
West	0.9x	1	x	4.75	x	73.59	x	0.5	x	0.9	=	424.7	(80)
West	0.9x	1	x	2	x	73.59	x	0.5	x	0.9	=	59.61	(80)
West	0.9x	1	x	4.75	x	73.59	x	0.5	x	0.9	=	424.7	(80)
West	0.9x	1	x	2	x	73.59	x	0.5	x	0.9	=	59.61	(80)
West	0.9x	1	x	4.75	x	45.59	x	0.5	x	0.9	=	263.11	(80)
West	0.9x	1	x	2	x	45.59	x	0.5	x	0.9	=	36.93	(80)
West	0.9x	1	x	4.75	x	45.59	x	0.5	x	0.9	=	263.11	(80)
West	0.9x	1	x	2	x	45.59	x	0.5	x	0.9	=	36.93	(80)
West	0.9x	1	x	4.75	x	24.49	x	0.5	x	0.9	=	141.33	(80)
West	0.9x	1	x	2	x	24.49	x	0.5	x	0.9	=	19.84	(80)
West	0.9x	1	x	4.75	x	24.49	x	0.5	x	0.9	=	141.33	(80)
West	0.9x	1	x	2	x	24.49	x	0.5	x	0.9	=	19.84	(80)
West	0.9x	1	x	4.75	x	16.15	x	0.5	x	0.9	=	93.21	(80)
West	0.9x	1	x	2	x	16.15	x	0.5	x	0.9	=	13.08	(80)
West	0.9x	1	x	4.75	x	16.15	x	0.5	x	0.9	=	93.21	(80)
West	0.9x	1	x	2	x	16.15	x	0.5	x	0.9	=	13.08	(80)

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

(83)m=	292.97	571.55	944.71	1394.34	1730.66	1782.98	1692.7	1438.13	1103.13	678.44	364.84	241.31	(83)

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

(84)m=	1282.96	1555.01	1890.46	2280.73	2554.39	2551.99	2430.7	2187.15	1887.19	1522.1	1274.81	1203.27	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	0.98	0.97	0.94	0.88	0.78	0.63	0.5	0.56	0.77	0.92	0.97	0.98	(86)

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

(87)m=	18.01	18.32	18.88	19.66	20.27	20.72	20.89	20.85	20.49	19.66	18.75	18.03	(87)

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

(88)m=	19.79	19.8	19.81	19.86	19.87	19.92	19.92	19.93	19.9	19.87	19.85	19.83	(88)

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

(89)m=	0.98	0.96	0.93	0.86	0.73	0.56	0.4	0.46	0.71	0.9	0.96	0.98	(89)

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

(90)m=	15.81	16.27	17.07	18.21	19.06	19.67	19.85	19.83	19.39	18.23	16.91	15.86	(90)

fLA = Living area ÷ (4) = 0.5 (91)

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

(92)m=	16.91	17.29	17.97	18.93	19.67	20.19	20.37	20.34	19.94	18.94	17.83	16.94	(92)

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

(93)m=	16.91	17.29	17.97	18.93	19.67	20.19	20.37	20.34	19.94	18.94	17.83	16.94	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.96	0.94	0.91	0.83	0.73	0.58	0.45	0.5	0.72	0.88	0.95	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1235.47	1467.7	1713.22	1899.66	1852.55	1477.56	1085.84	1092.51	1350.32	1344.38	1209.13	1164.7	(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=	4531.25	4414.34	4049.44	3376.94	2655.77	1773.81	1194.41	1236.32	1889.04	2781.8	3646.8	4413.75	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	2452.06	1980.14	1738.14	1063.64	597.6	0	0	0	0	1069.44	1755.13	2417.29	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 13073.45 (98)

Space heating requirement in kWh/m²/year 49.52 (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		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	2452.06	1980.14	1738.14	1063.64	597.6	0	0	0	0	1069.44	1755.13	2417.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	2709.45	2188	1920.6	1175.29	660.33	0	0	0	0	1181.71	1939.37	2671.04	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 14445.8 (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)

	226.87	199.9	209.78	187.83	183.91	164.11	157.39	173	172.79	194.78	206.24	221.34		
Efficiency of water heater													79.8	(216)
(217)m=	89.48	89.4	89.21	88.71	87.73	79.8	79.8	79.8	79.8	88.67	89.24	89.49		(217)

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

(219)m=	253.53	223.6	235.15	211.73	209.63	205.65	197.23	216.8	216.53	219.68	231.1	247.32		
Total = Sum(219a)$_{1...12}$ =													2667.94	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			14445.8	
Water heating fuel used			2667.94	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		606.03		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		636.03	(231)
Electricity for lighting			674.51	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	502.71	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	92.84	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	83.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	88.97	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	888.42	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.15	(258)

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

SAP WorkSheet: Existing dwelling (SAP)

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	3120.29	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	576.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =				3696.57	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	330.1	(267)
Electricity for lighting	(232)	x	0.519	=	350.07	(268)
Total CO2, kg/year			sum of (265)…(271) =		4376.73	(272)
CO2 emissions per m²			(272) ÷ (4) =		16.58	(273)
EI rating (section 14)					81	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	1.22	=	17623.87	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	1.22	=	3254.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =				20878.76	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	1952.6	(267)
Electricity for lighting	(232)	x	0	=	2070.74	(268)
'Total Primary Energy			sum of (265)…(271) =		24902.1	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		94.33	(273)

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.18

Property Address: LG04

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77	(1a) x	3.2	(2a) =	246.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	246.4	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(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

SAP WorkSheet: Existing dwelling (SAP)

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.35 (23c)

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

(24a)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(24a)

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

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

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

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

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

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

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

(25)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			1.3	x1/[1/(1.8)+ 0.04] =	2.18			(27)
Windows Type 2			1.3	x1/[1/(1.8)+ 0.04] =	2.18			(27)
Windows Type 3			1.3	x1/[1/(1.8)+ 0.04] =	2.18			(27)
Windows Type 4			2.25	x1/[1/(1.8)+ 0.04] =	3.78			(27)
Windows Type 5			2.25	x1/[1/(1.8)+ 0.04] =	3.78			(27)
Windows Type 6			2.25	x1/[1/(1.8)+ 0.04] =	3.78			(27)
Walls Type1	16.64	7.1	9.54	x 0.25 =	2.38			(29)
Walls Type2	19	4.85	14.15	x 0.25 =	3.54			(29)
Walls Type3	5.5	1.3	4.2	x 0.25 =	1.05			(29)
Walls Type4	15	2.25	12.75	x 0.25 =	3.19			(29)
Total area of elements, m²			56.14					(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) = 36.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7721.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.42 (36)

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

Total fabric heat loss (33) + (36) = 44.61 (37)

SAP WorkSheet: Existing dwelling (SAP)

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=	48.86	48.09	47.31	43.42	42.64	38.76	38.76	37.98	40.31	42.64	44.2	45.75	(38)

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

(39)m=	93.47	92.69	91.92	88.03	87.25	83.36	83.36	82.58	84.92	87.25	88.81	90.36	

Average = Sum(39)$_{1…12}$ /12= 87.83 (39)

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

(40)m=	1.21	1.2	1.19	1.14	1.13	1.08	1.08	1.07	1.1	1.13	1.15	1.17	

Average = Sum(40)$_{1…12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (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 91.28 (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=	100.41	96.76	93.11	89.46	85.81	82.15	82.15	85.81	89.46	93.11	96.76	100.41	

Total = Sum(44)$_{1…12}$ = 1095.39 (44)

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

(45)m=	148.91	130.23	134.39	117.16	112.42	97.01	89.9	103.16	104.39	121.65	132.8	144.21	

Total = Sum(45)$_{1…12}$ = 1436.23 (45)

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

(46)m=	22.34	19.54	20.16	17.57	16.86	14.55	13.48	15.47	15.66	18.25	19.92	21.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(56)

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SAP WorkSheet: Existing dwelling (SAP)

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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	200.46	176.8	185.94	167.05	163.98	146.9	141.45	154.71	154.28	173.21	182.69	195.76	(62)

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

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

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

Output from water heater

(64)m=	200.46	176.8	185.94	167.05	163.98	146.9	141.45	154.71	154.28	173.21	182.69	195.76

Output from water heater (annual)$_{1...12}$ — 2043.22 (64)

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

(65)m=	90.75	80.55	85.93	78.87	78.62	72.17	71.13	75.54	74.62	81.69	84.07	89.19	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	47.49	42.18	34.3	25.97	19.41	16.39	17.71	23.02	30.89	39.23	45.78	48.81	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	317.99	321.29	312.98	295.28	272.93	251.93	237.9	234.6	242.91	260.62	282.96	303.96	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	(71)
Water heating gains (Table 5)													
(72)m=	121.98	119.87	115.49	109.54	105.68	100.23	95.61	101.53	103.64	109.8	116.76	119.88	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	590.35	586.24	565.67	533.68	500.91	471.44	454.11	462.04	480.34	512.54	548.4	575.54	(73)

6. Solar gains:

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

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

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+44 02072427272

SAP WorkSheet: Existing dwelling (SAP)

East	0.9x	1	x	1.3	x	19.64	x	0.5	x	0.9	=	20.68	(76)
East	0.9x	1	x	1.3	x	19.64	x	0.5	x	0.9	=	20.68	(76)
East	0.9x	1	x	2.25	x	19.64	x	0.5	x	0.9	=	35.79	(76)
East	0.9x	1	x	2.25	x	19.64	x	0.5	x	0.9	=	17.9	(76)
East	0.9x	1	x	1.3	x	38.42	x	0.5	x	0.9	=	40.46	(76)
East	0.9x	1	x	1.3	x	38.42	x	0.5	x	0.9	=	40.46	(76)
East	0.9x	1	x	2.25	x	38.42	x	0.5	x	0.9	=	70.02	(76)
East	0.9x	1	x	2.25	x	38.42	x	0.5	x	0.9	=	35.01	(76)
East	0.9x	1	x	1.3	x	63.27	x	0.5	x	0.9	=	66.63	(76)
East	0.9x	1	x	1.3	x	63.27	x	0.5	x	0.9	=	66.63	(76)
East	0.9x	1	x	2.25	x	63.27	x	0.5	x	0.9	=	115.32	(76)
East	0.9x	1	x	2.25	x	63.27	x	0.5	x	0.9	=	57.66	(76)
East	0.9x	1	x	1.3	x	92.28	x	0.5	x	0.9	=	97.17	(76)
East	0.9x	1	x	1.3	x	92.28	x	0.5	x	0.9	=	97.17	(76)
East	0.9x	1	x	2.25	x	92.28	x	0.5	x	0.9	=	168.18	(76)
East	0.9x	1	x	2.25	x	92.28	x	0.5	x	0.9	=	84.09	(76)
East	0.9x	1	x	1.3	x	113.09	x	0.5	x	0.9	=	119.09	(76)
East	0.9x	1	x	1.3	x	113.09	x	0.5	x	0.9	=	119.09	(76)
East	0.9x	1	x	2.25	x	113.09	x	0.5	x	0.9	=	206.11	(76)
East	0.9x	1	x	2.25	x	113.09	x	0.5	x	0.9	=	103.06	(76)
East	0.9x	1	x	1.3	x	115.77	x	0.5	x	0.9	=	121.91	(76)
East	0.9x	1	x	1.3	x	115.77	x	0.5	x	0.9	=	121.91	(76)
East	0.9x	1	x	2.25	x	115.77	x	0.5	x	0.9	=	210.99	(76)
East	0.9x	1	x	2.25	x	115.77	x	0.5	x	0.9	=	105.5	(76)
East	0.9x	1	x	1.3	x	110.22	x	0.5	x	0.9	=	116.06	(76)
East	0.9x	1	x	1.3	x	110.22	x	0.5	x	0.9	=	116.06	(76)
East	0.9x	1	x	2.25	x	110.22	x	0.5	x	0.9	=	200.87	(76)
East	0.9x	1	x	2.25	x	110.22	x	0.5	x	0.9	=	100.44	(76)
East	0.9x	1	x	1.3	x	94.68	x	0.5	x	0.9	=	99.69	(76)
East	0.9x	1	x	1.3	x	94.68	x	0.5	x	0.9	=	99.69	(76)
East	0.9x	1	x	2.25	x	94.68	x	0.5	x	0.9	=	172.55	(76)
East	0.9x	1	x	2.25	x	94.68	x	0.5	x	0.9	=	86.27	(76)
East	0.9x	1	x	1.3	x	73.59	x	0.5	x	0.9	=	77.49	(76)
East	0.9x	1	x	1.3	x	73.59	x	0.5	x	0.9	=	77.49	(76)
East	0.9x	1	x	2.25	x	73.59	x	0.5	x	0.9	=	134.12	(76)
East	0.9x	1	x	2.25	x	73.59	x	0.5	x	0.9	=	67.06	(76)
East	0.9x	1	x	1.3	x	45.59	x	0.5	x	0.9	=	48.01	(76)
East	0.9x	1	x	1.3	x	45.59	x	0.5	x	0.9	=	48.01	(76)
East	0.9x	1	x	2.25	x	45.59	x	0.5	x	0.9	=	83.09	(76)
East	0.9x	1	x	2.25	x	45.59	x	0.5	x	0.9	=	41.54	(76)
East	0.9x	1	x	1.3	x	24.49	x	0.5	x	0.9	=	25.79	(76)

SAP WorkSheet: Existing dwelling (SAP)

East	0.9x	1	x	1.3	x	24.49	x	0.5	x	0.9	=	25.79	(76)
East	0.9x	1	x	2.25	x	24.49	x	0.5	x	0.9	=	44.63	(76)
East	0.9x	1	x	2.25	x	24.49	x	0.5	x	0.9	=	22.32	(76)
East	0.9x	1	x	1.3	x	16.15	x	0.5	x	0.9	=	17.01	(76)
East	0.9x	1	x	1.3	x	16.15	x	0.5	x	0.9	=	17.01	(76)
East	0.9x	1	x	2.25	x	16.15	x	0.5	x	0.9	=	29.44	(76)
East	0.9x	1	x	2.25	x	16.15	x	0.5	x	0.9	=	14.72	(76)
South	0.9x	1	x	1.3	x	46.75	x	0.5	x	0.9	=	24.61	(78)
South	0.9x	1	x	2.25	x	46.75	x	0.5	x	0.9	=	42.6	(78)
South	0.9x	1	x	1.3	x	76.57	x	0.5	x	0.9	=	40.31	(78)
South	0.9x	1	x	2.25	x	76.57	x	0.5	x	0.9	=	69.77	(78)
South	0.9x	1	x	1.3	x	97.53	x	0.5	x	0.9	=	51.35	(78)
South	0.9x	1	x	2.25	x	97.53	x	0.5	x	0.9	=	88.88	(78)
South	0.9x	1	x	1.3	x	110.23	x	0.5	x	0.9	=	58.04	(78)
South	0.9x	1	x	2.25	x	110.23	x	0.5	x	0.9	=	100.45	(78)
South	0.9x	1	x	1.3	x	114.87	x	0.5	x	0.9	=	60.48	(78)
South	0.9x	1	x	2.25	x	114.87	x	0.5	x	0.9	=	104.68	(78)
South	0.9x	1	x	1.3	x	110.55	x	0.5	x	0.9	=	58.2	(78)
South	0.9x	1	x	2.25	x	110.55	x	0.5	x	0.9	=	100.74	(78)
South	0.9x	1	x	1.3	x	108.01	x	0.5	x	0.9	=	56.87	(78)
South	0.9x	1	x	2.25	x	108.01	x	0.5	x	0.9	=	98.43	(78)
South	0.9x	1	x	1.3	x	104.89	x	0.5	x	0.9	=	55.23	(78)
South	0.9x	1	x	2.25	x	104.89	x	0.5	x	0.9	=	95.59	(78)
South	0.9x	1	x	1.3	x	101.89	x	0.5	x	0.9	=	53.64	(78)
South	0.9x	1	x	2.25	x	101.89	x	0.5	x	0.9	=	92.84	(78)
South	0.9x	1	x	1.3	x	82.59	x	0.5	x	0.9	=	43.48	(78)
South	0.9x	1	x	2.25	x	82.59	x	0.5	x	0.9	=	75.26	(78)
South	0.9x	1	x	1.3	x	55.42	x	0.5	x	0.9	=	29.18	(78)
South	0.9x	1	x	2.25	x	55.42	x	0.5	x	0.9	=	50.5	(78)
South	0.9x	1	x	1.3	x	40.4	x	0.5	x	0.9	=	21.27	(78)
South	0.9x	1	x	2.25	x	40.4	x	0.5	x	0.9	=	36.81	(78)

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

(83)m=	162.27	296.03	446.46	605.1	712.5	719.24	688.72	609.02	502.64	339.38	198.2	136.25	(83)

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

(84)m=	752.63	882.27	1012.12	1138.78	1213.41	1190.68	1142.83	1071.06	982.98	851.91	746.59	711.79	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.87	0.81	0.7	0.57	0.42	0.31	0.34	0.53	0.75	0.87	0.92	(86)

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

(87)m=	19.01	19.35	19.82	20.37	20.72	20.92	20.97	20.96	20.84	20.37	19.65	19.01	(87)

SAP WorkSheet: Existing dwelling (SAP)

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

(88)m=	19.91	19.92	19.93	19.97	19.97	20.02	20.02	20.02	20	19.97	19.96	19.94	(88)

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

(89)m=	0.9	0.86	0.79	0.67	0.52	0.36	0.24	0.27	0.46	0.71	0.85	0.91	(89)

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

(90)m=	17.31	17.79	18.46	19.23	19.67	19.94	20	20	19.85	19.25	18.25	17.33	(90)

fLA = Living area ÷ (4) = 0.39 (91)

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

(92)m=	17.97	18.4	18.99	19.67	20.08	20.32	20.38	20.38	20.23	19.68	18.79	17.98	(92)

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

(93)m=	17.97	18.4	18.99	19.67	20.08	20.32	20.38	20.38	20.23	19.68	18.79	17.98	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.87	0.83	0.76	0.65	0.53	0.38	0.27	0.3	0.48	0.7	0.83	0.88	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	656.53	731.27	771.27	745.69	640.23	452.22	307.91	319.16	471.31	594.76	618.92	628.44	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1277.99	1251.5	1147.93	948.46	731.19	477	314.9	328.34	520.71	792.48	1038.37	1245.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	462.37	349.59	280.24	145.99	67.67	0	0	0	0	147.1	302.01	459.06	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2214.03 (98)

Space heating requirement in kWh/m²/year 28.75 (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		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	462.37	349.59	280.24	145.99	67.67	0	0	0	0	147.1	302.01	459.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	510.91	386.29	309.65	161.32	74.77	0	0	0	0	162.54	333.71	507.24	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2446.44 (211)

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

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

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

SAP WorkSheet: Existing dwelling (SAP)

Water heating

Output from water heater (calculated above)

200.46	176.8	185.94	167.05	163.98	146.9	141.45	154.71	154.28	173.21	182.69	195.76

Efficiency of water heater 79.8 (216)

(217)m=	86.97	86.6	85.91	84.46	82.65	79.8	79.8	79.8	79.8	84.38	86.15	87.01	(217)

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

(219)m=	230.48	204.16	216.45	197.8	198.39	184.09	177.25	193.87	193.33	205.27	212.06	224.98

Total = Sum(219a)$_{1...12}$ = 2438.13 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2446.44	
Water heating fuel used		2438.13	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	176.76		(230a)
central heating pump:	30		(230c)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		206.76	(231)
Electricity for lighting		335.44	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	85.14	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	84.85	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	27.27	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	44.24	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 361.5 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)		82.64	(258)

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	=	528.43	(261)

SAP WorkSheet: Existing dwelling (SAP)

Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	526.64 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1055.07 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	107.31 (267)
Electricity for lighting	(232) x	0.519	=	174.09 (268)
Total CO2, kg/year		sum of (265)…(271) =		1336.47 (272)
CO2 emissions per m²		(272) ÷ (4) =		17.36 (273)
EI rating (section 14)				85 (274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year
Space heating (main system 1)	(211) x	1.22	=	2984.65 (261)
Space heating (secondary)	(215) x	3.07	=	0 (263)
Energy for water heating	(219) x	1.22	=	2974.52 (264)
Space and water heating	(261) + (262) + (263) + (264) =			5959.17 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	634.75 (267)
Electricity for lighting	(232) x	0	=	1029.81 (268)
'Total Primary Energy		sum of (265)…(271) =		7623.73 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =		99.01 (273)

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SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.18

Property Address: GF03

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121	(1a) x	3.2	(2a) =	387.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		387.2	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(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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SAP WorkSheet: Existing dwelling (SAP)

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

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

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

(24a)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(24a)

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

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

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

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

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

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

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

(25)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.7	x1/[1/(1.8)+ 0.04]		=	4.53			(27)
Windows Type 2			1.8	x1/[1/(1.8)+ 0.04]		=	3.02			(27)
Windows Type 3			4.4	x1/[1/(1.8)+ 0.04]		=	7.39			(27)
Windows Type 4			2.16	x1/[1/(1.8)+ 0.04]		=	3.63			(27)
Windows Type 5			5.61	x1/[1/(1.8)+ 0.04]		=	9.42			(27)
Walls Type1	6	0	6	x	0.25	=	1.5			(29)
Walls Type2	14	2.7	11.3	x	0.25	=	2.82			(29)
Walls Type3	40.5	8	32.5	x	0.25	=	8.12			(29)
Walls Type4	22	9.93	12.07	x	0.25	=	3.02			(29)
Total area of elements, m²			82.5							(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) =	50.11	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	11755.3	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		12.38	(36)

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

Total fabric heat loss	(33) + (36) =	62.48	(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

SAP WorkSheet: Existing dwelling (SAP)

(38)m=	76.79	75.56	74.34	68.23	67.01	60.9	60.9	59.68	63.34	67.01	69.45	71.9	(38)

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

(39)m=	139.27	138.05	136.82	130.71	129.49	123.38	123.38	122.16	125.83	129.49	131.94	134.38	

Average = Sum(39)1…12 /12= 130.41 (39)

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

(40)m=	1.15	1.14	1.13	1.08	1.07	1.02	1.02	1.01	1.04	1.07	1.09	1.11	

Average = Sum(40)1…12 /12= 1.08 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.87 (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) + 36 102.29 (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=	112.52	108.43	104.34	100.25	96.16	92.06	92.06	96.16	100.25	104.34	108.43	112.52	

Total = Sum(44)1…12 = 1227.52 (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=	166.87	145.94	150.6	131.3	125.98	108.71	100.74	115.6	116.98	136.33	148.81	161.6	

Total = Sum(45)1…12 = 1609.48 (45)

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

(46)m=	25.03	21.89	22.59	19.69	18.9	16.31	15.11	17.34	17.55	20.45	22.32	24.24	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	218.42	192.51	202.15	181.19	177.54	158.6	152.29	167.15	166.87	187.88	198.7	213.16	(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=	218.42	192.51	202.15	181.19	177.54	158.6	152.29	167.15	166.87	187.88	198.7	213.16

Output from water heater (annual)$_{1...12}$ | 2216.47 | (64)

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

(65)m=	96.73	85.78	91.32	83.57	83.13	76.06	74.74	79.68	78.81	86.57	89.39	94.98	(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=	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	(66)

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

(67)m=	63.86	56.72	46.13	34.92	26.1	22.04	23.81	30.95	41.54	52.75	61.57	65.63	(67)

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

(68)m=	427.63	432.06	420.88	397.08	367.03	338.78	319.91	315.48	326.66	350.46	380.52	408.76	(68)

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

(69)m=	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	(71)

Water heating gains (Table 5)

(72)m=	130.01	127.65	122.74	116.07	111.74	105.64	100.45	107.1	109.46	116.36	124.16	127.66	(72)

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

(73)m=	736.9	731.84	705.16	663.47	620.28	581.87	559.59	568.94	593.07	634.99	681.65	717.46	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	1	x	2.7	x	46.75	x	0.5	x	0.9	=	51.12	(78)
South	0.9x	1	x	1.8	x	46.75	x	0.5	x	0.9	=	68.16	(78)

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South	0.9x	1	x	4.4	x	46.75	x	0.5	x	0.9	=	83.31	(78)
South	0.9x	1	x	2.7	x	76.57	x	0.5	x	0.9	=	83.73	(78)
South	0.9x	1	x	1.8	x	76.57	x	0.5	x	0.9	=	111.64	(78)
South	0.9x	1	x	4.4	x	76.57	x	0.5	x	0.9	=	136.44	(78)
South	0.9x	1	x	2.7	x	97.53	x	0.5	x	0.9	=	106.65	(78)
South	0.9x	1	x	1.8	x	97.53	x	0.5	x	0.9	=	142.2	(78)
South	0.9x	1	x	4.4	x	97.53	x	0.5	x	0.9	=	173.81	(78)
South	0.9x	1	x	2.7	x	110.23	x	0.5	x	0.9	=	120.54	(78)
South	0.9x	1	x	1.8	x	110.23	x	0.5	x	0.9	=	160.72	(78)
South	0.9x	1	x	4.4	x	110.23	x	0.5	x	0.9	=	196.44	(78)
South	0.9x	1	x	2.7	x	114.87	x	0.5	x	0.9	=	125.61	(78)
South	0.9x	1	x	1.8	x	114.87	x	0.5	x	0.9	=	167.48	(78)
South	0.9x	1	x	4.4	x	114.87	x	0.5	x	0.9	=	204.7	(78)
South	0.9x	1	x	2.7	x	110.55	x	0.5	x	0.9	=	120.88	(78)
South	0.9x	1	x	1.8	x	110.55	x	0.5	x	0.9	=	161.18	(78)
South	0.9x	1	x	4.4	x	110.55	x	0.5	x	0.9	=	197	(78)
South	0.9x	1	x	2.7	x	108.01	x	0.5	x	0.9	=	118.11	(78)
South	0.9x	1	x	1.8	x	108.01	x	0.5	x	0.9	=	157.48	(78)
South	0.9x	1	x	4.4	x	108.01	x	0.5	x	0.9	=	192.48	(78)
South	0.9x	1	x	2.7	x	104.89	x	0.5	x	0.9	=	114.7	(78)
South	0.9x	1	x	1.8	x	104.89	x	0.5	x	0.9	=	152.94	(78)
South	0.9x	1	x	4.4	x	104.89	x	0.5	x	0.9	=	186.92	(78)
South	0.9x	1	x	2.7	x	101.89	x	0.5	x	0.9	=	111.41	(78)
South	0.9x	1	x	1.8	x	101.89	x	0.5	x	0.9	=	148.55	(78)
South	0.9x	1	x	4.4	x	101.89	x	0.5	x	0.9	=	181.56	(78)
South	0.9x	1	x	2.7	x	82.59	x	0.5	x	0.9	=	90.31	(78)
South	0.9x	1	x	1.8	x	82.59	x	0.5	x	0.9	=	120.41	(78)
South	0.9x	1	x	4.4	x	82.59	x	0.5	x	0.9	=	147.17	(78)
South	0.9x	1	x	2.7	x	55.42	x	0.5	x	0.9	=	60.6	(78)
South	0.9x	1	x	1.8	x	55.42	x	0.5	x	0.9	=	80.8	(78)
South	0.9x	1	x	4.4	x	55.42	x	0.5	x	0.9	=	98.75	(78)
South	0.9x	1	x	2.7	x	40.4	x	0.5	x	0.9	=	44.18	(78)
South	0.9x	1	x	1.8	x	40.4	x	0.5	x	0.9	=	58.9	(78)
South	0.9x	1	x	4.4	x	40.4	x	0.5	x	0.9	=	71.99	(78)
West	0.9x	1	x	2.16	x	19.64	x	0.5	x	0.9	=	34.36	(80)
West	0.9x	1	x	5.61	x	19.64	x	0.5	x	0.9	=	44.62	(80)
West	0.9x	1	x	2.16	x	38.42	x	0.5	x	0.9	=	67.22	(80)
West	0.9x	1	x	5.61	x	38.42	x	0.5	x	0.9	=	87.29	(80)
West	0.9x	1	x	2.16	x	63.27	x	0.5	x	0.9	=	110.7	(80)
West	0.9x	1	x	5.61	x	63.27	x	0.5	x	0.9	=	143.76	(80)
West	0.9x	1	x	2.16	x	92.28	x	0.5	x	0.9	=	161.45	(80)

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West	0.9x	1	x	5.61	x	92.28	x	0.5	x	0.9	=	209.66	(80)
West	0.9x	1	x	2.16	x	113.09	x	0.5	x	0.9	=	197.87	(80)
West	0.9x	1	x	5.61	x	113.09	x	0.5	x	0.9	=	256.95	(80)
West	0.9x	1	x	2.16	x	115.77	x	0.5	x	0.9	=	202.55	(80)
West	0.9x	1	x	5.61	x	115.77	x	0.5	x	0.9	=	263.04	(80)
West	0.9x	1	x	2.16	x	110.22	x	0.5	x	0.9	=	192.84	(80)
West	0.9x	1	x	5.61	x	110.22	x	0.5	x	0.9	=	250.42	(80)
West	0.9x	1	x	2.16	x	94.68	x	0.5	x	0.9	=	165.64	(80)
West	0.9x	1	x	5.61	x	94.68	x	0.5	x	0.9	=	215.11	(80)
West	0.9x	1	x	2.16	x	73.59	x	0.5	x	0.9	=	128.75	(80)
West	0.9x	1	x	5.61	x	73.59	x	0.5	x	0.9	=	167.2	(80)
West	0.9x	1	x	2.16	x	45.59	x	0.5	x	0.9	=	79.76	(80)
West	0.9x	1	x	5.61	x	45.59	x	0.5	x	0.9	=	103.58	(80)
West	0.9x	1	x	2.16	x	24.49	x	0.5	x	0.9	=	42.85	(80)
West	0.9x	1	x	5.61	x	24.49	x	0.5	x	0.9	=	55.64	(80)
West	0.9x	1	x	2.16	x	16.15	x	0.5	x	0.9	=	28.26	(80)
West	0.9x	1	x	5.61	x	16.15	x	0.5	x	0.9	=	36.7	(80)

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

(83)m=	281.59	486.32	677.13	848.82	952.61	944.65	911.33	835.31	737.47	541.23	338.64	240.02	(83)

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

(84)m=	1018.49	1218.16	1382.28	1512.29	1572.89	1526.52	1470.92	1404.25	1330.54	1176.21	1020.29	957.48	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.89	0.84	0.75	0.63	0.47	0.35	0.38	0.57	0.78	0.9	0.94	(86)

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

(87)m=	18.97	19.32	19.78	20.32	20.67	20.9	20.97	20.96	20.82	20.35	19.61	18.97	(87)

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

(88)m=	19.96	19.97	19.98	20.02	20.03	20.07	20.07	20.08	20.05	20.03	20.01	19.99	(88)

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

(89)m=	0.92	0.88	0.82	0.72	0.58	0.42	0.28	0.31	0.51	0.75	0.88	0.93	(89)

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

(90)m=	17.27	17.78	18.43	19.2	19.67	19.98	20.05	20.05	19.88	19.26	18.23	17.29	(90)

fLA = Living area ÷ (4) = | 0.29 | (91)

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

(92)m=	17.77	18.24	18.82	19.52	19.96	20.25	20.32	20.32	20.16	19.58	18.64	17.78	(92)

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

(93)m=	17.77	18.24	18.82	19.52	19.96	20.25	20.32	20.32	20.16	19.58	18.64	17.78	(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=	0.9	0.85	0.79	0.7	0.58	0.43	0.3	0.33	0.51	0.73	0.85	0.91	(94)

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

(95)m=	912.17	1038.38	1095.72	1057	913.32	653.06	446.51	463.15	683.56	855.94	872.32	867.62	(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=	1876.1	1840.85	1686.24	1388.82	1070.08	696.88	458.49	478.29	762.33	1162.75	1522.45	1825.4	(97)

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

(98)m=	717.16	539.26	439.35	238.91	116.63	0	0	0	0	228.27	468.09	712.59

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3460.25 (98)

Space heating requirement in kWh/m²/year 28.6 (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		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	717.16	539.26	439.35	238.91	116.63	0	0	0	0	228.27	468.09	712.59	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	792.44	595.87	485.47	263.99	128.87	0	0	0	0	252.23	517.22	787.39	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3823.48 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

218.42	192.51	202.15	181.19	177.54	158.6	152.29	167.15	166.87	187.88	198.7	213.16

Efficiency of water heater 79.8 (216)

(217)m=	87.75	87.42	86.83	85.55	83.72	79.8	79.8	79.8	79.8	85.33	87.02	87.79	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	248.9	220.22	232.81	211.79	212.05	198.75	190.84	209.46	209.11	220.17	228.34	242.8

Total = Sum(219a)$_{1...12}$ = 2625.25 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3823.48
Water heating fuel used		2625.25
Electricity for pumps, fans and electric keep-hot		

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mechanical ventilation - balanced, extract or positive input from outside		330.67		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		360.67	(231)
Electricity for lighting			451.09	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	3.48	x 0.01 =	133.06	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		3.48	x 0.01 =	91.36	(247)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	47.57	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	59.5	(250)
Additional standing charges (Table 12)					120	(251)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				451.49	(255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.14	(257)
SAP rating (Section 12)		84.06	(258)

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	=	825.87	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	567.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1392.93	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	187.19	(267)
Electricity for lighting	(232)	x	0.519	=	234.12	(268)
Total CO2, kg/year			sum of (265)…(271) =		1814.23	(272)
CO2 emissions per m²			(272) ÷ (4) =		14.99	(273)
EI rating (section 14)					85	(274)

13a. Primary Energy

	Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x	1.22	=	4664.65	(261)

SAP WorkSheet: Existing dwelling (SAP)

Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		1.22	=	3202.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =				7867.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	1107.25	(267)
Electricity for lighting	(232) x		0	=	1384.84	(268)
'Total Primary Energy		sum of (265)…(271) =			10359.55	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			85.62	(273)

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SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.18

Property Address: FF01

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	72	(1a)	x	3.2	(2a)	=	230.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	230.4	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.35 (23c)

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

(24a)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(24a)

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

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

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

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

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

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

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

(25)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			1.44	x1/[1/(1.8)+ 0.04]	=	2.42			(27)
Windows Type 2			5.4	x1/[1/(1.8)+ 0.04]	=	9.07			(27)
Windows Type 3			1.8	x1/[1/(1.8)+ 0.04]	=	3.02			(27)
Walls Type1	36	5.76	30.24	x 0.25	=	7.56			(29)
Walls Type2	30	12.6	17.4	x 0.25	=	4.35			(29)
Total area of elements, m²			66						(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) = 42.74 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7842 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.9 (36)

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

Total fabric heat loss (33) + (36) = 52.64 (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=	45.69	44.96	44.24	40.6	39.87	36.24	36.24	35.51	37.69	39.87	41.33	42.78	(38)

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

(39)m=	98.33	97.6	96.87	93.24	92.51	88.88	88.88	88.15	90.33	92.51	93.97	95.42	

Average = Sum(39)$_{1…12}$ /12= 93.06 (39)

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

(40)m=	1.37	1.36	1.35	1.29	1.28	1.23	1.23	1.22	1.25	1.28	1.31	1.33

Average = Sum(40)1…12 /12= 1.29 (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 2.29 (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 93.34 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.68	98.94	95.21	91.48	87.74	84.01	84.01	87.74	91.48	95.21	98.94	102.68	
Total = Sum(44)1…12 =												1120.11	(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=	152.27	133.17	137.42	119.81	114.96	99.2	91.92	105.48	106.74	124.4	135.79	147.46	
Total = Sum(45)1…12 =												1468.63	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.84	19.98	20.61	17.97	17.24	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	203.82	179.74	188.98	169.7	166.51	149.09	143.48	157.04	156.63	175.95	185.68	199.01	(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=	203.82	179.74	188.98	169.7	166.51	149.09	143.48	157.04	156.63	175.95	185.68	199.01	

Output from water heater (annual)$_{1...12}$ 2075.63 (64)

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

(65)m=	91.87	81.53	86.94	79.75	79.47	72.9	71.81	76.32	75.4	82.61	85.06	90.27	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	45	39.97	32.51	24.61	18.4	15.53	16.78	21.81	29.28	37.17	43.39	46.25	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	301.37	304.5	296.62	279.84	258.66	238.76	225.46	222.33	230.22	246.99	268.17	288.07	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	(71)
Water heating gains (Table 5)													
(72)m=	123.48	121.33	116.85	110.76	106.81	101.24	96.51	102.58	104.73	111.03	118.14	121.34	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	569.79	565.73	545.9	515.14	483.8	455.46	438.69	446.65	464.15	495.13	529.63	555.59	(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	1	x	1.44	x	10.63	x	0.5	x	0.9	=	24.81	(74)
North	0.9x	1	x	1.44	x	20.32	x	0.5	x	0.9	=	47.4	(74)
North	0.9x	1	x	1.44	x	34.53	x	0.5	x	0.9	=	80.55	(74)
North	0.9x	1	x	1.44	x	55.46	x	0.5	x	0.9	=	129.39	(74)
North	0.9x	1	x	1.44	x	74.72	x	0.5	x	0.9	=	174.3	(74)

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North	0.9x	1	x	1.44	x	79.99	x	0.5	x	0.9	=	186.59	(74)
North	0.9x	1	x	1.44	x	74.68	x	0.5	x	0.9	=	174.21	(74)
North	0.9x	1	x	1.44	x	59.25	x	0.5	x	0.9	=	138.21	(74)
North	0.9x	1	x	1.44	x	41.52	x	0.5	x	0.9	=	96.85	(74)
North	0.9x	1	x	1.44	x	24.19	x	0.5	x	0.9	=	56.43	(74)
North	0.9x	1	x	1.44	x	13.12	x	0.5	x	0.9	=	30.6	(74)
North	0.9x	1	x	1.44	x	8.86	x	0.5	x	0.9	=	20.68	(74)
West	0.9x	1	x	5.4	x	19.64	x	0.5	x	0.9	=	85.91	(80)
West	0.9x	1	x	1.8	x	19.64	x	0.5	x	0.9	=	14.32	(80)
West	0.9x	1	x	5.4	x	38.42	x	0.5	x	0.9	=	168.05	(80)
West	0.9x	1	x	1.8	x	38.42	x	0.5	x	0.9	=	28.01	(80)
West	0.9x	1	x	5.4	x	63.27	x	0.5	x	0.9	=	276.76	(80)
West	0.9x	1	x	1.8	x	63.27	x	0.5	x	0.9	=	46.13	(80)
West	0.9x	1	x	5.4	x	92.28	x	0.5	x	0.9	=	403.63	(80)
West	0.9x	1	x	1.8	x	92.28	x	0.5	x	0.9	=	67.27	(80)
West	0.9x	1	x	5.4	x	113.09	x	0.5	x	0.9	=	494.67	(80)
West	0.9x	1	x	1.8	x	113.09	x	0.5	x	0.9	=	82.44	(80)
West	0.9x	1	x	5.4	x	115.77	x	0.5	x	0.9	=	506.38	(80)
West	0.9x	1	x	1.8	x	115.77	x	0.5	x	0.9	=	84.4	(80)
West	0.9x	1	x	5.4	x	110.22	x	0.5	x	0.9	=	482.09	(80)
West	0.9x	1	x	1.8	x	110.22	x	0.5	x	0.9	=	80.35	(80)
West	0.9x	1	x	5.4	x	94.68	x	0.5	x	0.9	=	414.11	(80)
West	0.9x	1	x	1.8	x	94.68	x	0.5	x	0.9	=	69.02	(80)
West	0.9x	1	x	5.4	x	73.59	x	0.5	x	0.9	=	321.88	(80)
West	0.9x	1	x	1.8	x	73.59	x	0.5	x	0.9	=	53.65	(80)
West	0.9x	1	x	5.4	x	45.59	x	0.5	x	0.9	=	199.41	(80)
West	0.9x	1	x	1.8	x	45.59	x	0.5	x	0.9	=	33.23	(80)
West	0.9x	1	x	5.4	x	24.49	x	0.5	x	0.9	=	107.12	(80)
West	0.9x	1	x	1.8	x	24.49	x	0.5	x	0.9	=	17.85	(80)
West	0.9x	1	x	5.4	x	16.15	x	0.5	x	0.9	=	70.65	(80)
West	0.9x	1	x	1.8	x	16.15	x	0.5	x	0.9	=	11.77	(80)

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

(83)m=	125.03	243.46	403.43	600.29	751.41	777.37	736.65	621.34	472.38	289.07	155.57	103.1	(83)

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

(84)m=	694.82	809.19	949.34	1115.43	1235.21	1232.83	1175.34	1067.99	936.53	784.2	685.2	658.69	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.89	0.83	0.71	0.57	0.42	0.32	0.36	0.56	0.78	0.89	0.93	(86)

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

(87)m=	18.68	19.02	19.56	20.21	20.64	20.89	20.96	20.94	20.76	20.17	19.36	18.68	(87)

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

(88)m=	19.79	19.8	19.81	19.84	19.85	19.89	19.89	19.9	19.88	19.85	19.84	19.82	(88)

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

(89)m=	0.91	0.87	0.8	0.68	0.52	0.36	0.24	0.28	0.49	0.74	0.87	0.92	(89)

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

(90)m=	16.77	17.26	18.01	18.92	19.48	19.8	19.87	19.87	19.66	18.89	17.76	16.78	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	17.44	17.87	18.55	19.37	19.88	20.17	20.25	20.24	20.04	19.34	18.32	17.44	(92)

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

(93)m=	17.44	17.87	18.55	19.37	19.88	20.17	20.25	20.24	20.04	19.34	18.32	17.44	(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=	0.88	0.84	0.77	0.66	0.52	0.38	0.27	0.3	0.5	0.72	0.84	0.89	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	609.69	679.08	733.35	736.13	648.07	463.84	314.66	325.41	469.14	564.63	575.42	584.4	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1291.64	1265.87	1167.09	976.33	756.92	495.48	324.14	338.54	536.57	808.19	1054.05	1263.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	507.37	394.32	322.7	172.94	80.98	0	0	0	0	181.2	344.61	505.13	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2509.27 (98)

Space heating requirement in kWh/m²/year 34.85 (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		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	507.37	394.32	322.7	172.94	80.98	0	0	0	0	181.2	344.61	505.13	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	560.63	435.72	356.58	191.1	89.48	0	0	0	0	200.22	380.78	558.16	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2772.67 (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)

SAP WorkSheet: Existing dwelling (SAP)

Water heating

Output from water heater (calculated above)

	203.82	179.74	188.98	169.7	166.51	149.09	143.48	157.04	156.63	175.95	185.68	199.01	
Efficiency of water heater												79.8	(216)
(217)m=	87.15	86.85	86.23	84.86	83.01	79.8	79.8	79.8	79.8	84.89	86.44	87.2	(217)

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

(219)m=	233.87	206.94	219.15	199.96	200.59	186.83	179.8	196.79	196.28	207.27	214.81	228.24	
Total = Sum(219a)$_{1...12}$ =												2470.53	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2772.67	
Water heating fuel used		2470.53	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	165.28		(230a)
central heating pump:	30		(230c)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		195.28	(231)
Electricity for lighting		317.91	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	96.49	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	85.97	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	25.76	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	41.93	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	370.15	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.46	(258)

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	=	598.9	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.63	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1132.53	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	101.35	(267)
Electricity for lighting	(232) x	0.519	=	164.99	(268)
Total CO2, kg/year		sum of (265)…(271) =		1398.88	(272)
CO2 emissions per m²		(272) ÷ (4) =		19.43	(273)
EI rating (section 14)				84	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3382.66	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3014.04	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6396.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	599.51	(267)
Electricity for lighting	(232) x	0	=	975.98	(268)
‘Total Primary Energy		sum of (265)…(271) =		7972.19	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		110.72	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.18

Property Address: SF03

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	156	(1a) x	3.2	(2a) =	499.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	156	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	499.2	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.65	(23c)

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

(24a)m=	0.61	0.6	0.59	0.54	0.53	0.49	0.49	0.48	0.5	0.53	0.55	0.57	(24a)

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

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

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

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

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

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

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

(25)m=	0.61	0.6	0.59	0.54	0.53	0.49	0.49	0.48	0.5	0.53	0.55	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			3.04	x1/[1/(1.8)+ 0.04]		=	5.1			(27)
Windows Type 2			3.23	x1/[1/(1.8)+ 0.04]		=	5.42			(27)
Windows Type 3			3.52	x1/[1/(1.8)+ 0.04]		=	5.91			(27)
Windows Type 4			3.36	x1/[1/(1.8)+ 0.04]		=	5.64			(27)
Windows Type 5			3.52	x1/[1/(1.8)+ 0.04]		=	5.91			(27)
Walls Type1	15	3.04	11.96	x	0.25	=	2.99			(29)
Walls Type2	21	3.23	17.77	x	0.25	=	4.44			(29)
Walls Type3	27.5	6.88	20.62	x	0.25	=	5.16			(29)
Walls Type4	22.5	3.52	18.98	x	0.25	=	4.75			(29)
Total area of elements, m²			86							(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) =	45.32	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	13172.7	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(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		12.9	(36)

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

Total fabric heat loss	(33) + (36) =	58.22	(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=	100.4	98.82	97.25	89.37	87.79	79.92	79.92	78.34	83.07	87.79	90.94	94.1	(38)

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

(39)m=	158.62	157.04	155.47	147.59	146.02	138.14	138.14	136.57	141.29	146.02	149.17	152.32	

Average = Sum(39)$_{1…12}$ /12= 147.2 (39)

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

(40)m=	1.02	1.01	1	0.95	0.94	0.89	0.89	0.88	0.91	0.94	0.96	0.98	

Average = Sum(40)$_{1…12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.94 (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) + 36 109.58 (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=	120.54	116.15	111.77	107.39	103.01	98.62	98.62	103.01	107.39	111.77	116.15	120.54	

Total = Sum(44)$_{1…12}$ = 1314.96 (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=	178.75	156.34	161.33	140.65	134.96	116.46	107.92	123.83	125.31	146.04	159.41	173.11	

Total = Sum(45)$_{1…12}$ = 1724.12 (45)

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

(46)m=	26.81	23.45	24.2	21.1	20.24	17.47	16.19	18.58	18.8	21.91	23.91	25.97	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	230.31	202.9	212.88	190.54	186.51	166.35	159.47	175.39	175.2	197.59	209.3	224.67	(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=	230.31	202.9	212.88	190.54	186.51	166.35	159.47	175.39	175.2	197.59	209.3	224.67

Output from water heater (annual)1…12 | 2331.11 | (64)

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

(65)m=	100.68	89.23	94.88	86.68	86.12	78.63	77.12	82.42	81.58	89.8	92.92	98.8	(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=	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	(66)

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

(67)m=	75.53	67.09	54.56	41.3	30.88	26.07	28.17	36.61	49.14	62.39	72.82	77.63	(67)

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

(68)m=	488.02	493.09	480.33	453.16	418.86	386.63	365.1	360.04	372.8	399.96	434.26	466.49	(68)

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

(69)m=	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	(71)

Water heating gains (Table 5)

(72)m=	135.32	132.79	127.53	120.39	115.75	109.21	103.66	110.78	113.3	120.7	129.05	132.8	(72)

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

(73)m=	816.34	810.43	779.88	732.32	682.95	639.38	614.39	624.89	652.71	700.52	753.6	794.39	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	3.04	x	19.64	x	0.5	x	0.9	=	24.18	(76)
East	0.9x	1	x	3.23	x	19.64	x	0.5	x	0.9	=	25.69	(76)

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East	0.9x	1	x	3.04	x	38.42	x	0.5	x	0.9	=	47.3	(76)
East	0.9x	1	x	3.23	x	38.42	x	0.5	x	0.9	=	50.26	(76)
East	0.9x	1	x	3.04	x	63.27	x	0.5	x	0.9	=	77.9	(76)
East	0.9x	1	x	3.23	x	63.27	x	0.5	x	0.9	=	82.77	(76)
East	0.9x	1	x	3.04	x	92.28	x	0.5	x	0.9	=	113.62	(76)
East	0.9x	1	x	3.23	x	92.28	x	0.5	x	0.9	=	120.72	(76)
East	0.9x	1	x	3.04	x	113.09	x	0.5	x	0.9	=	139.24	(76)
East	0.9x	1	x	3.23	x	113.09	x	0.5	x	0.9	=	147.94	(76)
East	0.9x	1	x	3.04	x	115.77	x	0.5	x	0.9	=	142.54	(76)
East	0.9x	1	x	3.23	x	115.77	x	0.5	x	0.9	=	151.45	(76)
East	0.9x	1	x	3.04	x	110.22	x	0.5	x	0.9	=	135.7	(76)
East	0.9x	1	x	3.23	x	110.22	x	0.5	x	0.9	=	144.18	(76)
East	0.9x	1	x	3.04	x	94.68	x	0.5	x	0.9	=	116.56	(76)
East	0.9x	1	x	3.23	x	94.68	x	0.5	x	0.9	=	123.85	(76)
East	0.9x	1	x	3.04	x	73.59	x	0.5	x	0.9	=	90.6	(76)
East	0.9x	1	x	3.23	x	73.59	x	0.5	x	0.9	=	96.27	(76)
East	0.9x	1	x	3.04	x	45.59	x	0.5	x	0.9	=	56.13	(76)
East	0.9x	1	x	3.23	x	45.59	x	0.5	x	0.9	=	59.64	(76)
East	0.9x	1	x	3.04	x	24.49	x	0.5	x	0.9	=	30.15	(76)
East	0.9x	1	x	3.23	x	24.49	x	0.5	x	0.9	=	32.04	(76)
East	0.9x	1	x	3.04	x	16.15	x	0.5	x	0.9	=	19.89	(76)
East	0.9x	1	x	3.23	x	16.15	x	0.5	x	0.9	=	21.13	(76)
South	0.9x	1	x	3.52	x	46.75	x	0.5	x	0.9	=	66.65	(78)
South	0.9x	1	x	3.36	x	46.75	x	0.5	x	0.9	=	63.62	(78)
South	0.9x	1	x	3.52	x	46.75	x	0.5	x	0.9	=	66.65	(78)
South	0.9x	1	x	3.52	x	76.57	x	0.5	x	0.9	=	109.16	(78)
South	0.9x	1	x	3.36	x	76.57	x	0.5	x	0.9	=	104.19	(78)
South	0.9x	1	x	3.52	x	76.57	x	0.5	x	0.9	=	109.16	(78)
South	0.9x	1	x	3.52	x	97.53	x	0.5	x	0.9	=	139.04	(78)
South	0.9x	1	x	3.36	x	97.53	x	0.5	x	0.9	=	132.72	(78)
South	0.9x	1	x	3.52	x	97.53	x	0.5	x	0.9	=	139.04	(78)
South	0.9x	1	x	3.52	x	110.23	x	0.5	x	0.9	=	157.15	(78)
South	0.9x	1	x	3.36	x	110.23	x	0.5	x	0.9	=	150.01	(78)
South	0.9x	1	x	3.52	x	110.23	x	0.5	x	0.9	=	157.15	(78)
South	0.9x	1	x	3.52	x	114.87	x	0.5	x	0.9	=	163.76	(78)
South	0.9x	1	x	3.36	x	114.87	x	0.5	x	0.9	=	156.32	(78)
South	0.9x	1	x	3.52	x	114.87	x	0.5	x	0.9	=	163.76	(78)
South	0.9x	1	x	3.52	x	110.55	x	0.5	x	0.9	=	157.6	(78)
South	0.9x	1	x	3.36	x	110.55	x	0.5	x	0.9	=	150.43	(78)
South	0.9x	1	x	3.52	x	110.55	x	0.5	x	0.9	=	157.6	(78)
South	0.9x	1	x	3.52	x	108.01	x	0.5	x	0.9	=	153.98	(78)

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South	0.9x	1	x	3.36	x	108.01	x	0.5	x	0.9	=	146.98	(78)
South	0.9x	1	x	3.52	x	108.01	x	0.5	x	0.9	=	153.98	(78)
South	0.9x	1	x	3.52	x	104.89	x	0.5	x	0.9	=	149.54	(78)
South	0.9x	1	x	3.36	x	104.89	x	0.5	x	0.9	=	142.74	(78)
South	0.9x	1	x	3.52	x	104.89	x	0.5	x	0.9	=	149.54	(78)
South	0.9x	1	x	3.52	x	101.89	x	0.5	x	0.9	=	145.25	(78)
South	0.9x	1	x	3.36	x	101.89	x	0.5	x	0.9	=	138.65	(78)
South	0.9x	1	x	3.52	x	101.89	x	0.5	x	0.9	=	145.25	(78)
South	0.9x	1	x	3.52	x	82.59	x	0.5	x	0.9	=	117.73	(78)
South	0.9x	1	x	3.36	x	82.59	x	0.5	x	0.9	=	112.38	(78)
South	0.9x	1	x	3.52	x	82.59	x	0.5	x	0.9	=	117.73	(78)
South	0.9x	1	x	3.52	x	55.42	x	0.5	x	0.9	=	79	(78)
South	0.9x	1	x	3.36	x	55.42	x	0.5	x	0.9	=	75.41	(78)
South	0.9x	1	x	3.52	x	55.42	x	0.5	x	0.9	=	79	(78)
South	0.9x	1	x	3.52	x	40.4	x	0.5	x	0.9	=	57.59	(78)
South	0.9x	1	x	3.36	x	40.4	x	0.5	x	0.9	=	54.97	(78)
South	0.9x	1	x	3.52	x	40.4	x	0.5	x	0.9	=	57.59	(78)

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

(83)m=	246.79	420.07	571.49	698.64	771.02	759.61	734.83	682.23	616.01	463.62	295.6	211.17	(83)

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

(84)m=	1063.14	1230.5	1351.37	1430.95	1453.97	1398.99	1349.22	1307.12	1268.72	1164.14	1049.2	1005.56	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.95	0.93	0.89	0.82	0.72	0.57	0.43	0.45	0.65	0.84	0.93	0.96	(86)

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

(87)m=	19.04	19.33	19.73	20.25	20.62	20.88	20.96	20.96	20.81	20.33	19.65	19.06	(87)

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

(88)m=	20.07	20.08	20.09	20.13	20.14	20.18	20.18	20.19	20.16	20.14	20.12	20.1	(88)

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

(89)m=	0.95	0.92	0.88	0.8	0.68	0.51	0.36	0.38	0.59	0.81	0.92	0.95	(89)

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

(90)m=	17.44	17.87	18.45	19.2	19.71	20.07	20.15	20.16	19.97	19.33	18.36	17.49	(90)

fLA = Living area ÷ (4) = | 0.25 | (91)

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

(92)m=	17.84	18.23	18.77	19.46	19.93	20.27	20.36	20.36	20.18	19.58	18.68	17.88	(92)

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

(93)m=	17.84	18.23	18.77	19.46	19.93	20.27	20.36	20.36	20.18	19.58	18.68	17.88	(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

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Utilisation factor for gains, hm:

(94)m=	0.93	0.9	0.85	0.78	0.67	0.51	0.37	0.4	0.59	0.79	0.89	0.93	(94)

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

(95)m=	983.89	1101.63	1151.28	1113.88	979.63	720.22	501.84	519.44	752.25	921	938.39	938.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2147.58	2093.99	1907.14	1559.16	1202.37	783.59	518.82	540.18	858.82	1310.64	1727.56	2083.89	(97)

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

(98)m=	865.79	666.86	562.36	320.61	165.72	0	0	0	0	289.89	568.2	852.09

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4291.52 (98)

Space heating requirement in kWh/m²/year 27.51 (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 90.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	865.79	666.86	562.36	320.61	165.72	0	0	0	0	289.89	568.2	852.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	956.67	736.87	621.39	354.26	183.11	0	0	0	0	320.32	627.85	941.54	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4742.01 (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)

230.31	202.9	212.88	190.54	186.51	166.35	159.47	175.39	175.2	197.59	209.3	224.67

Efficiency of water heater 79.8 (216)

(217)m=	88.02	87.76	87.29	86.19	84.5	79.8	79.8	79.8	79.8	85.83	87.35	88.04	(217)

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

(219)m=	261.65	231.22	243.89	221.07	220.72	208.46	199.83	219.78	219.55	230.2	239.62	255.2

Total = Sum(219a)$_{1...12}$ = 2751.19 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4742.01
Water heating fuel used		2751.19
Electricity for pumps, fans and electric keep-hot		

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mechanical ventilation - balanced, extract or positive input from outside		520.11		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		550.11	(231)
Electricity for lighting			533.57	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	165.02	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	95.74	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	72.56	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	70.38	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			523.7	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.09	(257)
SAP rating (Section 12)		84.73	(258)

12a. CO_2 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	=	1024.27	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	594.26	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1618.53	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	285.51	(267)
Electricity for lighting	(232) x	0.519	=	276.92	(268)
Total CO2, kg/year		sum of (265)…(271) =		2180.96	(272)
CO2 emissions per m²		(272) ÷ (4) =		13.98	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	5785.25	(261)

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Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3356.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =			9141.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	1688.83	(267)
Electricity for lighting	(232) x	0	=	1638.06	(268)
'Total Primary Energy	sum of (265)…(271) =			12468.59	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			79.93	(273)

9.3. Appendix 3 – SAP Worksheets 'Be Clean'

(Refer to Appendix 2. 'Be Clean' and 'Be Lean' SAP Worksheets are identical)

9.4. Appendix 4 – SAP Worksheets 'Be Green'

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.18

Property Address: LG01

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	132	(1a)	x	3.2	(2a)	=	422.4	(3a)
Ground floor	132	(1b)	x	3.2	(2b)	=	422.4	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	264	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	844.8	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)		2	(9)
Additional infiltration	[(9)-1]x0.1 =	0.1	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.55	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.55	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.47	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.6	0.58	0.57	0.51	0.5	0.44	0.44	0.43	0.47	0.5	0.53	0.55

Calculate effective air change rate for the applicable case

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

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

(24a)m=	0.71	0.7	0.69	0.63	0.62	0.56	0.56	0.55	0.58	0.62	0.64	0.66	(24a)

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

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

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

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

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

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

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

(25)m=	0.71	0.7	0.69	0.63	0.62	0.56	0.56	0.55	0.58	0.62	0.64	0.66	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			4.75	x1/[1/(1.8)+ 0.04]		=	7.98			(27)
Windows Type 2			2	x1/[1/(1.8)+ 0.04]		=	3.36			(27)
Windows Type 3			4.75	x1/[1/(1.8)+ 0.04]		=	7.98			(27)
Windows Type 4			2	x1/[1/(1.8)+ 0.04]		=	3.36			(27)
Windows Type 5			2	x1/[1/(1.8)+ 0.04]		=	3.36			(27)
Windows Type 6			2	x1/[1/(1.8)+ 0.04]		=	3.36			(27)
Floor			132	x	0.2	=	26.4			(28)
Walls Type1	32	16.25	15.75	x	0.25	=	3.94			(29)
Walls Type2	40	4	36	x	0.25	=	9			(29)
Walls Type3	32	16.25	15.75	x	0.25	=	3.94			(29)
Walls Type4	22	0	22	x	0.25	=	5.5			(29)
Walls Type5	18	4	14	x	0.25	=	3.5			(29)
Total area of elements, m²			276							(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) =	120.28	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	34185	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(35)

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

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 41.4 | (36)

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

Total fabric heat loss (33) + (36) = | 161.68 | (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=	197.74	194.49	191.23	174.94	171.68	155.39	155.39	152.13	161.9	171.68	178.2	184.71	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(39)m=	359.42	356.17	352.91	336.62	333.36	317.07	317.07	313.81	323.58	333.36	339.87	346.39

Average = $Sum(39)_{1...12}$ /12= | 335.8 | (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(40)m=	1.36	1.35	1.34	1.28	1.26	1.2	1.2	1.19	1.23	1.26	1.29	1.31

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 3.09 | (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 | 107.47 | (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=	118.22	113.92	109.62	105.32	101.02	96.72	96.72	101.02	105.32	109.62	113.92	118.22

Total = $Sum(44)_{1...12}$ = | 1289.66 | (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=	175.32	153.33	158.22	137.94	132.36	114.22	105.84	121.45	122.9	143.23	156.35	169.78

Total = $Sum(45)_{1...12}$ = | 1690.95 | (45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	26.3	23	23.73	20.69	19.85	17.13	15.88	18.22	18.44	21.48	23.45	25.47	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 300 | (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 1.69 | (48)

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

Energy lost from water storage, kWh/year (48) x (49) = | 0.91 | (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.91	(55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	226.87	199.9	209.78	187.83	183.91	164.11	157.39	173	172.79	194.78	206.24	221.34	(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=	226.87	199.9	209.78	187.83	183.91	164.11	157.39	173	172.79	194.78	206.24	221.34	

Output from water heater (annual)$_{1...12}$ | 2297.95 | (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=	99.53	88.23	93.85	85.78	85.25	77.89	76.43	81.63	80.78	88.87	91.9	97.7	(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=	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	185.11	(66)

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

(67)m=	95.48	84.81	68.97	52.21	39.03	32.95	35.61	46.28	62.12	78.87	92.06	98.14	(67)

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

(68)m=	639.42	646.06	629.34	593.74	548.81	506.58	478.36	471.73	488.45	524.05	568.98	611.21	(68)

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

(69)m=	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	56.6	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	-123.41	(71)

Water heating gains (Table 5)

(72)m=	133.78	131.3	126.15	119.14	114.59	108.18	102.73	109.71	112.19	119.44	127.64	131.31	(72)

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

(73)m=	989.99	983.46	945.75	886.39	823.72	769.01	738	749.02	784.06	843.66	909.97	961.96	(73)

6. Solar gains:

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

SAP WorkSheet: Existing dwelling (SAP)

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	2	x	10.63	x	0.5	x	0.9	=	17.23	(74)
North	0.9x	1	x	2	x	10.63	x	0.5	x	0.9	=	17.23	(74)
North	0.9x	1	x	2	x	20.32	x	0.5	x	0.9	=	32.92	(74)
North	0.9x	1	x	2	x	20.32	x	0.5	x	0.9	=	32.92	(74)
North	0.9x	1	x	2	x	34.53	x	0.5	x	0.9	=	55.94	(74)
North	0.9x	1	x	2	x	34.53	x	0.5	x	0.9	=	55.94	(74)
North	0.9x	1	x	2	x	55.46	x	0.5	x	0.9	=	89.85	(74)
North	0.9x	1	x	2	x	55.46	x	0.5	x	0.9	=	89.85	(74)
North	0.9x	1	x	2	x	74.72	x	0.5	x	0.9	=	121.04	(74)
North	0.9x	1	x	2	x	74.72	x	0.5	x	0.9	=	121.04	(74)
North	0.9x	1	x	2	x	79.99	x	0.5	x	0.9	=	129.58	(74)
North	0.9x	1	x	2	x	79.99	x	0.5	x	0.9	=	129.58	(74)
North	0.9x	1	x	2	x	74.68	x	0.5	x	0.9	=	120.98	(74)
North	0.9x	1	x	2	x	74.68	x	0.5	x	0.9	=	120.98	(74)
North	0.9x	1	x	2	x	59.25	x	0.5	x	0.9	=	95.98	(74)
North	0.9x	1	x	2	x	59.25	x	0.5	x	0.9	=	95.98	(74)
North	0.9x	1	x	2	x	41.52	x	0.5	x	0.9	=	67.26	(74)
North	0.9x	1	x	2	x	41.52	x	0.5	x	0.9	=	67.26	(74)
North	0.9x	1	x	2	x	24.19	x	0.5	x	0.9	=	39.19	(74)
North	0.9x	1	x	2	x	24.19	x	0.5	x	0.9	=	39.19	(74)
North	0.9x	1	x	2	x	13.12	x	0.5	x	0.9	=	21.25	(74)
North	0.9x	1	x	2	x	13.12	x	0.5	x	0.9	=	21.25	(74)
North	0.9x	1	x	2	x	8.86	x	0.5	x	0.9	=	14.36	(74)
North	0.9x	1	x	2	x	8.86	x	0.5	x	0.9	=	14.36	(74)
West	0.9x	1	x	4.75	x	19.64	x	0.5	x	0.9	=	113.35	(80)
West	0.9x	1	x	2	x	19.64	x	0.5	x	0.9	=	15.91	(80)
West	0.9x	1	x	4.75	x	19.64	x	0.5	x	0.9	=	113.35	(80)
West	0.9x	1	x	2	x	19.64	x	0.5	x	0.9	=	15.91	(80)
West	0.9x	1	x	4.75	x	38.42	x	0.5	x	0.9	=	221.73	(80)
West	0.9x	1	x	2	x	38.42	x	0.5	x	0.9	=	31.12	(80)
West	0.9x	1	x	4.75	x	38.42	x	0.5	x	0.9	=	221.73	(80)
West	0.9x	1	x	2	x	38.42	x	0.5	x	0.9	=	31.12	(80)
West	0.9x	1	x	4.75	x	63.27	x	0.5	x	0.9	=	365.17	(80)
West	0.9x	1	x	2	x	63.27	x	0.5	x	0.9	=	51.25	(80)
West	0.9x	1	x	4.75	x	63.27	x	0.5	x	0.9	=	365.17	(80)
West	0.9x	1	x	2	x	63.27	x	0.5	x	0.9	=	51.25	(80)
West	0.9x	1	x	4.75	x	92.28	x	0.5	x	0.9	=	532.57	(80)
West	0.9x	1	x	2	x	92.28	x	0.5	x	0.9	=	74.75	(80)
West	0.9x	1	x	4.75	x	92.28	x	0.5	x	0.9	=	532.57	(80)

West	0.9x	1	x	2	x	92.28	x	0.5	x	0.9	=	74.75	(80)
West	0.9x	1	x	4.75	x	113.09	x	0.5	x	0.9	=	652.69	(80)
West	0.9x	1	x	2	x	113.09	x	0.5	x	0.9	=	91.61	(80)
West	0.9x	1	x	4.75	x	113.09	x	0.5	x	0.9	=	652.69	(80)
West	0.9x	1	x	2	x	113.09	x	0.5	x	0.9	=	91.61	(80)
West	0.9x	1	x	4.75	x	115.77	x	0.5	x	0.9	=	668.14	(80)
West	0.9x	1	x	2	x	115.77	x	0.5	x	0.9	=	93.77	(80)
West	0.9x	1	x	4.75	x	115.77	x	0.5	x	0.9	=	668.14	(80)
West	0.9x	1	x	2	x	115.77	x	0.5	x	0.9	=	93.77	(80)
West	0.9x	1	x	4.75	x	110.22	x	0.5	x	0.9	=	636.1	(80)
West	0.9x	1	x	2	x	110.22	x	0.5	x	0.9	=	89.28	(80)
West	0.9x	1	x	4.75	x	110.22	x	0.5	x	0.9	=	636.1	(80)
West	0.9x	1	x	2	x	110.22	x	0.5	x	0.9	=	89.28	(80)
West	0.9x	1	x	4.75	x	94.68	x	0.5	x	0.9	=	546.4	(80)
West	0.9x	1	x	2	x	94.68	x	0.5	x	0.9	=	76.69	(80)
West	0.9x	1	x	4.75	x	94.68	x	0.5	x	0.9	=	546.4	(80)
West	0.9x	1	x	2	x	94.68	x	0.5	x	0.9	=	76.69	(80)
West	0.9x	1	x	4.75	x	73.59	x	0.5	x	0.9	=	424.7	(80)
West	0.9x	1	x	2	x	73.59	x	0.5	x	0.9	=	59.61	(80)
West	0.9x	1	x	4.75	x	73.59	x	0.5	x	0.9	=	424.7	(80)
West	0.9x	1	x	2	x	73.59	x	0.5	x	0.9	=	59.61	(80)
West	0.9x	1	x	4.75	x	45.59	x	0.5	x	0.9	=	263.11	(80)
West	0.9x	1	x	2	x	45.59	x	0.5	x	0.9	=	36.93	(80)
West	0.9x	1	x	4.75	x	45.59	x	0.5	x	0.9	=	263.11	(80)
West	0.9x	1	x	2	x	45.59	x	0.5	x	0.9	=	36.93	(80)
West	0.9x	1	x	4.75	x	24.49	x	0.5	x	0.9	=	141.33	(80)
West	0.9x	1	x	2	x	24.49	x	0.5	x	0.9	=	19.84	(80)
West	0.9x	1	x	4.75	x	24.49	x	0.5	x	0.9	=	141.33	(80)
West	0.9x	1	x	2	x	24.49	x	0.5	x	0.9	=	19.84	(80)
West	0.9x	1	x	4.75	x	16.15	x	0.5	x	0.9	=	93.21	(80)
West	0.9x	1	x	2	x	16.15	x	0.5	x	0.9	=	13.08	(80)
West	0.9x	1	x	4.75	x	16.15	x	0.5	x	0.9	=	93.21	(80)
West	0.9x	1	x	2	x	16.15	x	0.5	x	0.9	=	13.08	(80)

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

(83)m=	292.97	571.55	944.71	1394.34	1730.66	1782.98	1692.7	1438.13	1103.13	678.44	364.84	241.31	(83)

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

(84)m=	1282.96	1555.01	1890.46	2280.73	2554.39	2551.99	2430.7	2187.15	1887.19	1522.1	1274.81	1203.27	(84)

7. Mean internal temperature (heating season)

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

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

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

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(86)m=	0.98	0.97	0.94	0.88	0.78	0.63	0.5	0.56	0.77	0.92	0.97	0.98	(86)

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

(87)m=	18.01	18.32	18.88	19.66	20.27	20.72	20.89	20.85	20.49	19.66	18.75	18.03	(87)

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

(88)m=	19.79	19.8	19.81	19.86	19.87	19.92	19.92	19.93	19.9	19.87	19.85	19.83	(88)

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

(89)m=	0.98	0.96	0.93	0.86	0.73	0.56	0.4	0.46	0.71	0.9	0.96	0.98	(89)

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

(90)m=	15.81	16.27	17.07	18.21	19.06	19.67	19.85	19.83	19.39	18.23	16.91	15.86	(90)

fLA = Living area ÷ (4) = 0.5 (91)

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

(92)m=	16.91	17.29	17.97	18.93	19.67	20.19	20.37	20.34	19.94	18.94	17.83	16.94	(92)

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

(93)m=	16.91	17.29	17.97	18.93	19.67	20.19	20.37	20.34	19.94	18.94	17.83	16.94	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.96	0.94	0.91	0.83	0.73	0.58	0.45	0.5	0.72	0.88	0.95	0.97	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1235.47	1467.7	1713.22	1899.66	1852.55	1477.56	1085.84	1092.51	1350.32	1344.38	1209.13	1164.7	(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=	4531.25	4414.34	4049.44	3376.94	2655.77	1773.81	1194.41	1236.32	1889.04	2781.8	3646.8	4413.75	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	2452.06	1980.14	1738.14	1063.64	597.6	0	0	0	0	1069.44	1755.13	2417.29	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 13073.45 (98)

Space heating requirement in kWh/m²/year 49.52 (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		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	2452.06	1980.14	1738.14	1063.64	597.6	0	0	0	0	1069.44	1755.13	2417.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	2709.45	2188	1920.6	1175.29	660.33	0	0	0	0	1181.71	1939.37	2671.04	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 14445.8 (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)

226.87	199.9	209.78	187.83	183.91	164.11	157.39	173	172.79	194.78	206.24	221.34

Efficiency of water heater 79.8 (216)

(217)m=	89.48	89.4	89.21	88.71	87.73	79.8	79.8	79.8	79.8	88.67	89.24	89.49	(217)

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

(219)m=	253.53	223.6	235.15	211.73	209.63	205.65	197.23	216.8	216.53	219.68	231.1	247.32

Total = Sum(219a)$_{1...12}$ = 2667.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		14445.8	
Water heating fuel used		2667.94	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	721.46		(230a)
central heating pump:	30		(230c)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		751.46	(231)
Electricity for lighting		674.51	(232)
Electricity generated by PVs		-714.86	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	502.71	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	92.84	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	99.12	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	88.97	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	0	(252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 903.64 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.23	(257)

SAP WorkSheet: Existing dwelling (SAP)

SAP rating (Section 12)				82.87	(258)

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	=	3120.29	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	576.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3696.57	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	390.01	(267)
Electricity for lighting	(232) x	0.519	=	350.07	(268)
Energy saving/generation technologies Item 1		0.519	=	-371.01	(269)
Total CO2, kg/year		sum of (265)…(271) =		4065.63	(272)
CO2 emissions per m²		(272) ÷ (4) =		15.4	(273)
EI rating (section 14)				82	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	17623.87	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3254.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =			20878.76	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	2306.98	(267)
Electricity for lighting	(232) x	0	=	2070.74	(268)
Energy saving/generation technologies Item 1		3.07	=	-2194.63	(269)
'Total Primary Energy		sum of (265)…(271) =		23061.85	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		87.36	(273)

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.18

Property Address: LG04

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77	(1a) x	3.2	(2a) =	246.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	246.4	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

SAP WorkSheet: Existing dwelling (SAP)

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

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

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

(24a)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(24a)

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

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

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

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

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

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

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

(25)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			1.3	x1/[1/(1.8)+ 0.04]	=	2.18			(27)
Windows Type 2			1.3	x1/[1/(1.8)+ 0.04]	=	2.18			(27)
Windows Type 3			1.3	x1/[1/(1.8)+ 0.04]	=	2.18			(27)
Windows Type 4			2.25	x1/[1/(1.8)+ 0.04]	=	3.78			(27)
Windows Type 5			2.25	x1/[1/(1.8)+ 0.04]	=	3.78			(27)
Windows Type 6			2.25	x1/[1/(1.8)+ 0.04]	=	3.78			(27)
Walls Type1	16.64	7.1	9.54	x 0.25	=	2.38			(29)
Walls Type2	19	4.85	14.15	x 0.25	=	3.54			(29)
Walls Type3	5.5	1.3	4.2	x 0.25	=	1.05			(29)
Walls Type4	15	2.25	12.75	x 0.25	=	3.19			(29)
Total area of elements, m²			56.14						(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) =	36.19	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	7721.6	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Low	100	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		8.42	(36)

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

Total fabric heat loss	(33) + (36) =	44.61	(37)

SAP WorkSheet: Existing dwelling (SAP)

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=	48.86	48.09	47.31	43.42	42.64	38.76	38.76	37.98	40.31	42.64	44.2	45.75	(38)

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

(39)m=	93.47	92.69	91.92	88.03	87.25	83.36	83.36	82.58	84.92	87.25	88.81	90.36	

Average = Sum(39)$_{1…12}$ /12= 87.83 (39)

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

(40)m=	1.21	1.2	1.19	1.14	1.13	1.08	1.08	1.07	1.1	1.13	1.15	1.17	

Average = Sum(40)$_{1…12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.4 (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 91.28 (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=	100.41	96.76	93.11	89.46	85.81	82.15	82.15	85.81	89.46	93.11	96.76	100.41	

Total = Sum(44)$_{1…12}$ = 1095.39 (44)

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

(45)m=	148.91	130.23	134.39	117.16	112.42	97.01	89.9	103.16	104.39	121.65	132.8	144.21	

Total = Sum(45)$_{1…12}$ = 1436.23 (45)

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

(46)m=	22.34	19.54	20.16	17.57	16.86	14.55	13.48	15.47	15.66	18.25	19.92	21.63	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	200.46	176.8	185.94	167.05	163.98	146.9	141.45	154.71	154.28	173.21	182.69	195.76	(62)

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

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

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

Output from water heater

(64)m=	200.46	176.8	185.94	167.05	163.98	146.9	141.45	154.71	154.28	173.21	182.69	195.76

Output from water heater (annual)$_{1...12}$ — 2043.22 (64)

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

(65)m=	90.75	80.55	85.93	78.87	78.62	72.17	71.13	75.54	74.62	81.69	84.07	89.19	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	144.21	(66)

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

(67)m=	47.49	42.18	34.3	25.97	19.41	16.39	17.71	23.02	30.89	39.23	45.78	48.81	(67)

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

(68)m=	317.99	321.29	312.98	295.28	272.93	251.93	237.9	234.6	242.91	260.62	282.96	303.96	(68)

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

(69)m=	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	51.82	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	-96.14	(71)

Water heating gains (Table 5)

(72)m=	121.98	119.87	115.49	109.54	105.68	100.23	95.61	101.53	103.64	109.8	116.76	119.88	(72)

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

(73)m=	590.35	586.24	565.67	533.68	500.91	471.44	454.11	462.04	480.34	512.54	548.4	575.54	(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)

SAP WorkSheet: Existing dwelling (SAP)

East	0.9x	1	x	1.3	x	19.64	x	0.5	x	0.9	=	20.68	(76)
East	0.9x	1	x	1.3	x	19.64	x	0.5	x	0.9	=	20.68	(76)
East	0.9x	1	x	2.25	x	19.64	x	0.5	x	0.9	=	35.79	(76)
East	0.9x	1	x	2.25	x	19.64	x	0.5	x	0.9	=	17.9	(76)
East	0.9x	1	x	1.3	x	38.42	x	0.5	x	0.9	=	40.46	(76)
East	0.9x	1	x	1.3	x	38.42	x	0.5	x	0.9	=	40.46	(76)
East	0.9x	1	x	2.25	x	38.42	x	0.5	x	0.9	=	70.02	(76)
East	0.9x	1	x	2.25	x	38.42	x	0.5	x	0.9	=	35.01	(76)
East	0.9x	1	x	1.3	x	63.27	x	0.5	x	0.9	=	66.63	(76)
East	0.9x	1	x	1.3	x	63.27	x	0.5	x	0.9	=	66.63	(76)
East	0.9x	1	x	2.25	x	63.27	x	0.5	x	0.9	=	115.32	(76)
East	0.9x	1	x	2.25	x	63.27	x	0.5	x	0.9	=	57.66	(76)
East	0.9x	1	x	1.3	x	92.28	x	0.5	x	0.9	=	97.17	(76)
East	0.9x	1	x	1.3	x	92.28	x	0.5	x	0.9	=	97.17	(76)
East	0.9x	1	x	2.25	x	92.28	x	0.5	x	0.9	=	168.18	(76)
East	0.9x	1	x	2.25	x	92.28	x	0.5	x	0.9	=	84.09	(76)
East	0.9x	1	x	1.3	x	113.09	x	0.5	x	0.9	=	119.09	(76)
East	0.9x	1	x	1.3	x	113.09	x	0.5	x	0.9	=	119.09	(76)
East	0.9x	1	x	2.25	x	113.09	x	0.5	x	0.9	=	206.11	(76)
East	0.9x	1	x	2.25	x	113.09	x	0.5	x	0.9	=	103.06	(76)
East	0.9x	1	x	1.3	x	115.77	x	0.5	x	0.9	=	121.91	(76)
East	0.9x	1	x	1.3	x	115.77	x	0.5	x	0.9	=	121.91	(76)
East	0.9x	1	x	2.25	x	115.77	x	0.5	x	0.9	=	210.99	(76)
East	0.9x	1	x	2.25	x	115.77	x	0.5	x	0.9	=	105.5	(76)
East	0.9x	1	x	1.3	x	110.22	x	0.5	x	0.9	=	116.06	(76)
East	0.9x	1	x	1.3	x	110.22	x	0.5	x	0.9	=	116.06	(76)
East	0.9x	1	x	2.25	x	110.22	x	0.5	x	0.9	=	200.87	(76)
East	0.9x	1	x	2.25	x	110.22	x	0.5	x	0.9	=	100.44	(76)
East	0.9x	1	x	1.3	x	94.68	x	0.5	x	0.9	=	99.69	(76)
East	0.9x	1	x	1.3	x	94.68	x	0.5	x	0.9	=	99.69	(76)
East	0.9x	1	x	2.25	x	94.68	x	0.5	x	0.9	=	172.55	(76)
East	0.9x	1	x	2.25	x	94.68	x	0.5	x	0.9	=	86.27	(76)
East	0.9x	1	x	1.3	x	73.59	x	0.5	x	0.9	=	77.49	(76)
East	0.9x	1	x	1.3	x	73.59	x	0.5	x	0.9	=	77.49	(76)
East	0.9x	1	x	2.25	x	73.59	x	0.5	x	0.9	=	134.12	(76)
East	0.9x	1	x	2.25	x	73.59	x	0.5	x	0.9	=	67.06	(76)
East	0.9x	1	x	1.3	x	45.59	x	0.5	x	0.9	=	48.01	(76)
East	0.9x	1	x	1.3	x	45.59	x	0.5	x	0.9	=	48.01	(76)
East	0.9x	1	x	2.25	x	45.59	x	0.5	x	0.9	=	83.09	(76)
East	0.9x	1	x	2.25	x	45.59	x	0.5	x	0.9	=	41.54	(76)
East	0.9x	1	x	1.3	x	24.49	x	0.5	x	0.9	=	25.79	(76)

SAP WorkSheet: Existing dwelling (SAP)

East	0.9x	1	x	1.3	x	24.49	x	0.5	x	0.9	=	25.79	(76)
East	0.9x	1	x	2.25	x	24.49	x	0.5	x	0.9	=	44.63	(76)
East	0.9x	1	x	2.25	x	24.49	x	0.5	x	0.9	=	22.32	(76)
East	0.9x	1	x	1.3	x	16.15	x	0.5	x	0.9	=	17.01	(76)
East	0.9x	1	x	1.3	x	16.15	x	0.5	x	0.9	=	17.01	(76)
East	0.9x	1	x	2.25	x	16.15	x	0.5	x	0.9	=	29.44	(76)
East	0.9x	1	x	2.25	x	16.15	x	0.5	x	0.9	=	14.72	(76)
South	0.9x	1	x	1.3	x	46.75	x	0.5	x	0.9	=	24.61	(78)
South	0.9x	1	x	2.25	x	46.75	x	0.5	x	0.9	=	42.6	(78)
South	0.9x	1	x	1.3	x	76.57	x	0.5	x	0.9	=	40.31	(78)
South	0.9x	1	x	2.25	x	76.57	x	0.5	x	0.9	=	69.77	(78)
South	0.9x	1	x	1.3	x	97.53	x	0.5	x	0.9	=	51.35	(78)
South	0.9x	1	x	2.25	x	97.53	x	0.5	x	0.9	=	88.88	(78)
South	0.9x	1	x	1.3	x	110.23	x	0.5	x	0.9	=	58.04	(78)
South	0.9x	1	x	2.25	x	110.23	x	0.5	x	0.9	=	100.45	(78)
South	0.9x	1	x	1.3	x	114.87	x	0.5	x	0.9	=	60.48	(78)
South	0.9x	1	x	2.25	x	114.87	x	0.5	x	0.9	=	104.68	(78)
South	0.9x	1	x	1.3	x	110.55	x	0.5	x	0.9	=	58.2	(78)
South	0.9x	1	x	2.25	x	110.55	x	0.5	x	0.9	=	100.74	(78)
South	0.9x	1	x	1.3	x	108.01	x	0.5	x	0.9	=	56.87	(78)
South	0.9x	1	x	2.25	x	108.01	x	0.5	x	0.9	=	98.43	(78)
South	0.9x	1	x	1.3	x	104.89	x	0.5	x	0.9	=	55.23	(78)
South	0.9x	1	x	2.25	x	104.89	x	0.5	x	0.9	=	95.59	(78)
South	0.9x	1	x	1.3	x	101.89	x	0.5	x	0.9	=	53.64	(78)
South	0.9x	1	x	2.25	x	101.89	x	0.5	x	0.9	=	92.84	(78)
South	0.9x	1	x	1.3	x	82.59	x	0.5	x	0.9	=	43.48	(78)
South	0.9x	1	x	2.25	x	82.59	x	0.5	x	0.9	=	75.26	(78)
South	0.9x	1	x	1.3	x	55.42	x	0.5	x	0.9	=	29.18	(78)
South	0.9x	1	x	2.25	x	55.42	x	0.5	x	0.9	=	50.5	(78)
South	0.9x	1	x	1.3	x	40.4	x	0.5	x	0.9	=	21.27	(78)
South	0.9x	1	x	2.25	x	40.4	x	0.5	x	0.9	=	36.81	(78)

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

(83)m=	162.27	296.03	446.46	605.1	712.5	719.24	688.72	609.02	502.64	339.38	198.2	136.25	(83)

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

(84)m=	752.63	882.27	1012.12	1138.78	1213.41	1190.68	1142.83	1071.06	982.98	851.91	746.59	711.79	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.91	0.87	0.81	0.7	0.57	0.42	0.31	0.34	0.53	0.75	0.87	0.92	(86)

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

(87)m=	19.01	19.35	19.82	20.37	20.72	20.92	20.97	20.96	20.84	20.37	19.65	19.01	(87)

SAP WorkSheet: Existing dwelling (SAP)

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

(88)m=	19.91	19.92	19.93	19.97	19.97	20.02	20.02	20.02	20	19.97	19.96	19.94	(88)

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

(89)m=	0.9	0.86	0.79	0.67	0.52	0.36	0.24	0.27	0.46	0.71	0.85	0.91	(89)

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

(90)m=	17.31	17.79	18.46	19.23	19.67	19.94	20	20	19.85	19.25	18.25	17.33	(90)

fLA = Living area ÷ (4) = 0.39 (91)

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

(92)m=	17.97	18.4	18.99	19.67	20.08	20.32	20.38	20.38	20.23	19.68	18.79	17.98	(92)

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

(93)m=	17.97	18.4	18.99	19.67	20.08	20.32	20.38	20.38	20.23	19.68	18.79	17.98	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.87	0.83	0.76	0.65	0.53	0.38	0.27	0.3	0.48	0.7	0.83	0.88	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	656.53	731.27	771.27	745.69	640.23	452.22	307.91	319.16	471.31	594.76	618.92	628.44	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1277.99	1251.5	1147.93	948.46	731.19	477	314.9	328.34	520.71	792.48	1038.37	1245.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	462.37	349.59	280.24	145.99	67.67	0	0	0	0	147.1	302.01	459.06	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2214.03 (98)

Space heating requirement in kWh/m²/year 28.75 (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		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	462.37	349.59	280.24	145.99	67.67	0	0	0	0	147.1	302.01	459.06	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	510.91	386.29	309.65	161.32	74.77	0	0	0	0	162.54	333.71	507.24	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2446.44 (211)

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

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

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

SAP WorkSheet: Existing dwelling (SAP)

Water heating

Output from water heater (calculated above)

200.46	176.8	185.94	167.05	163.98	146.9	141.45	154.71	154.28	173.21	182.69	195.76

Efficiency of water heater — 79.8 (216)

(217)m=	86.97	86.6	85.91	84.46	82.65	79.8	79.8	79.8	79.8	84.38	86.15	87.01	(217)

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

(219)m=	230.48	204.16	216.45	197.8	198.39	184.09	177.25	193.87	193.33	205.27	212.06	224.98

Total = Sum(219a)$_{1...12}$ = 2438.13 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2446.44	
Water heating fuel used			2438.13	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		176.76		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		206.76	(231)
Electricity for lighting			335.44	(232)
Electricity generated by PVs			-714.86	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	85.14	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	84.85	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	27.27	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	44.24	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	0	(252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 361.5 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.24	(257)
SAP rating (Section 12)		82.64	(258)

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

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

SAP WorkSheet: Existing dwelling (SAP)

Space heating (main system 1)	(211) x	0.216	=	528.43	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	526.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1055.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	107.31	(267)
Electricity for lighting	(232) x	0.519	=	174.09	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-371.01	(269)
Total CO2, kg/year		sum of (265)…(271) =		965.45	(272)
CO2 emissions per m²		(272) ÷ (4) =		12.54	(273)
EI rating (section 14)				89	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	2984.65	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2974.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5959.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	634.75	(267)
Electricity for lighting	(232) x	0	=	1029.81	(268)
Energy saving/generation technologies					
Item 1		3.07	=	-2194.63	(269)
'Total Primary Energy		sum of (265)…(271) =		5429.1	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		70.51	(273)

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SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.18

Property Address: GF03

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	121	(1a) x	3.2	(2a) =	387.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	121	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	387.2	(5)

2. Ventilation rate:

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

Air changes per hour

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(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

SAP WorkSheet: Existing dwelling (SAP)

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.35 (23c)

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

(24a)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(24a)

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

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

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

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

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

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

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

(25)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			2.7	x1/[1/(1.8)+ 0.04]		=	4.53			(27)
Windows Type 2			1.8	x1/[1/(1.8)+ 0.04]		=	3.02			(27)
Windows Type 3			4.4	x1/[1/(1.8)+ 0.04]		=	7.39			(27)
Windows Type 4			2.16	x1/[1/(1.8)+ 0.04]		=	3.63			(27)
Windows Type 5			5.61	x1/[1/(1.8)+ 0.04]		=	9.42			(27)
Walls Type1	6	0	6	x	0.25	=	1.5			(29)
Walls Type2	14	2.7	11.3	x	0.25	=	2.82			(29)
Walls Type3	40.5	8	32.5	x	0.25	=	8.12			(29)
Walls Type4	22	9.93	12.07	x	0.25	=	3.02			(29)
Total area of elements, m²			82.5							(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) = 50.11 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11755.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 12.38 (36)

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

Total fabric heat loss (33) + (36) = 62.48 (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

SAP WorkSheet: Existing dwelling (SAP)

(38)m=	76.79	75.56	74.34	68.23	67.01	60.9	60.9	59.68	63.34	67.01	69.45	71.9	(38)

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

(39)m=	139.27	138.05	136.82	130.71	129.49	123.38	123.38	122.16	125.83	129.49	131.94	134.38	

Average = $Sum(39)_{1...12}$ /12= 130.41 (39)

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

(40)m=	1.15	1.14	1.13	1.08	1.07	1.02	1.02	1.01	1.04	1.07	1.09	1.11	

Average = $Sum(40)_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.87 (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) + 36 102.29 (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=	112.52	108.43	104.34	100.25	96.16	92.06	92.06	96.16	100.25	104.34	108.43	112.52	

Total = $Sum(44)_{1...12}$ = 1227.52 (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=	166.87	145.94	150.6	131.3	125.98	108.71	100.74	115.6	116.98	136.33	148.81	161.6	

Total = $Sum(45)_{1...12}$ = 1609.48 (45)

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

(46)m=	25.03	21.89	22.59	19.69	18.9	16.31	15.11	17.34	17.55	20.45	22.32	24.24	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

SAP WorkSheet: Existing dwelling (SAP)

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

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

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

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

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

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

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

(62)m=	218.42	192.51	202.15	181.19	177.54	158.6	152.29	167.15	166.87	187.88	198.7	213.16	(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=	218.42	192.51	202.15	181.19	177.54	158.6	152.29	167.15	166.87	187.88	198.7	213.16

Output from water heater (annual)$_{1...12}$ | 2216.47 | (64)

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

(65)m=	96.73	85.78	91.32	83.57	83.13	76.06	74.74	79.68	78.81	86.57	89.39	94.98	(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=	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	172.03	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	63.86	56.72	46.13	34.92	26.1	22.04	23.81	30.95	41.54	52.75	61.57	65.63	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	427.63	432.06	420.88	397.08	367.03	338.78	319.91	315.48	326.66	350.46	380.52	408.76	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	-114.68	(71)
Water heating gains (Table 5)													
(72)m=	130.01	127.65	122.74	116.07	111.74	105.64	100.45	107.1	109.46	116.36	124.16	127.66	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	736.9	731.84	705.16	663.47	620.28	581.87	559.59	568.94	593.07	634.99	681.65	717.46	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	1	x	2.7	x	46.75	x	0.5	x	0.9	=	51.12	(78)
South	0.9x	1	x	1.8	x	46.75	x	0.5	x	0.9	=	68.16	(78)

SAP WorkSheet: Existing dwelling (SAP)

South	0.9x	1	x	4.4	x	46.75	x	0.5	x	0.9	=	83.31	(78)
South	0.9x	1	x	2.7	x	76.57	x	0.5	x	0.9	=	83.73	(78)
South	0.9x	1	x	1.8	x	76.57	x	0.5	x	0.9	=	111.64	(78)
South	0.9x	1	x	4.4	x	76.57	x	0.5	x	0.9	=	136.44	(78)
South	0.9x	1	x	2.7	x	97.53	x	0.5	x	0.9	=	106.65	(78)
South	0.9x	1	x	1.8	x	97.53	x	0.5	x	0.9	=	142.2	(78)
South	0.9x	1	x	4.4	x	97.53	x	0.5	x	0.9	=	173.81	(78)
South	0.9x	1	x	2.7	x	110.23	x	0.5	x	0.9	=	120.54	(78)
South	0.9x	1	x	1.8	x	110.23	x	0.5	x	0.9	=	160.72	(78)
South	0.9x	1	x	4.4	x	110.23	x	0.5	x	0.9	=	196.44	(78)
South	0.9x	1	x	2.7	x	114.87	x	0.5	x	0.9	=	125.61	(78)
South	0.9x	1	x	1.8	x	114.87	x	0.5	x	0.9	=	167.48	(78)
South	0.9x	1	x	4.4	x	114.87	x	0.5	x	0.9	=	204.7	(78)
South	0.9x	1	x	2.7	x	110.55	x	0.5	x	0.9	=	120.88	(78)
South	0.9x	1	x	1.8	x	110.55	x	0.5	x	0.9	=	161.18	(78)
South	0.9x	1	x	4.4	x	110.55	x	0.5	x	0.9	=	197	(78)
South	0.9x	1	x	2.7	x	108.01	x	0.5	x	0.9	=	118.11	(78)
South	0.9x	1	x	1.8	x	108.01	x	0.5	x	0.9	=	157.48	(78)
South	0.9x	1	x	4.4	x	108.01	x	0.5	x	0.9	=	192.48	(78)
South	0.9x	1	x	2.7	x	104.89	x	0.5	x	0.9	=	114.7	(78)
South	0.9x	1	x	1.8	x	104.89	x	0.5	x	0.9	=	152.94	(78)
South	0.9x	1	x	4.4	x	104.89	x	0.5	x	0.9	=	186.92	(78)
South	0.9x	1	x	2.7	x	101.89	x	0.5	x	0.9	=	111.41	(78)
South	0.9x	1	x	1.8	x	101.89	x	0.5	x	0.9	=	148.55	(78)
South	0.9x	1	x	4.4	x	101.89	x	0.5	x	0.9	=	181.56	(78)
South	0.9x	1	x	2.7	x	82.59	x	0.5	x	0.9	=	90.31	(78)
South	0.9x	1	x	1.8	x	82.59	x	0.5	x	0.9	=	120.41	(78)
South	0.9x	1	x	4.4	x	82.59	x	0.5	x	0.9	=	147.17	(78)
South	0.9x	1	x	2.7	x	55.42	x	0.5	x	0.9	=	60.6	(78)
South	0.9x	1	x	1.8	x	55.42	x	0.5	x	0.9	=	80.8	(78)
South	0.9x	1	x	4.4	x	55.42	x	0.5	x	0.9	=	98.75	(78)
South	0.9x	1	x	2.7	x	40.4	x	0.5	x	0.9	=	44.18	(78)
South	0.9x	1	x	1.8	x	40.4	x	0.5	x	0.9	=	58.9	(78)
South	0.9x	1	x	4.4	x	40.4	x	0.5	x	0.9	=	71.99	(78)
West	0.9x	1	x	2.16	x	19.64	x	0.5	x	0.9	=	34.36	(80)
West	0.9x	1	x	5.61	x	19.64	x	0.5	x	0.9	=	44.62	(80)
West	0.9x	1	x	2.16	x	38.42	x	0.5	x	0.9	=	67.22	(80)
West	0.9x	1	x	5.61	x	38.42	x	0.5	x	0.9	=	87.29	(80)
West	0.9x	1	x	2.16	x	63.27	x	0.5	x	0.9	=	110.7	(80)
West	0.9x	1	x	5.61	x	63.27	x	0.5	x	0.9	=	143.76	(80)
West	0.9x	1	x	2.16	x	92.28	x	0.5	x	0.9	=	161.45	(80)

SAP WorkSheet: Existing dwelling (SAP)

West	0.9x	1	x	5.61	x	92.28	x	0.5	x	0.9	=	209.66	(80)
West	0.9x	1	x	2.16	x	113.09	x	0.5	x	0.9	=	197.87	(80)
West	0.9x	1	x	5.61	x	113.09	x	0.5	x	0.9	=	256.95	(80)
West	0.9x	1	x	2.16	x	115.77	x	0.5	x	0.9	=	202.55	(80)
West	0.9x	1	x	5.61	x	115.77	x	0.5	x	0.9	=	263.04	(80)
West	0.9x	1	x	2.16	x	110.22	x	0.5	x	0.9	=	192.84	(80)
West	0.9x	1	x	5.61	x	110.22	x	0.5	x	0.9	=	250.42	(80)
West	0.9x	1	x	2.16	x	94.68	x	0.5	x	0.9	=	165.64	(80)
West	0.9x	1	x	5.61	x	94.68	x	0.5	x	0.9	=	215.11	(80)
West	0.9x	1	x	2.16	x	73.59	x	0.5	x	0.9	=	128.75	(80)
West	0.9x	1	x	5.61	x	73.59	x	0.5	x	0.9	=	167.2	(80)
West	0.9x	1	x	2.16	x	45.59	x	0.5	x	0.9	=	79.76	(80)
West	0.9x	1	x	5.61	x	45.59	x	0.5	x	0.9	=	103.58	(80)
West	0.9x	1	x	2.16	x	24.49	x	0.5	x	0.9	=	42.85	(80)
West	0.9x	1	x	5.61	x	24.49	x	0.5	x	0.9	=	55.64	(80)
West	0.9x	1	x	2.16	x	16.15	x	0.5	x	0.9	=	28.26	(80)
West	0.9x	1	x	5.61	x	16.15	x	0.5	x	0.9	=	36.7	(80)

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

(83)m=	281.59	486.32	677.13	848.82	952.61	944.65	911.33	835.31	737.47	541.23	338.64	240.02	(83)

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

(84)m=	1018.49	1218.16	1382.28	1512.29	1572.89	1526.52	1470.92	1404.25	1330.54	1176.21	1020.29	957.48	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.89	0.84	0.75	0.63	0.47	0.35	0.38	0.57	0.78	0.9	0.94	(86)

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

(87)m=	18.97	19.32	19.78	20.32	20.67	20.9	20.97	20.96	20.82	20.35	19.61	18.97	(87)

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

(88)m=	19.96	19.97	19.98	20.02	20.03	20.07	20.07	20.08	20.05	20.03	20.01	19.99	(88)

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

(89)m=	0.92	0.88	0.82	0.72	0.58	0.42	0.28	0.31	0.51	0.75	0.88	0.93	(89)

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

(90)m=	17.27	17.78	18.43	19.2	19.67	19.98	20.05	20.05	19.88	19.26	18.23	17.29	(90)

fLA = Living area ÷ (4) = 0.29 (91)

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

(92)m=	17.77	18.24	18.82	19.52	19.96	20.25	20.32	20.32	20.16	19.58	18.64	17.78	(92)

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

(93)m=	17.77	18.24	18.82	19.52	19.96	20.25	20.32	20.32	20.16	19.58	18.64	17.78	(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

SAP WorkSheet: Existing dwelling (SAP)

Utilisation factor for gains, hm:

(94)m=	0.9	0.85	0.79	0.7	0.58	0.43	0.3	0.33	0.51	0.73	0.85	0.91	(94)

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

(95)m=	912.17	1038.38	1095.72	1057	913.32	653.06	446.51	463.15	683.56	855.94	872.32	867.62	(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=	1876.1	1840.85	1686.24	1388.82	1070.08	696.88	458.49	478.29	762.33	1162.75	1522.45	1825.4	(97)

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

(98)m=	717.16	539.26	439.35	238.91	116.63	0	0	0	0	228.27	468.09	712.59

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3460.25 (98)

Space heating requirement in kWh/m²/year 28.6 (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		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	717.16	539.26	439.35	238.91	116.63	0	0	0	0	228.27	468.09	712.59	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	792.44	595.87	485.47	263.99	128.87	0	0	0	0	252.23	517.22	787.39	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3823.48 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	218.42	192.51	202.15	181.19	177.54	158.6	152.29	167.15	166.87	187.88	198.7	213.16	

Efficiency of water heater 79.8 (216)

(217)m=	87.75	87.42	86.83	85.55	83.72	79.8	79.8	79.8	79.8	85.33	87.02	87.79	(217)

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

(219)m=	248.9	220.22	232.81	211.79	212.05	198.75	190.84	209.46	209.11	220.17	228.34	242.8

Total = Sum(219a)$_{1...12}$ = 2625.25 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3823.48
Water heating fuel used		2625.25
Electricity for pumps, fans and electric keep-hot		

SAP WorkSheet: Existing dwelling (SAP)

mechanical ventilation - balanced, extract or positive input from outside		330.67		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		360.67	(231)
Electricity for lighting			451.09	(232)
Electricity generated by PVs			-714.86	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	133.06	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	91.36	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	47.57	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	59.5	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	0	(252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	451.49	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.14	(257)
SAP rating (Section 12)		84.06	(258)

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	=	825.87	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	567.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1392.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	187.19	(267)
Electricity for lighting	(232) x	0.519	=	234.12	(268)
Energy saving/generation technologies Item 1		0.519	=	-371.01	(269)
Total CO2, kg/year		sum of (265)…(271) =		1443.22	(272)
CO2 emissions per m²		(272) ÷ (4) =		11.93	(273)

SAP WorkSheet: Existing dwelling (SAP)

EI rating (section 14)				88	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	4664.65	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3202.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7867.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	1107.25	(267)
Electricity for lighting	(232) x	0	=	1384.84	(268)
Energy saving/generation technologies Item 1		3.07	=	-2194.63	(269)
‘Total Primary Energy		sum of (265)…(271) =		8164.92	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		67.48	(273)

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.18

Property Address: FF01

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	72	(1a) x	3.2	(2a) =	230.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	230.4	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(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

SAP WorkSheet: Existing dwelling (SAP)

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.35 (23c)

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

(24a)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(24a)

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

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

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

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

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

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

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

(25)m=	0.6	0.59	0.58	0.53	0.52	0.48	0.48	0.47	0.5	0.52	0.54	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			1.44	x1/[1/(1.8)+ 0.04]	=	2.42			(27)
Windows Type 2			5.4	x1/[1/(1.8)+ 0.04]	=	9.07			(27)
Windows Type 3			1.8	x1/[1/(1.8)+ 0.04]	=	3.02			(27)
Walls Type1	36	5.76	30.24	x 0.25	=	7.56			(29)
Walls Type2	30	12.6	17.4	x 0.25	=	4.35			(29)
Total area of elements, m²			66						(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) = 42.74 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7842 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.9 (36)

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

Total fabric heat loss (33) + (36) = 52.64 (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=	45.69	44.96	44.24	40.6	39.87	36.24	36.24	35.51	37.69	39.87	41.33	42.78	(38)

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

(39)m=	98.33	97.6	96.87	93.24	92.51	88.88	88.88	88.15	90.33	92.51	93.97	95.42	

Average = Sum(39)$_{1\ldots12}$ /12= 93.06 (39)

SAP WorkSheet: Existing dwelling (SAP)

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

(40)m=	1.37	1.36	1.35	1.29	1.28	1.23	1.23	1.22	1.25	1.28	1.31	1.33

Average = Sum(40)$_{1…12}$ /12= 1.29 (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 2.29 (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 93.34 (43)

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

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

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

(44)m=	102.68	98.94	95.21	91.48	87.74	84.01	84.01	87.74	91.48	95.21	98.94	102.68

Total = Sum(44)$_{1…12}$ = 1120.11 (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=	152.27	133.17	137.42	119.81	114.96	99.2	91.92	105.48	106.74	124.4	135.79	147.46

Total = Sum(45)$_{1…12}$ = 1468.63 (45)

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

(46)m=	22.84	19.98	20.61	17.97	17.24	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

SAP WorkSheet: Existing dwelling (SAP)

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=	203.82	179.74	188.98	169.7	166.51	149.09	143.48	157.04	156.63	175.95	185.68	199.01	(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=	203.82	179.74	188.98	169.7	166.51	149.09	143.48	157.04	156.63	175.95	185.68	199.01

Output from water heater (annual)$_{1...12}$ 2075.63 (64)

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

(65)m=	91.87	81.53	86.94	79.75	79.47	72.9	71.81	76.32	75.4	82.61	85.06	90.27	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	137.62	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	45	39.97	32.51	24.61	18.4	15.53	16.78	21.81	29.28	37.17	43.39	46.25	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	301.37	304.5	296.62	279.84	258.66	238.76	225.46	222.33	230.22	246.99	268.17	288.07	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	51.06	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	(71)
Water heating gains (Table 5)													
(72)m=	123.48	121.33	116.85	110.76	106.81	101.24	96.51	102.58	104.73	111.03	118.14	121.34	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	569.79	565.73	545.9	515.14	483.8	455.46	438.69	446.65	464.15	495.13	529.63	555.59	(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	1	x	1.44	x	10.63	x	0.5	x	0.9	=	24.81	(74)
North	0.9x	1	x	1.44	x	20.32	x	0.5	x	0.9	=	47.4	(74)
North	0.9x	1	x	1.44	x	34.53	x	0.5	x	0.9	=	80.55	(74)
North	0.9x	1	x	1.44	x	55.46	x	0.5	x	0.9	=	129.39	(74)
North	0.9x	1	x	1.44	x	74.72	x	0.5	x	0.9	=	174.3	(74)

North	0.9x	1	x	1.44	x	79.99	x	0.5	x	0.9	=	186.59	(74)
North	0.9x	1	x	1.44	x	74.68	x	0.5	x	0.9	=	174.21	(74)
North	0.9x	1	x	1.44	x	59.25	x	0.5	x	0.9	=	138.21	(74)
North	0.9x	1	x	1.44	x	41.52	x	0.5	x	0.9	=	96.85	(74)
North	0.9x	1	x	1.44	x	24.19	x	0.5	x	0.9	=	56.43	(74)
North	0.9x	1	x	1.44	x	13.12	x	0.5	x	0.9	=	30.6	(74)
North	0.9x	1	x	1.44	x	8.86	x	0.5	x	0.9	=	20.68	(74)
West	0.9x	1	x	5.4	x	19.64	x	0.5	x	0.9	=	85.91	(80)
West	0.9x	1	x	1.8	x	19.64	x	0.5	x	0.9	=	14.32	(80)
West	0.9x	1	x	5.4	x	38.42	x	0.5	x	0.9	=	168.05	(80)
West	0.9x	1	x	1.8	x	38.42	x	0.5	x	0.9	=	28.01	(80)
West	0.9x	1	x	5.4	x	63.27	x	0.5	x	0.9	=	276.76	(80)
West	0.9x	1	x	1.8	x	63.27	x	0.5	x	0.9	=	46.13	(80)
West	0.9x	1	x	5.4	x	92.28	x	0.5	x	0.9	=	403.63	(80)
West	0.9x	1	x	1.8	x	92.28	x	0.5	x	0.9	=	67.27	(80)
West	0.9x	1	x	5.4	x	113.09	x	0.5	x	0.9	=	494.67	(80)
West	0.9x	1	x	1.8	x	113.09	x	0.5	x	0.9	=	82.44	(80)
West	0.9x	1	x	5.4	x	115.77	x	0.5	x	0.9	=	506.38	(80)
West	0.9x	1	x	1.8	x	115.77	x	0.5	x	0.9	=	84.4	(80)
West	0.9x	1	x	5.4	x	110.22	x	0.5	x	0.9	=	482.09	(80)
West	0.9x	1	x	1.8	x	110.22	x	0.5	x	0.9	=	80.35	(80)
West	0.9x	1	x	5.4	x	94.68	x	0.5	x	0.9	=	414.11	(80)
West	0.9x	1	x	1.8	x	94.68	x	0.5	x	0.9	=	69.02	(80)
West	0.9x	1	x	5.4	x	73.59	x	0.5	x	0.9	=	321.88	(80)
West	0.9x	1	x	1.8	x	73.59	x	0.5	x	0.9	=	53.65	(80)
West	0.9x	1	x	5.4	x	45.59	x	0.5	x	0.9	=	199.41	(80)
West	0.9x	1	x	1.8	x	45.59	x	0.5	x	0.9	=	33.23	(80)
West	0.9x	1	x	5.4	x	24.49	x	0.5	x	0.9	=	107.12	(80)
West	0.9x	1	x	1.8	x	24.49	x	0.5	x	0.9	=	17.85	(80)
West	0.9x	1	x	5.4	x	16.15	x	0.5	x	0.9	=	70.65	(80)
West	0.9x	1	x	1.8	x	16.15	x	0.5	x	0.9	=	11.77	(80)

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

(83)m=	125.03	243.46	403.43	600.29	751.41	777.37	736.65	621.34	472.38	289.07	155.57	103.1	(83)

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

(84)m=	694.82	809.19	949.34	1115.43	1235.21	1232.83	1175.34	1067.99	936.53	784.2	685.2	658.69	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.92	0.89	0.83	0.71	0.57	0.42	0.32	0.36	0.56	0.78	0.89	0.93	(86)

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

(87)m=	18.68	19.02	19.56	20.21	20.64	20.89	20.96	20.94	20.76	20.17	19.36	18.68	(87)

SAP WorkSheet: Existing dwelling (SAP)

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

(88)m=	19.79	19.8	19.81	19.84	19.85	19.89	19.89	19.9	19.88	19.85	19.84	19.82	(88)

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

(89)m=	0.91	0.87	0.8	0.68	0.52	0.36	0.24	0.28	0.49	0.74	0.87	0.92	(89)

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

(90)m=	16.77	17.26	18.01	18.92	19.48	19.8	19.87	19.87	19.66	18.89	17.76	16.78	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	17.44	17.87	18.55	19.37	19.88	20.17	20.25	20.24	20.04	19.34	18.32	17.44	(92)

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

(93)m=	17.44	17.87	18.55	19.37	19.88	20.17	20.25	20.24	20.04	19.34	18.32	17.44	(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=	0.88	0.84	0.77	0.66	0.52	0.38	0.27	0.3	0.5	0.72	0.84	0.89	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	609.69	679.08	733.35	736.13	648.07	463.84	314.66	325.41	469.14	564.63	575.42	584.4	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1291.64	1265.87	1167.09	976.33	756.92	495.48	324.14	338.54	536.57	808.19	1054.05	1263.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	507.37	394.32	322.7	172.94	80.98	0	0	0	0	181.2	344.61	505.13	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2509.27 (98)

Space heating requirement in kWh/m²/year 34.85 (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		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	507.37	394.32	322.7	172.94	80.98	0	0	0	0	181.2	344.61	505.13	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	560.63	435.72	356.58	191.1	89.48	0	0	0	0	200.22	380.78	558.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2772.67 (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)

SAP WorkSheet: Existing dwelling (SAP)

Water heating

Output from water heater (calculated above)

203.82	179.74	188.98	169.7	166.51	149.09	143.48	157.04	156.63	175.95	185.68	199.01

Efficiency of water heater 79.8 (216)

(217)m=	87.15	86.85	86.23	84.86	83.01	79.8	79.8	79.8	79.8	84.89	86.44	87.2	(217)

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

(219)m=	233.87	206.94	219.15	199.96	200.59	186.83	179.8	196.79	196.28	207.27	214.81	228.24

Total = Sum(219a)$_{1...12}$ = 2470.53 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2772.67	
Water heating fuel used			2470.53	
Electricity for pumps, fans and electric keep-hot				
mechanical ventilation - balanced, extract or positive input from outside		165.28		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		195.28	(231)
Electricity for lighting			317.91	(232)
Electricity generated by PVs			-714.86	(233)

10a. Fuel costs - individual heating systems:

		Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x		3.48	x 0.01 =	96.49	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		3.48	x 0.01 =	85.97	(247)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	25.76	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	41.93	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	0	(252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 370.15 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.33	(257)
SAP rating (Section 12)		81.46	(258)

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

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

SAP WorkSheet: Existing dwelling (SAP)

Space heating (main system 1)	(211) x	0.216	=	598.9	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	533.63	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1132.53	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	101.35	(267)
Electricity for lighting	(232) x	0.519	=	164.99	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-371.01	(269)
Total CO2, kg/year	sum of (265)…(271) =			1027.86	(272)
CO2 emissions per m²	(272) ÷ (4) =			14.28	(273)
EI rating (section 14)				88	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3382.66	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3014.04	(264)
Space and water heating	(261) + (262) + (263) + (264) =			6396.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	599.51	(267)
Electricity for lighting	(232) x	0	=	975.98	(268)
Energy saving/generation technologies					
Item 1		3.07	=	-2194.63	(269)
‘Total Primary Energy	sum of (265)…(271) =			5777.56	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			80.24	(273)

SAP WorkSheet: Existing dwelling (SAP)

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.18

Property Address: SF03

Address : 39, Fitzjohns Avenue, LONDON, NW3 5JY

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	156	(1a) x	3.2	(2a) =	499.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	156	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	499.2	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)		1	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0.35	(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		0.05	(13)
Percentage of windows and doors draught stripped		100	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0.05	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0.45	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		0	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.45	(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) =	0.38	(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

SAP WorkSheet: Existing dwelling (SAP)

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.65 (23c)

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

(24a)m=	0.61	0.6	0.59	0.54	0.53	0.49	0.49	0.48	0.5	0.53	0.55	0.57	(24a)

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

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

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

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

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

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

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

(25)m=	0.61	0.6	0.59	0.54	0.53	0.49	0.49	0.48	0.5	0.53	0.55	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			3.04	x1/[1/(1.8)+ 0.04] =	5.1			(27)
Windows Type 2			3.23	x1/[1/(1.8)+ 0.04] =	5.42			(27)
Windows Type 3			3.52	x1/[1/(1.8)+ 0.04] =	5.91			(27)
Windows Type 4			3.36	x1/[1/(1.8)+ 0.04] =	5.64			(27)
Windows Type 5			3.52	x1/[1/(1.8)+ 0.04] =	5.91			(27)
Walls Type1	15	3.04	11.96	x 0.25 =	2.99			(29)
Walls Type2	21	3.23	17.77	x 0.25 =	4.44			(29)
Walls Type3	27.5	6.88	20.62	x 0.25 =	5.16			(29)
Walls Type4	22.5	3.52	18.98	x 0.25 =	4.75			(29)
Total area of elements, m²			86					(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) = 45.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13172.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 12.9 (36)

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

Total fabric heat loss (33) + (36) = 58.22 (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=	100.4	98.82	97.25	89.37	87.79	79.92	79.92	78.34	83.07	87.79	90.94	94.1	(38)

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

(39)m=	158.62	157.04	155.47	147.59	146.02	138.14	138.14	136.57	141.29	146.02	149.17	152.32	

Average = $Sum(39)_{1...12}$ /12= 147.2 (39)

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

(40)m=	1.02	1.01	1	0.95	0.94	0.89	0.89	0.88	0.91	0.94	0.96	0.98	

Average = $Sum(40)_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.94 (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) + 36 109.58 (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=	120.54	116.15	111.77	107.39	103.01	98.62	98.62	103.01	107.39	111.77	116.15	120.54	

Total = $Sum(44)_{1...12}$ = 1314.96 (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=	178.75	156.34	161.33	140.65	134.96	116.46	107.92	123.83	125.31	146.04	159.41	173.11	

Total = $Sum(45)_{1...12}$ = 1724.12 (45)

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

(46)m=	26.81	23.45	24.2	21.1	20.24	17.47	16.19	18.58	18.8	21.91	23.91	25.97	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.69 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.91 (55)

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

(56)m=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(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=	28.29	25.55	28.29	27.38	28.29	27.38	28.29	28.29	27.38	28.29	27.38	28.29	(57)

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

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

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

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

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

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

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

(62)m=	230.31	202.9	212.88	190.54	186.51	166.35	159.47	175.39	175.2	197.59	209.3	224.67	(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=	230.31	202.9	212.88	190.54	186.51	166.35	159.47	175.39	175.2	197.59	209.3	224.67

Output from water heater (annual) 1…12 | 2331.11 | (64)

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

(65)m=	100.68	89.23	94.88	86.68	86.12	78.63	77.12	82.42	81.58	89.8	92.92	98.8	(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=	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	176.59	(66)

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

(67)m=	75.53	67.09	54.56	41.3	30.88	26.07	28.17	36.61	49.14	62.39	72.82	77.63	(67)

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

(68)m=	488.02	493.09	480.33	453.16	418.86	386.63	365.1	360.04	372.8	399.96	434.26	466.49	(68)

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

(69)m=	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	-117.73	(71)

Water heating gains (Table 5)

(72)m=	135.32	132.79	127.53	120.39	115.75	109.21	103.66	110.78	113.3	120.7	129.05	132.8	(72)

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

(73)m=	816.34	810.43	779.88	732.32	682.95	639.38	614.39	624.89	652.71	700.52	753.6	794.39	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	3.04	x	19.64	x	0.5	x	0.9	=	24.18	(76)
East	0.9x	1	x	3.23	x	19.64	x	0.5	x	0.9	=	25.69	(76)

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East	0.9x	1	x	3.04	x	38.42	x	0.5	x	0.9	=	47.3	(76)
East	0.9x	1	x	3.23	x	38.42	x	0.5	x	0.9	=	50.26	(76)
East	0.9x	1	x	3.04	x	63.27	x	0.5	x	0.9	=	77.9	(76)
East	0.9x	1	x	3.23	x	63.27	x	0.5	x	0.9	=	82.77	(76)
East	0.9x	1	x	3.04	x	92.28	x	0.5	x	0.9	=	113.62	(76)
East	0.9x	1	x	3.23	x	92.28	x	0.5	x	0.9	=	120.72	(76)
East	0.9x	1	x	3.04	x	113.09	x	0.5	x	0.9	=	139.24	(76)
East	0.9x	1	x	3.23	x	113.09	x	0.5	x	0.9	=	147.94	(76)
East	0.9x	1	x	3.04	x	115.77	x	0.5	x	0.9	=	142.54	(76)
East	0.9x	1	x	3.23	x	115.77	x	0.5	x	0.9	=	151.45	(76)
East	0.9x	1	x	3.04	x	110.22	x	0.5	x	0.9	=	135.7	(76)
East	0.9x	1	x	3.23	x	110.22	x	0.5	x	0.9	=	144.18	(76)
East	0.9x	1	x	3.04	x	94.68	x	0.5	x	0.9	=	116.56	(76)
East	0.9x	1	x	3.23	x	94.68	x	0.5	x	0.9	=	123.85	(76)
East	0.9x	1	x	3.04	x	73.59	x	0.5	x	0.9	=	90.6	(76)
East	0.9x	1	x	3.23	x	73.59	x	0.5	x	0.9	=	96.27	(76)
East	0.9x	1	x	3.04	x	45.59	x	0.5	x	0.9	=	56.13	(76)
East	0.9x	1	x	3.23	x	45.59	x	0.5	x	0.9	=	59.64	(76)
East	0.9x	1	x	3.04	x	24.49	x	0.5	x	0.9	=	30.15	(76)
East	0.9x	1	x	3.23	x	24.49	x	0.5	x	0.9	=	32.04	(76)
East	0.9x	1	x	3.04	x	16.15	x	0.5	x	0.9	=	19.89	(76)
East	0.9x	1	x	3.23	x	16.15	x	0.5	x	0.9	=	21.13	(76)
South	0.9x	1	x	3.52	x	46.75	x	0.5	x	0.9	=	66.65	(78)
South	0.9x	1	x	3.36	x	46.75	x	0.5	x	0.9	=	63.62	(78)
South	0.9x	1	x	3.52	x	46.75	x	0.5	x	0.9	=	66.65	(78)
South	0.9x	1	x	3.52	x	76.57	x	0.5	x	0.9	=	109.16	(78)
South	0.9x	1	x	3.36	x	76.57	x	0.5	x	0.9	=	104.19	(78)
South	0.9x	1	x	3.52	x	76.57	x	0.5	x	0.9	=	109.16	(78)
South	0.9x	1	x	3.52	x	97.53	x	0.5	x	0.9	=	139.04	(78)
South	0.9x	1	x	3.36	x	97.53	x	0.5	x	0.9	=	132.72	(78)
South	0.9x	1	x	3.52	x	97.53	x	0.5	x	0.9	=	139.04	(78)
South	0.9x	1	x	3.52	x	110.23	x	0.5	x	0.9	=	157.15	(78)
South	0.9x	1	x	3.36	x	110.23	x	0.5	x	0.9	=	150.01	(78)
South	0.9x	1	x	3.52	x	110.23	x	0.5	x	0.9	=	157.15	(78)
South	0.9x	1	x	3.52	x	114.87	x	0.5	x	0.9	=	163.76	(78)
South	0.9x	1	x	3.36	x	114.87	x	0.5	x	0.9	=	156.32	(78)
South	0.9x	1	x	3.52	x	114.87	x	0.5	x	0.9	=	163.76	(78)
South	0.9x	1	x	3.52	x	110.55	x	0.5	x	0.9	=	157.6	(78)
South	0.9x	1	x	3.36	x	110.55	x	0.5	x	0.9	=	150.43	(78)
South	0.9x	1	x	3.52	x	110.55	x	0.5	x	0.9	=	157.6	(78)
South	0.9x	1	x	3.52	x	108.01	x	0.5	x	0.9	=	153.98	(78)

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South	0.9x	1	x	3.36	x	108.01	x	0.5	x	0.9	=	146.98	(78)
South	0.9x	1	x	3.52	x	108.01	x	0.5	x	0.9	=	153.98	(78)
South	0.9x	1	x	3.52	x	104.89	x	0.5	x	0.9	=	149.54	(78)
South	0.9x	1	x	3.36	x	104.89	x	0.5	x	0.9	=	142.74	(78)
South	0.9x	1	x	3.52	x	104.89	x	0.5	x	0.9	=	149.54	(78)
South	0.9x	1	x	3.52	x	101.89	x	0.5	x	0.9	=	145.25	(78)
South	0.9x	1	x	3.36	x	101.89	x	0.5	x	0.9	=	138.65	(78)
South	0.9x	1	x	3.52	x	101.89	x	0.5	x	0.9	=	145.25	(78)
South	0.9x	1	x	3.52	x	82.59	x	0.5	x	0.9	=	117.73	(78)
South	0.9x	1	x	3.36	x	82.59	x	0.5	x	0.9	=	112.38	(78)
South	0.9x	1	x	3.52	x	82.59	x	0.5	x	0.9	=	117.73	(78)
South	0.9x	1	x	3.52	x	55.42	x	0.5	x	0.9	=	79	(78)
South	0.9x	1	x	3.36	x	55.42	x	0.5	x	0.9	=	75.41	(78)
South	0.9x	1	x	3.52	x	55.42	x	0.5	x	0.9	=	79	(78)
South	0.9x	1	x	3.52	x	40.4	x	0.5	x	0.9	=	57.59	(78)
South	0.9x	1	x	3.36	x	40.4	x	0.5	x	0.9	=	54.97	(78)
South	0.9x	1	x	3.52	x	40.4	x	0.5	x	0.9	=	57.59	(78)

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

(83)m=	246.79	420.07	571.49	698.64	771.02	759.61	734.83	682.23	616.01	463.62	295.6	211.17	(83)

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

(84)m=	1063.14	1230.5	1351.37	1430.95	1453.97	1398.99	1349.22	1307.12	1268.72	1164.14	1049.2	1005.56	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.95	0.93	0.89	0.82	0.72	0.57	0.43	0.45	0.65	0.84	0.93	0.96	(86)

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

(87)m=	19.04	19.33	19.73	20.25	20.62	20.88	20.96	20.96	20.81	20.33	19.65	19.06	(87)

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

(88)m=	20.07	20.08	20.09	20.13	20.14	20.18	20.18	20.19	20.16	20.14	20.12	20.1	(88)

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

(89)m=	0.95	0.92	0.88	0.8	0.68	0.51	0.36	0.38	0.59	0.81	0.92	0.95	(89)

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

(90)m=	17.44	17.87	18.45	19.2	19.71	20.07	20.15	20.16	19.97	19.33	18.36	17.49	(90)

fLA = Living area ÷ (4) = | 0.25 | (91)

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

(92)m=	17.84	18.23	18.77	19.46	19.93	20.27	20.36	20.36	20.18	19.58	18.68	17.88	(92)

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

(93)m=	17.84	18.23	18.77	19.46	19.93	20.27	20.36	20.36	20.18	19.58	18.68	17.88	(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

SAP WorkSheet: Existing dwelling (SAP)

Utilisation factor for gains, hm:

(94)m=	0.93	0.9	0.85	0.78	0.67	0.51	0.37	0.4	0.59	0.79	0.89	0.93	(94)

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

(95)m=	983.89	1101.63	1151.28	1113.88	979.63	720.22	501.84	519.44	752.25	921	938.39	938.61	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2147.58	2093.99	1907.14	1559.16	1202.37	783.59	518.82	540.18	858.82	1310.64	1727.56	2083.89	(97)

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

(98)m=	865.79	666.86	562.36	320.61	165.72	0	0	0	0	289.89	568.2	852.09

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4291.52 (98)

Space heating requirement in kWh/m²/year 27.51 (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		90.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	865.79	666.86	562.36	320.61	165.72	0	0	0	0	289.89	568.2	852.09		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	956.67	736.87	621.39	354.26	183.11	0	0	0	0	320.32	627.85	941.54		(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4742.01 (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)

	230.31	202.9	212.88	190.54	186.51	166.35	159.47	175.39	175.2	197.59	209.3	224.67	

Efficiency of water heater 79.8 (216)

(217)m=	88.02	87.76	87.29	86.19	84.5	79.8	79.8	79.8	79.8	85.83	87.35	88.04	(217)

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

(219)m=	261.65	231.22	243.89	221.07	220.72	208.46	199.83	219.78	219.55	230.2	239.62	255.2

Total = Sum(219a)$_{1...12}$ = 2751.19 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4742.01
Water heating fuel used		2751.19
Electricity for pumps, fans and electric keep-hot		

SAP WorkSheet: Existing dwelling (SAP)

mechanical ventilation - balanced, extract or positive input from outside		520.11		(230a)
central heating pump:		30		(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		550.11	(231)
Electricity for lighting			533.57	(232)
Electricity generated by PVs			-714.86	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	165.02	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	95.74	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	72.56	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	70.38	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	0	(252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	523.7	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.09	(257)
SAP rating (Section 12)		84.73	(258)

12a. CO_2 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	=	1024.27	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	594.26	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1618.53	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	285.51	(267)
Electricity for lighting	(232) x	0.519	=	276.92	(268)
Energy saving/generation technologies Item 1		0.519	=	-371.01	(269)
Total CO2, kg/year		sum of (265)…(271) =		1809.94	(272)
CO2 emissions per m²		(272) ÷ (4) =		11.6	(273)

DRAFT

SAP WorkSheet: Existing dwelling (SAP)

EI rating (section 14)				88	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	5785.25	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3356.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =			9141.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	1688.83	(267)
Electricity for lighting	(232) x	0	=	1638.06	(268)
Energy saving/generation technologies Item 1		3.07	=	-2194.63	(269)
‘Total Primary Energy		sum of (265)…(271) =		10273.96	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		65.86	(273)

9.5. Appendix 5 – Existing Baseline EPC Report

Energy Performance Certificate

SAP

39 Fitzjohns Avenue, LONDON, NW3 5JT

Dwelling type:	Detached house	**Reference number:**	2878-7084-7224-3355-5920
Date of assessment:	23 April 2015	**Type of assessment:**	RdSAP, existing dwelling
Date of certificate:	28 April 2015	**Total floor area:**	2232 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

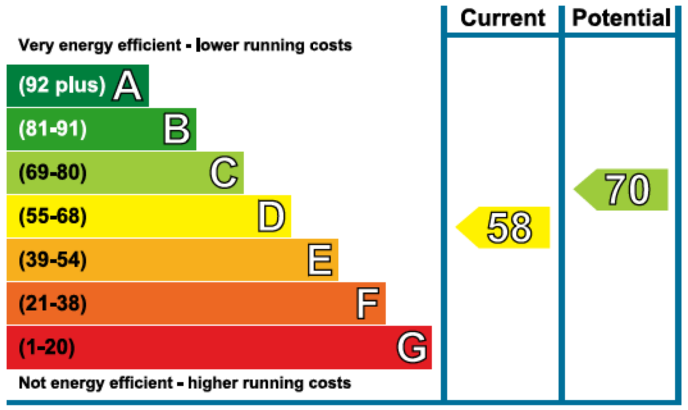
Estimated energy costs of dwelling for 3 years:	**£ 52,578**
Over 3 years you could save	**£ 15,249**

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£ 1,911 over 3 years	£ 1,938 over 3 years	You could save £ 15,249 over 3 years
Heating	£ 50,082 over 3 years	£ 34,806 over 3 years	
Hot Water	£ 585 over 3 years	£ 585 over 3 years	
Totals	**£ 52,578**	**£ 37,329**	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating



The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Internal or external wall insulation	£4,000 - £14,000	£ 9,795	✓
2 Heating controls (time and temperature zone control)	£350 - £450	£ 4,410	✓
3 Replace single glazed windows with low-E double glazed windows	£3,300 - £6,500	£ 1,038	✓

To find out more about the recommended measures and other actions you could take today to save money, visit **www.direct.gov.uk/savingenergy** or call **0300 123 1234** (standard national rate). The Green Deal may allow you to make your home warmer and cheaper to run at no up-front cost.

Summary of this home's energy performance related features

Element	Description	Energy Efficiency
Walls	Solid brick, as built, no insulation (assumed)	★☆☆☆☆
Roof	Roof room(s), no insulation (assumed)	★☆☆☆☆
	Flat, no insulation (assumed)	★☆☆☆☆
Floor	To unheated space, no insulation (assumed)	—
	Solid, no insulation (assumed)	—
	Suspended, no insulation (assumed)	—
Windows	Partial double glazing	★★☆☆☆
Main heating	Boiler and radiators, mains gas	★★★★☆
Main heating controls	Programmer and at least two room thermostats	★★★★☆
Secondary heating	None	—
Hot water	From main system	★★★★☆
Lighting	Low energy lighting in 54% of fixed outlets	★★★★☆

Current primary energy use per square metre of floor area: 225 kWh/m² per year

The assessment does not take into consideration the physical condition of any element. 'Assumed' means that the insulation could not be inspected and an assumption has been made in the methodology based on age and type of construction.

Low and zero carbon energy sources

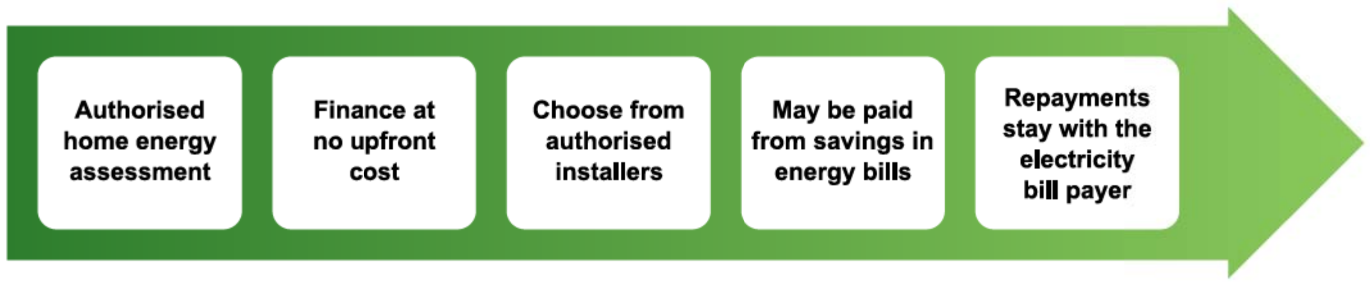
Low and zero carbon energy sources are sources of energy that release either very little or no carbon dioxide into the atmosphere when they are used. Installing these sources may help reduce energy bills as well as cutting carbon. There are none provided for this home.

Opportunity to benefit from a Green Deal on this property

The Green Deal may enable owners and occupiers to make improvements to their property to make it more energy efficient. Under a Green Deal, the cost of the improvements is repaid over time via a credit agreement. Repayments are made through a charge added to the electricity bill for the property. To see which improvements are recommended for this property, please turn to page 3. You can choose which improvements you want to install and ask for a quote from an authorised Green Deal provider. They will organise installation by an authorised Green Deal installer. If you move home, the responsibility for paying the Green Deal charge under the credit agreement passes to the new electricity bill payer.

For householders in receipt of income-related benefits, additional help may be available.

To find out more, visit **www.direct.gov.uk/savingenergy** or call **0300 123 1234**.



eTech SMART EPC engine 1.0.0 (SAP 9.92)

Recommendations

The measures below will improve the energy performance of your dwelling. The performance ratings after improvements listed below are cumulative; that is, they assume the improvements have been installed in the order that they appear in the table. Further information about the recommended measures and other simple actions you could take today to save money is available at **www.direct.gov.uk/savingenergy**. Before installing measures, you should make sure you have secured the appropriate permissions, where necessary. Such permissions might include permission from your landlord (if you are a tenant) or approval under Building Regulations for certain types of work.

Measures with a green tick ✓ are likely to be fully financed through the Green Deal since the cost of the measures should be covered by the energy they save. Additional support may be available for homes where solid wall insulation is recommended. If you want to take up measures with an orange tick ✓, be aware you may need to contribute some payment up-front.

Recommended measures	Indicative cost	Typical savings per year	Rating after improvement	Green Deal finance
Internal or external wall insulation	£4,000 - £14,000	£ 3,265	D65	✓ (green)
Heating controls (time and temperature zone control)	£350 - £450	£ 1,470	C69	✓ (green)
Replace single glazed windows with low-E double glazed windows	£3,300 - £6,500	£ 346	C70	✓ (orange)

Choosing the right package

Visit **www.epcadviser.direct.gov.uk**, our online tool which uses information from this EPC to show you how to save money on your fuel bills. You can use this tool to personalise your Green Deal package.

Green Deal package	Typical annual savings
Internal or external wall insulation	**Total savings of £4736**
Heating controls	
Electricity/gas/other fuel savings	£0 / £4736 / £0

You could finance this package of measures under the Green Deal. It could **save you £4736 a year** in energy costs, based on typical energy use. Some or all of this saving would be recouped through the charge on your bill.

About this document

The Energy Performance Certificate for this dwelling was produced following an energy assessment undertaken by a qualified assessor, accredited by ECMK. You can get contact details of the accreditation scheme at www.ecmk.co.uk, together with details of their procedures for confirming authenticity of a certificate and for making a complaint. A copy of this EPC has been lodged on a national register. It will be publicly available and some of the underlying data may be shared with others for compliance and marketing of relevant energy efficiency information. The Government may use some of this data for research or statistical purposes. Green Deal financial details that are obtained by the Government for these purposes will not be disclosed to non-authorised recipients. The current property owner and/or tenant may opt out of having their information shared for marketing purposes.

Assessor's accreditation number: ECMK201493
Assessor's name: Mr Paul Fearon
Phone number: 0208 279 5619
E-mail address: info@epcstart.co.uk
Related party disclosure: No related party

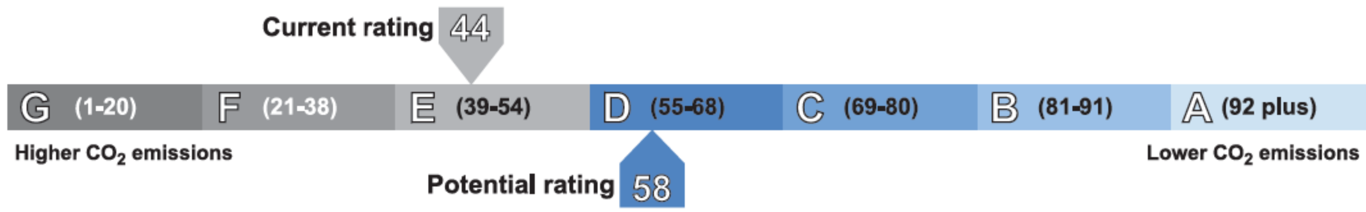
Further information about Energy Performance Certificates can be found under Frequently Asked Questions at **www.epcregister.com**.

About the impact of buildings on the environment

One of the biggest contributors to global warming is carbon dioxide. The energy we use for heating, lighting and power in homes produces over a quarter of the UK's carbon dioxide emissions.

The average household causes about 6 tonnes of carbon dioxide every year. Based on this assessment, your home currently produces approximately 89 tonnes of carbon dioxide every year. Adopting the recommendations in this report can reduce emissions and protect the environment. If you were to install these recommendations you could reduce this amount by 27.0 tonnes per year. You could reduce emissions even more by switching to renewable energy sources.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.



Your home's heat demand

For most homes, the vast majority of energy costs derive from heating the home. Where applicable, this table shows the energy that could be saved in this property by insulating the loft and walls, based on typical energy use (shown within brackets as it is a reduction in energy use).

Heat demand	Existing dwelling	Impact of loft insulation	Impact of cavity wall insulation	Impact of solid wall insulation
Space heating (kWh per year)	357,220	(1,723)	N/A	(70,546)
Water heating (kWh per year)	4,042			

9.6. Appendix 6 – Water Calculation Sheets

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

Project Details

Adress/Reference	39 Fitzjohns Avenue NW3	Case Reference	LG01
Number of Bedrooms	3	Occupancy for Calculation Purposes	4

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Basin Type 1	5.60	2	11.20
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			11.20
Maximum Flow (l/s)			5.60
Average Flow (l/s)			5.60
Weighted Average Flow (l/s)			3.92
Flow for Calculation (l/s)			**5.60**

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bath 1	6.50	1	6.50
Bath 2	6.50	1	6.50
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			13.00
Maximum Flow (l/s)			6.50
Average Flow (l/s)			6.50
Weighted Average Flow (l/s)			4.55
Flow for Calculation (l/s)			**6.50**

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Bath 1	180.00	1	180.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Capacity (l)			180.00
Maximum Capacity (l)			180.00
Average Capacity (l)			180.00
Weighted Average Capacity (l)			126.00
Capacity for Calculation (l)			**180.00**

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Standard Dual	4.50	3.00	2
Total number of fittings			2
Average effective flushing volume			**3.50**

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
TBC	0.80	1	0.80
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			0.80
Maximum Consumption (l)			0.80
Average Consumption (l/s)			0.80
Weighted Average Consumption (l)			0.56
Consumption for Calculation (l/s)			**0.80**

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
TBC	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			6.00
Maximum Consumption (l)			6.00
Average Consumption (l/s)			6.00
Weighted Average Consumption (l)			4.20
Consumption for Calculation (l/s)			**6.00**

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Main Sink Cold	8.00	1	8.00
Main Sink Hot	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			14.00
Maximum Flow (l/s)			8.00
Average Flow (l/s)			7.00
Weighted Average Flow (l/s)			5.60
Flow for Calculation (l/s)			**7.00**

Other Fittings

Waste Disposal Y/N	0
Water softner	
Consumption beyond 4% l/p/d	0.00

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	0
Total Availble Grey Water Supply (l)	192.82
Possible Demand (l)	112.28
Grey/Rain Installed Capacity (l)	0.00
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	0.00	1.46	0.00	0.00
	Pt Flush (l)	0.00	2.96	0.00	0.00
WC's (Multiple)	Volume (l)	3.50	4.42	0.00	15.47
Taps Exc. Kitchen	Flow Rate	5.60	1.58	1.58	10.43
Bath (shower present)	(l/s)	180.00	0.11	0.00	19.80
Shower (bath present)	(l/s)	6.50	4.37	0.00	28.41
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	7.00	0.44	10.36	13.44
Washing Machines	(l/kgdry)	6.00	2.10	0.00	12.60
Dishwashers	(l/place)	0.80	3.60	0.00	2.88
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					**103.02**
Grey/RainWater Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Consumption CSH (l/p/day)					**93.75**
External Water Use Allowance (l)					5.00
Total Comsumption Part G (l/p/day)					**98.75**

Assesment Result	**PASS**

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

Project Details

Adress/Reference	39 Fitzjohns Avenue NW3	Case Reference	LG02
Number of Bedrooms	3	Occupancy for Calculation Purposes	4

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Basin Type 1	5.60	3	16.80
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		3	
Total Flow (l/s)			16.80
Maximum Flow (l/s)			5.60
Average Flow (l/s)			5.60
Weighted Average Flow (l/s)			3.92
Flow for Calculation (l/s)			**5.60**

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bath 1	6.50	2	13.00
Bath 2	6.50	1	6.50
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		3	
Total Flow (l/s)			19.50
Maximum Flow (l/s)			6.50
Average Flow (l/s)			6.50
Weighted Average Flow (l/s)			4.55
Flow for Calculation (l/s)			**6.50**

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Bath 1	180.00	2	360.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		2	
Total Capacity (l)			360.00
Maximum Capacity (l)			180.00
Average Capacity (l)			180.00
Weighted Average Capacity (l)			126.00
Capacity for Calculation (l)			**180.00**

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Standard Dual	4.50	3.00	3
Total number of fittings			3
Average effective flushing volume			**3.50**

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
TBC	0.80	1	0.80
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			0.80
Maximum Consumption (l)			0.80
Average Consumption (l/s)			0.80
Weighted Average Consumption (l)			0.56
Consumption for Calculation (l/s)			**0.80**

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
TBC	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			6.00
Maximum Consumption (l)			6.00
Average Consumption (l/s)			6.00
Weighted Average Consumption (l)			4.20
Consumption for Calculation (l/s)			**6.00**

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Main Sink Cold	8.00	1	8.00
Main Sink Hot	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			14.00
Maximum Flow (l/s)			8.00
Average Flow (l/s)			7.00
Weighted Average Flow (l/s)			5.60
Flow for Calculation (l/s)			**7.00**

Other Fittings

Waste Disposal Y/N	0
Water softner	
Consumption beyond 4% l/p/d	0.00

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	0
Total Availble Grey Water Supply (l)	192.82
Possible Demand (l)	112.28
Grey/Rain Installed Capacity (l)	0.00
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	0.00	1.46	0.00	0.00
	Pt Flush (l)	0.00	2.96	0.00	0.00
WC's (Multiple)	Volume (l)	3.50	4.42	0.00	15.47
Taps Exc. Kitchen	Flow Rate	5.60	1.58	1.58	10.43
Bath (shower present)	(l/s)	180.00	0.11	0.00	19.80
Shower (bath present)	(l/s)	6.50	4.37	0.00	28.41
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	7.00	0.44	10.36	13.44
Washing Machines	(l/kgdry)	6.00	2.10	0.00	12.60
Dishwashers	(l/place)	0.80	3.60	0.00	2.88
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					**103.02**
Grey/RainWater Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Consumption CSH (l/p/day)					**93.75**
External Water Use Allowance (l)					5.00
Total Comsumption Part G (l/p/day)					**98.75**

Assesment Result	**PASS**

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

Project Details

Adress/Reference	39 Fitzjohns Avenue NW3	Case Reference	LG03
Number of Bedrooms	2	Occupancy for Calculation Purposes	3

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Basin Type 1	5.60	2	11.20
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			11.20
Maximum Flow (l/s)			5.60
Average Flow (l/s)			5.60
Weighted Average Flow (l/s)			3.92
Flow for Calculation (l/s)			**5.60**

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bath 1	6.50	1	6.50
Bath 2	6.50	1	6.50
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			13.00
Maximum Flow (l/s)			6.50
Average Flow (l/s)			6.50
Weighted Average Flow (l/s)			4.55
Flow for Calculation (l/s)			**6.50**

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Bath 1	180.00	1	180.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Capacity (l)			180.00
Maximum Capacity (l)			180.00
Average Capacity (l)			180.00
Weighted Average Capacity (l)			126.00
Capacity for Calculation (l)			**180.00**

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Standard Dual	4.50	3.00	2
Total number of fittings			**2**
Average effective flushing volume			**3.50**

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
TBC	0.80	1	0.80
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			0.80
Maximum Consumption (l)			0.80
Average Consumption (l/s)			0.80
Weighted Average Consumption (l)			0.56
Consumption for Calculation (l/s)			**0.80**

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
TBC	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			6.00
Maximum Consumption (l)			6.00
Average Consumption (l/s)			6.00
Weighted Average Consumption (l)			4.20
Consumption for Calculation (l/s)			**6.00**

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Main Sink Cold	8.00	1	8.00
Main Sink Hot	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			14.00
Maximum Flow (l/s)			8.00
Average Flow (l/s)			7.00
Weighted Average Flow (l/s)			5.60
Flow for Calculation (l/s)			**7.00**

Other Fittings

Waste Disposal Y/N	0
Water softner	
Consumption beyond 4% l/p/d	0.00

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	0
Total Availble Grey Water Supply (l)	144.62
Possible Demand (l)	84.21
Grey/Rain Installed Capacity (l)	0.00
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	0.00	1.46	0.00	0.00
	Pt Flush (l)	0.00	2.96	0.00	0.00
WC's (Multiple)	Volume (l)	3.50	4.42	0.00	15.47
Taps Exc. Kitchen	Flow Rate	5.60	1.58	1.58	10.43
Bath (shower present)	(l/s)	180.00	0.11	0.00	19.80
Shower (bath present)	(l/s)	6.50	4.37	0.00	28.41
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	7.00	0.44	10.36	13.44
Washing Machines	(l/kgdry)	6.00	2.10	0.00	12.60
Dishwashers	(l/place)	0.80	3.60	0.00	2.88
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					**103.02**
Grey/RainWater Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Consumption CSH (l/p/day)					**93.75**
External Water Use Allowance (l)					5.00
Total Comsumption Part G (l/p/day)					**98.75**

Assesment Result	**PASS**

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

Project Details

Adress/Reference	39 Fitzjohns Avenue NW3	Case Reference	LG04
Number of Bedrooms	1	Occupancy for Calculation Purposes	2

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Basin Type 1	5.60	1	5.60
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Flow (l/s)			5.60
Maximum Flow (l/s)			5.60
Average Flow (l/s)			5.60
Weighted Average Flow (l/s)			3.92
Flow for Calculation (l/s)			**5.60**

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bath 1	6.50	1	6.50
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Flow (l/s)			6.50
Maximum Flow (l/s)			6.50
Average Flow (l/s)			6.50
Weighted Average Flow (l/s)			4.55
Flow for Calculation (l/s)			**6.50**

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Bath 1	180.00	1	180.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Capacity (l)			180.00
Maximum Capacity (l)			180.00
Average Capacity (l)			180.00
Weighted Average Capacity (l)			126.00
Capacity for Calculation (l)			**180.00**

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Standard Dual	4.50	3.00	1
Total number of fittings			**1**
Average effective flushing volume			**N/a**

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
TBC	0.80	1	0.80
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			0.80
Maximum Consumption (l)			0.80
Average Consumption (l/s)			0.80
Weighted Average Consumption (l)			0.56
Consumption for Calculation (l/s)			**0.80**

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
TBC	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			6.00
Maximum Consumption (l)			6.00
Average Consumption (l/s)			6.00
Weighted Average Consumption (l)			4.20
Consumption for Calculation (l/s)			**6.00**

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Main Sink Cold	8.00	1	8.00
Main Sink Hot	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			14.00
Maximum Flow (l/s)			8.00
Average Flow (l/s)			7.00
Weighted Average Flow (l/s)			5.60
Flow for Calculation (l/s)			**7.00**

Other Fittings

Waste Disposal Y/N	0
Water softner	
Consumption beyond 4% l/p/d	0.00

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	0
Total Availble Grey Water Supply (l)	96.41
Possible Demand (l)	56.10
Grey/Rain Installed Capacity (l)	0.00
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	4.50	1.46	0.00	6.57
	Pt Flush (l)	3.00	2.96	0.00	8.88
WC's (Multiple)	Volume (l)	0.00	4.42	0.00	0.00
Taps Exc. Kitchen	Flow Rate	5.60	1.58	1.58	10.43
Bath (shower present)	(l/s)	180.00	0.11	0.00	19.80
Shower (bath present)	(l/s)	6.50	4.37	0.00	28.41
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	7.00	0.44	10.36	13.44
Washing Machines	(l/kgdry)	6.00	2.10	0.00	12.60
Dishwashers	(l/place)	0.80	3.60	0.00	2.88
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					**103.00**
Grey/RainWater Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Consumption CSH (l/p/day)					**93.73**
External Water Use Allowance (l)					5.00
Total Comsumption Part G (l/p/day)					**98.73**

Assesment Result	**PASS**

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

Project Details

Adress/Reference	39 Fitzjohns Avenue NW3	Case Reference	LG05
Number of Bedrooms	1	Occupancy for Calculation Purposes	2

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Basin Type 1	5.60	2	11.20
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			11.20
Maximum Flow (l/s)			5.60
Average Flow (l/s)			5.60
Weighted Average Flow (l/s)			3.92
Flow for Calculation (l/s)			5.60

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bath 1	6.50	1	6.50
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Flow (l/s)			6.50
Maximum Flow (l/s)			6.50
Average Flow (l/s)			6.50
Weighted Average Flow (l/s)			4.55
Flow for Calculation (l/s)			6.50

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Bath 1	180.00	1	180.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Capacity (l)			180.00
Maximum Capacity (l)			180.00
Average Capacity (l)			180.00
Weighted Average Capacity (l)			126.00
Capacity for Calculation (l)			180.00

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Standard Dual	4.50	3.00	2
Total number of fittings			2
Average effective flushing volume			3.50

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
TBC	0.80	1	0.80
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			0.80
Maximum Consumption (l)			0.80
Average Consumption (l/s)			0.80
Weighted Average Consumption (l)			0.56
Consumption for Calculation (l/s)			0.80

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
TBC	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			6.00
Maximum Consumption (l)			6.00
Average Consumption (l/s)			6.00
Weighted Average Consumption (l)			4.20
Consumption for Calculation (l/s)			6.00

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Main Sink Cold	8.00	1	8.00
Main Sink Hot	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			14.00
Maximum Flow (l/s)			8.00
Average Flow (l/s)			7.00
Weighted Average Flow (l/s)			5.60
Flow for Calculation (l/s)			7.00

Other Fittings

Waste Disposal Y/N	0
Water softner	
Consumption beyond 4% l/p/d	0.00

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	0
Total Availble Grey Water Supply (l)	96.41
Possible Demand (l)	56.14
Grey/Rain Installed Capacity (l)	0.00
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	0.00	1.46	0.00	0.00
	Pt Flush (l)	0.00	2.96	0.00	0.00
WC's (Multiple)	Volume (l)	3.50	4.42	0.00	15.47
Taps Exc. Kitchen	Flow Rate	5.60	1.58	1.58	10.43
Bath (shower present)	(l/s)	180.00	0.11	0.00	19.80
Shower (bath present)	(l/s)	6.50	4.37	0.00	28.41
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	7.00	0.44	10.36	13.44
Washing Machines	(l/kgdry)	6.00	2.10	0.00	12.60
Dishwashers	(l/place)	0.80	3.60	0.00	2.88
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					103.02
Grey/RainWater Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Consumption CSH (l/p/day)					93.75
External Water Use Allowance (l)					5.00
Total Comsumption Part G (l/p/day)					98.75

Assesment Result: **PASS**

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

Project Details

Adress/Reference	39 Fitzjohns Avenue NW3	Case Reference	TF01
Number of Bedrooms	4	Occupancy for Calculation Purposes	5

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Basin Type 1	5.60	3	16.80
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		3	
Total Flow (l/s)			16.80
Maximum Flow (l/s)			5.60
Average Flow (l/s)			5.60
Weighted Average Flow (l/s)			3.92
Flow for Calculation (l/s)			5.60

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bath 1	6.50	2	13.00
Bath 2	6.50	1	6.50
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		3	
Total Flow (l/s)			19.50
Maximum Flow (l/s)			6.50
Average Flow (l/s)			6.50
Weighted Average Flow (l/s)			4.55
Flow for Calculation (l/s)			6.50

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Bath 1	180.00	2	360.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		2	
Total Capacity (l)			360.00
Maximum Capacity (l)			180.00
Average Capacity (l)			180.00
Weighted Average Capacity (l)			126.00
Capacity for Calculation (l)			180.00

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Standard Dual	4.50	3.00	3
Total number of fittings			3
Average effective flushing volume			3.50

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
TBC	0.80	1	0.80
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			0.80
Maximum Consumption (l)			0.80
Average Consumption (l/s)			0.80
Weighted Average Consumption (l)			0.56
Consumption for Calculation (l/s)			0.80

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
TBC	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			6.00
Maximum Consumption (l)			6.00
Average Consumption (l/s)			6.00
Weighted Average Consumption (l)			4.20
Consumption for Calculation (l/s)			6.00

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Main Sink Cold	8.00	1	8.00
Main Sink Hot	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			14.00
Maximum Flow (l/s)			8.00
Average Flow (l/s)			7.00
Weighted Average Flow (l/s)			5.60
Flow for Calculation (l/s)			7.00

Other Fittings

Waste Disposal Y/N	0
Water softner	
Consumption beyond 4% l/p/d	0.00

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	0
Total Availble Grey Water Supply (l)	241.03
Possible Demand (l)	140.35
Grey/Rain Installed Capacity (l)	0.00
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	0.00	1.46	0.00	0.00
	Pt Flush (l)	0.00	2.96	0.00	0.00
WC's (Multiple)	Volume (l)	3.50	4.42	0.00	15.47
Taps Exc. Kitchen	Flow Rate	5.60	1.58	1.58	10.43
Bath (shower present)	(l/s)	180.00	0.11	0.00	19.80
Shower (bath present)	(l/s)	6.50	4.37	0.00	28.41
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	7.00	0.44	10.36	13.44
Washing Machines	(l/kgdry)	6.00	2.10	0.00	12.60
Dishwashers	(l/place)	0.80	3.60	0.00	2.88
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					103.02
Grey/RainWater Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Consumption CSH (l/p/day)					93.75
External Water Use Allowance (l)					5.00
Total Comsumption Part G (l/p/day)					98.75

Assesment Result: **PASS**

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

Project Details

Adress/Reference	39 Fitzjohns Avenue NW3	Case Reference	GF01
Number of Bedrooms	3	Occupancy for Calculation Purposes	4

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Basin Type 1	5.60	4	22.40
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		4	
Total Flow (l/s)			22.40
Maximum Flow (l/s)			5.60
Average Flow (l/s)			5.60
Weighted Average Flow (l/s)			3.92
Flow for Calculation (l/s)			**5.60**

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bath 1	6.50	3	19.50
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		3	
Total Flow (l/s)			19.50
Maximum Flow (l/s)			6.50
Average Flow (l/s)			6.50
Weighted Average Flow (l/s)			4.55
Flow for Calculation (l/s)			**6.50**

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Bath 1	180.00	3	540.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		3	
Total Capacity (l)			540.00
Maximum Capacity (l)			180.00
Average Capacity (l)			180.00
Weighted Average Capacity (l)			126.00
Capacity for Calculation (l)			**180.00**

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Standard Dual	4.50	3.00	5
Total number of fittings			**5**
Average effective flushing volume			**3.50**

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
TBC	0.80	1	0.80
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			0.80
Maximum Consumption (l)			0.80
Average Consumption (l/s)			0.80
Weighted Average Consumption (l)			0.56
Consumption for Calculation (l/s)			**0.80**

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
TBC	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			6.00
Maximum Consumption (l)			6.00
Average Consumption (l/s)			6.00
Weighted Average Consumption (l)			4.20
Consumption for Calculation (l/s)			**6.00**

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Main Sink Cold	8.00	1	8.00
Main Sink Hot	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			14.00
Maximum Flow (l/s)			8.00
Average Flow (l/s)			7.00
Weighted Average Flow (l/s)			5.60
Flow for Calculation (l/s)			**7.00**

Other Fittings

Waste Disposal Y/N	0
Water softner	
Consumption beyond 4% l/p/d	0.00

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	0
Total Availble Grey Water Supply (l)	192.82
Possible Demand (l)	112.28
Grey/Rain Installed Capacity (l)	0.00
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	0.00	1.46	0.00	0.00
	Pt Flush (l)	0.00	2.96	0.00	0.00
WC's (Multiple)	Volume (l)	3.50	4.42	0.00	15.47
Taps Exc. Kitchen	Flow Rate	5.60	1.58	1.58	10.43
Bath (shower present)	(l/s)	180.00	0.11	0.00	19.80
Shower (bath present)	(l/s)	6.50	4.37	0.00	28.41
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	7.00	0.44	10.36	13.44
Washing Machines	(l/kgdry)	6.00	2.10	0.00	12.60
Dishwashers	(l/place)	0.80	3.60	0.00	2.88
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					**103.02**
Grey/RainWater Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Consumption CSH (l/p/day)					**93.75**
External Water Use Allowance (l)					5.00
Total Comsumption Part G (l/p/day)					**98.75**

Assesment Result	**PASS**

Water Efficiency Calculator for New Dwellings (V1f - Aug 2010)

Project Details

Adress/Reference	39 Fitzjohns Avenue NW3	Case Reference	FF01
Number of Bedrooms	2	Occupancy for Calculation Purposes	3

Appliance/Useage Details

Taps (Excluding Kitchen Taps)

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Basin Type 1	5.60	1	5.60
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Flow (l/s)			5.60
Maximum Flow (l/s)			5.60
Average Flow (l/s)			5.60
Weighted Average Flow (l/s)			3.92
Flow for Calculation (l/s)			**5.60**

Showers

Shower fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Bath 1	6.50	1	6.50
			0.00
			0.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Flow (l/s)			6.50
Maximum Flow (l/s)			6.50
Average Flow (l/s)			6.50
Weighted Average Flow (l/s)			4.55
Flow for Calculation (l/s)			**6.50**

Baths

Bath Type	Capacity to Overflow	Quantity (No.)	Total per Fitting type
Bath 1	180.00	1	180.00
			0.00
			0.00
			0.00
Total No. of Fittings (No.)		1	
Total Capacity (l)			180.00
Maximum Capacity (l)			180.00
Average Capacity (l)			180.00
Weighted Average Capacity (l)			126.00
Capacity for Calculation (l)			**180.00**

WCs

WC Type	Full Flush Volume	Part Flush Volume	Quantity (No)
Standard Dual	4.50	3.00	1
Total number of fittings			**1**
Average effective flushing volume			**N/a**

Dishwashers

Dishwasher Type	L per Place Setting	Quantity (No.)	Total per Fitting type
TBC	0.80	1	0.80
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			0.80
Maximum Consumption (l)			0.80
Average Consumption (l/s)			0.80
Weighted Average Consumption (l)			0.56
Consumption for Calculation (l/s)			**0.80**

Washing Machines

Washing Machine Type	L per Kg Dry Load	Quantity (No.)	Total per Fitting type
TBC	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		1	
Total Consumption (l)			6.00
Maximum Consumption (l)			6.00
Average Consumption (l/s)			6.00
Weighted Average Consumption (l)			4.20
Consumption for Calculation (l/s)			**6.00**

Kitchen Taps

Tap Fitting Type	Flow Rate Litres/Min	Quantity (No.)	Total per Fitting type
Main Sink Cold	8.00	1	8.00
Main Sink Hot	6.00	1	6.00
			0.00
Total No. of Fittings (No.)		2	
Total Flow (l/s)			14.00
Maximum Flow (l/s)			8.00
Average Flow (l/s)			7.00
Weighted Average Flow (l/s)			5.60
Flow for Calculation (l/s)			**7.00**

Other Fittings

Waste Disposal Y/N	0
Water softner	
Consumption beyond 4% l/p/d	0.00

Use of grey water and harvested rainwater

Total Grey water from WHB taps (l)	0
Total Availble Grey Water Supply (l)	144.62
Possible Demand (l)	84.15
Grey/Rain Installed Capacity (l)	0.00
Figure for Calculation lit/person/day	0.00

Water Use Assessment

Installation Type	Unit	Capacity/ Flow Rate	Use Factor	Fixed use (l/p/day)	Total Use (l/p/day)
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	4.50	1.46	0.00	6.57
	Pt Flush (l)	3.00	2.96	0.00	8.88
WC's (Multiple)	Volume (l)	0.00	4.42	0.00	0.00
Taps Exc. Kitchen	Flow Rate	5.60	1.58	1.58	10.43
Bath (shower present)	(l/s)	180.00	0.11	0.00	19.80
Shower (bath present)	(l/s)	6.50	4.37	0.00	28.41
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/s)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/s)	7.00	0.44	10.36	13.44
Washing Machines	(l/kgdry)	6.00	2.10	0.00	12.60
Dishwashers	(l/place)	0.80	3.60	0.00	2.88
Waste Disposal	(l/s)	0.00	3.08	0.00	0.00
Water Softner	(l/s)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					**103.00**
Grey/RainWater Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Consumption CSH (l/p/day)					**93.73**
External Water Use Allowance (l)					5.00
Total Comsumption Part G (l/p/day)					**98.73**

Assesment Result	**PASS**