
Energy Assessment Cornwall Road

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Executive Summary

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About the Scheme:

The Cornwall Road project comprises the construction of two residential blocks to provide 9 units in total. The development is located in the London Borough of Haringey. The scheme has a total internal floor area of approximately 603m².

Planning policy:

The scheme has been developed in accordance with the London Plan 2021 and with the Sustainable, Design and Construction SPG. The extent and emerging Development Plan policies require the development to achieve a minimum of 35% carbon reduction (London Plan Policy SI2).

The scheme complies with the Part L 2013 Building Regulations and the minimum energy efficiency targets in the following documents have been followed:

- New build (Part L1A) – The actual building CO₂ emissions rate (DER) is no greater than the notional building CO₂ target emissions rate.

Local Policy and Employer's Requirements

As per Haringey's policy SP4 Working towards a Low Carbon Haringey; all new residential developments will aim to achieve a 100% reduction in total (regulated) CO₂ emissions. Additionally: the scheme should target:

- A maximum space heating demand per unit of 15–20 kWh/m² to be achieved through services design
- A minimum 50% reduction in CO₂ emission (over Building Regulations Part L 2013) should be achieved as a minimum, and a fabric first approach adopted
- Developments should achieve a 40% reduction in CO₂ emissions from onsite renewable energy.

Emission factors:

The Greater London Authority (GLA) Guidance on Energy Assessments published in October 2018 highlights a critical development regarding carbon emission factors. Grid electricity has significantly decarbonised since the last update of Part L in April 2014 and in July 2018 the Government published updated carbon emission factors (SAP10.0) demonstrating this. Although SAP10.0 is not in use yet, the GLA Guidance encourages the use of SAP10.0 carbon emission factors from January 2019. Any applicants proposing to use the SAP 2012 emissions factors is required to provide adequate justification.

While the proposed scheme is expected to comply with SAP 2012, the assessment presents total emissions using both factors. The revised factors are below:

Fuel Type	Carbon Factor (kg CO ₂ /kWh)	
	SAP 2012	SAP10
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.233

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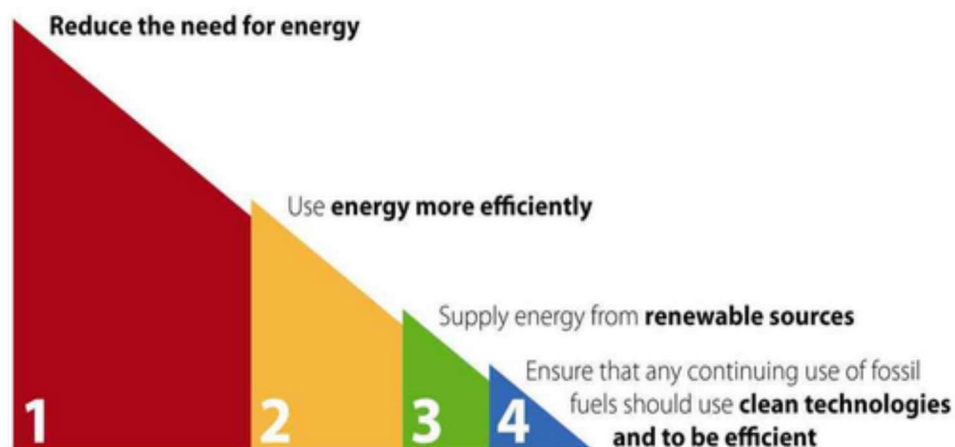
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The Energy Hierarchy

The proposed scheme has followed the energy hierarchy that is illustrated below:



GLA's Energy Hierarchy: Regulated carbon emissions Calculated using SAP 2012 carbon dioxide emission factors				
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	13.15	11.61	–	5.46
CO ₂ emissions saving (tCO ₂ /yr)	–	1.54	–	6.16
Saving from each stage (%)	–	11.7	–	46.8
Total CO ₂ emissions saving (tCO ₂ /yr)	7.70			
58.5% total carbon emissions savings over existing building and Part L1A achieved (using SAP 2012 emission factors)				
GLA's Energy Hierarchy: Regulated carbon emissions Calculated using SAP10.0 carbon dioxide emission factors				
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	11.86	10.13	–	2.45
CO ₂ emissions saving (tCO ₂ /yr)	–	1.73	–	7.68
Saving from each stage (%)	–	14.5	–	64.8
Total CO ₂ emissions saving (tCO ₂ /yr)	9.41			
80.0% total carbon emissions savings over existing building and Part L1A achieved (using SAP10.0 emission factors)				

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GLA's Energy Hierarchy: Regulated carbon emissions

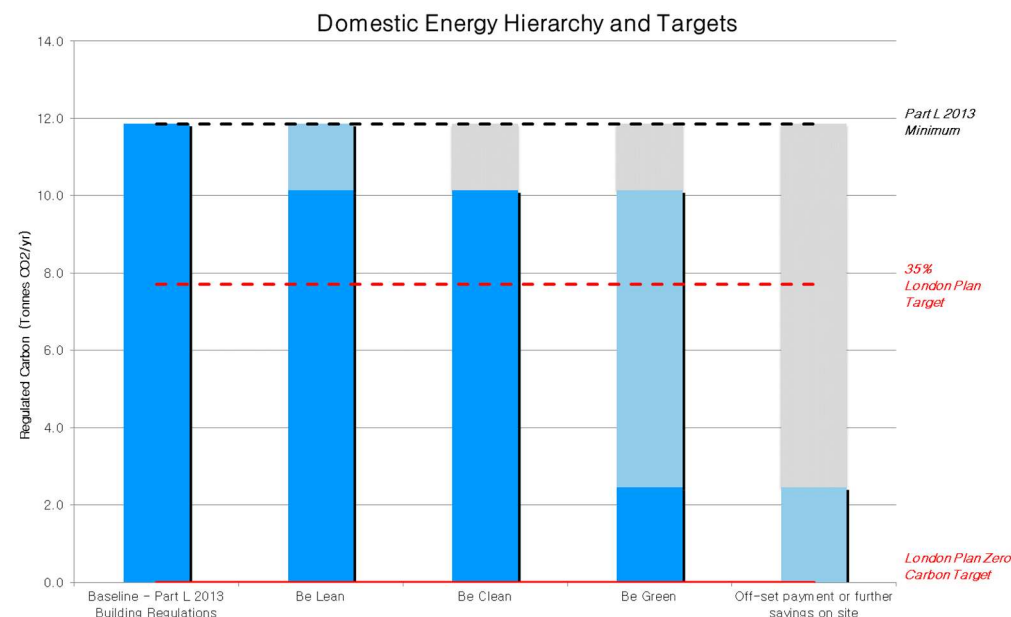
A graphical illustration of how the scheme performs in relation to Building Regulations and the Energy Hierarchy is shown below. Carbon dioxide emission factors for SAP10.0 have been used for the calculation.

Summary (SAP10.0 factors)

As demonstrated above the proposed scheme will reduce carbon emissions by 14.5% from the fabric energy efficiency measures described in the 'Be Lean' section and will reduce total carbon emissions by 80.0% over Building Regulations (using SAP10.0 carbon factors), with the further inclusion of the proposed ASHP and photovoltaic panels. **Therefore, the scheme meets and exceeds the target of overall 35% carbon reduction over Part L building Regulations as set out in The London Plan Policy SI2 and Haringey's policy SP4.**

In addition, each flat has the following space heating energy consumption.

Flat	Space heating (kWh/m ²)
Unit 1 – Block 1	14.39
Unit 2 – Block 1	10.14
Unit 3 – Block 1	18.11
Unit 1 – Block 2	11.20
Unit 2 – Block 2	10.54
Unit 3 – Block 2	9.86
Unit 4 – Block 2	10.15
Unit 5 – Block 2	14.17
Unit 6 – Block 2	14.34



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Total carbon emissions:

As required by the GLA both the regulated and unregulated emissions of the development must be quantified and demonstrated. The total emissions for the scheme are shown below.

Carbon Dioxide Emissions – Regulated and Unregulated (Tonnes CO ₂ /yr) SAP10.0			
	Regulated Emissions	Unregulated Emissions	Total Emissions
Baseline: Part L 2013	11.86	5.20	17.06
Be Lean: After demand reduction	10.13	5.20	15.33
Be Clean: After CHP	–	–	–
Be Green: After Renewable energy	2.45	5.20	7.65

Carbon Offset Payment Energy Assessment Cornwall Road

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Carbon offset

London plan policy SI2 and Haringey's policy SP4 requires carbon reductions to be achieved as far as possible on-site and a cash in lieu contribution will be considered acceptable only in instances where it has been clearly demonstrated that no further savings can be achieved on-site. The remaining savings to reach zero carbon can be achieved either on site or via a cash in lieu contribution, although savings on site are preferable.

The cumulative savings for offset payment and the cash-in-lieu contribution have been anticipated and tabulated below, using SAP10.0 carbon emission factors and an offset price of £95 per tonne.

	Annual CO ₂ for offset payment	Cumulative CO ₂ for offset payment (over 30 years)	Cash-in-lieu contribution (@£95/tonne)
Cornwall Road	2.45	73.51	£6,984

Methodology

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Aim of this study

The purpose of an energy assessment is to demonstrate that climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy. It also ensures energy remains an integral part of the scheme's design and evolution.

Methodology

The methodology followed in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the document "ENERGY PLANNING: Greater London Authority guidance on preparing energy assessments". The scheme has been developed in accordance with the London Plan 2021.

Under the GLA's guidance (April 2020) applications for major developments should be accompanied by an energy statement. The energy statement should provide information demonstrating how the energy hierarchy has been followed i.e. 'Lean, Clean, Green', including consideration of passive design and decentralised energy options such as CHP/Community CHP.

This report has followed these documents and comprises the following components:

- **BASELINE:** A calculation of the Part L1A CO₂ emission baseline using approved software. The baseline assumes a gas boiler would provide heating and any active cooling would be electrically powered.
- **LEAN:** A calculation of the impact of demand reduction measures. For example, passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading, and active design measures such as high efficacy lighting and efficient mechanical ventilation with heat recovery.
- **COOLING HIERARCHY:** In accordance with London Plan Policy SI4, measures that are proposed to reduce the demand for cooling have been set out such as minimisation of solar and internal gains and night cooling strategies.
- **CLEAN:** In accordance with London Plan Policy SI3, this report has demonstrated how the scheme has selected heating, cooling and power systems to minimise carbon emissions. This comprises an evaluation of the feasibility of connecting to existing low carbon heat networks, planned networks, site-wide and communal heat networks, and CHP.
- **GREEN:** In accordance with London Plan Policy SI2, this report has conducted a feasibility assessment of renewable energy technologies. This comprised a site-specific analysis of the technologies and, if applicable, how they would be integrated into the heating and cooling strategy for the scheme.

Establishing Emissions: The Carbon Profile Energy Assessment Cornwall Road

Part L1A minimum compliance:

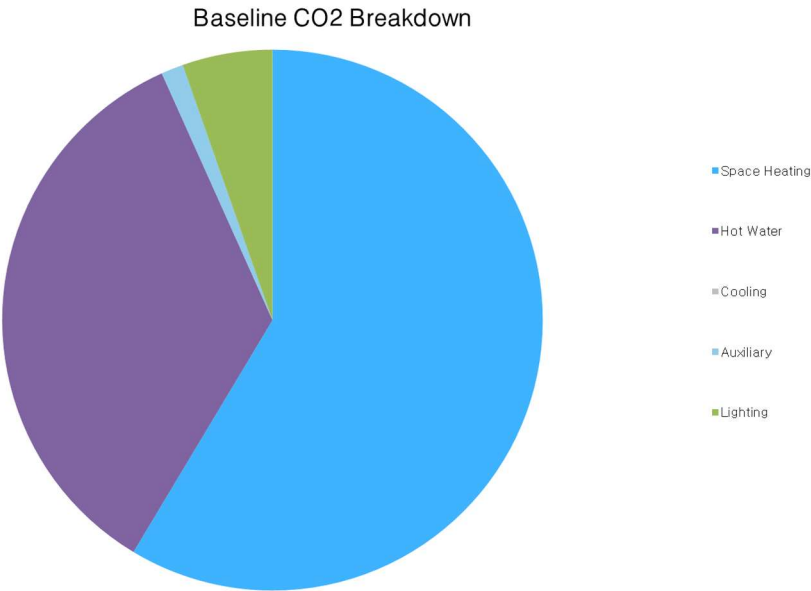
The total baseline carbon emissions for the whole scheme is 11.86 tonnes CO₂/yr (using SAP10.0 factors).

The pie chart provides a breakdown of the specific carbon emissions by system over the course of one year.

Overview

The chart shows that space heating is the primary source of carbon dioxide emissions, and hot water is the second largest, across the scheme as a whole.

	Heating	Hot Water	Cooling	Auxiliary	Lighting
Carbon Emissions in tonnes CO ₂ /yr.	6.95	4.11	0.00	0.16	0.64



'Be Lean': Demand Reduction Measures

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Be Lean: summary

Demand reduction measures have reduced the scheme's carbon emissions by 11.7% (using SAP 2012 figures) and by 14.5% (using SAP10.0 figures) over Part L1A baseline.

Building fabric: passive design measures

Element	Part L1A required U-value W/m ² K	Proposed / assumed U-value W/m ² K
Ground floor	0.25	0.11
Wall	0.30	0.14
Wall -Corridor	0.30	0.14
Roof	0.20	0.11
Window	2.00	1.3 (g-value 0.5)
Door	2.00	1.4
Air Permeability in m ³ /hr/m ² @ 50 Pa		
Whole Building	10	3

This will require careful attention to two key areas:

- Structural leakage
- Services leakage

Structural leakage occurs at joints in the building fabric and around window and door openings, loft hatches and access openings. There will also be some diffusion through materials such as cracks in masonry walls typically caused by poor perpends in blockwork inner leaf's. Structural leakage is hard to remedy retrospectively therefore good detailing at the design stage is essential.

Services leakage occurs at penetrations from pipes and cables entering the building. These can be sewerage pipes, water pipes and heating pipes. As well as electricity cables there may also be telecommunication cables. Attention, therefore, needs to be paid to sealing all penetrations during construction.

Thermal Bridging:

The scheme will be designed in line with the accredited construction details (ACD) and therefore it has been indicatively modelled with the accredited thermal bridge Psi-values for the following junctions:

- Lintels (E2)
- Sill (E3)
- Jambs (E4)
- Ground floor (E5)
- Party floor between dwellings (E7)
- Corners (E16)
- Corners inverted (E17)

A bespoke thermal bridging calculation will be required for the following junctions in order to achieve the specified Psi-values:

- Flat Roof with Parapet (E15); 0.30 W/mK
- Balcony (E23); 0.30 W/mK

The default psi-value has been used for the remaining junctions.

Thermal Mass:

Thermal mass of the scheme has been indicatively modelled as 250 kJ/m²K (medium).

'Be Lean': Demand Reduction Measures

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Heating:

For the 'Be Lean' scenario, the scheme has been modelled with a gas boiler with an efficiency of 89.5% (as required by the GLA).

For the 'Be Green' final scenario, an air source heat pump with a minimum COP of 2.90 will be proposed as the main heating system. Heat will be provided via radiators and will be controlled with a charging system linked to use of community with programmer and TRVs.

Hot Water:

For the 'Be Lean', the hot water will be provided by the main gas heating system (gas boilers with an efficiency of 89.5%).

For the 'Be Green' final scenario, hot water will be provided by the air source heat pump, with a minimum COP of 2.90. A top-up electric immersion heater will provide less than 20% of the hot water demand.

Ventilation:

Mechanical ventilation with heat recovery has been specified for the apartments. All apartments contain one toilet. Therefore, each dwelling has been modelled with a SFP of 0.53 W/l/s and a heat recovery efficiency of 89%.

Cooling:

Cooling has not been specified for the development.

Lighting:

High efficiency lighting has been specified for the dwellings with a minimum efficacy of 75 lumens/W.

Equipment:

All appliances will have a minimum rating of A+.

Controls:

The proposed scheme sets out to address demand side response to energy efficiency, including smart meters, to provide more consumption data to inform control which will allow the running of some equipment at a lower capacity during times of peak demand. The design team will also explore the possibility of energy storage, smart controls, to optimise heating and power systems at a later stage of the project.

Energy demand following energy efficiency measures (MWh/year)						
Space Heating	Hot water	Lighting	Auxiliary	Cooling	Unregulated gas	Unregulated electricity
23.9	19.6	2.7	1.5	0.0	0.0	11.6

Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement (%)
39.66	33.16	16%

‘Be Lean’: Heating Infrastructure & CHP Energy Assessment Cornwall Road

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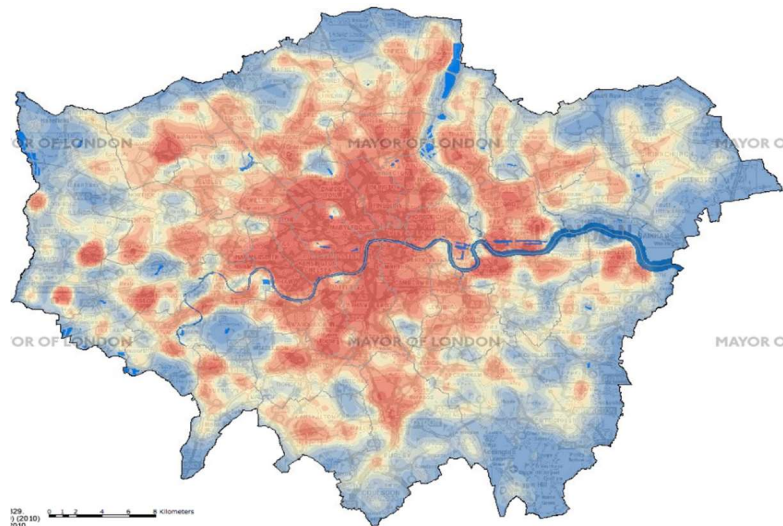
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Heating infrastructure including CHP

Once demand for energy has been minimised, schemes must demonstrate how their energy systems have been selected in accordance with the order of preference in London Plan Policy SI3. This has involved a systematic appraisal of the potential to connect to existing or planned heating networks and on site communal and CHP systems.

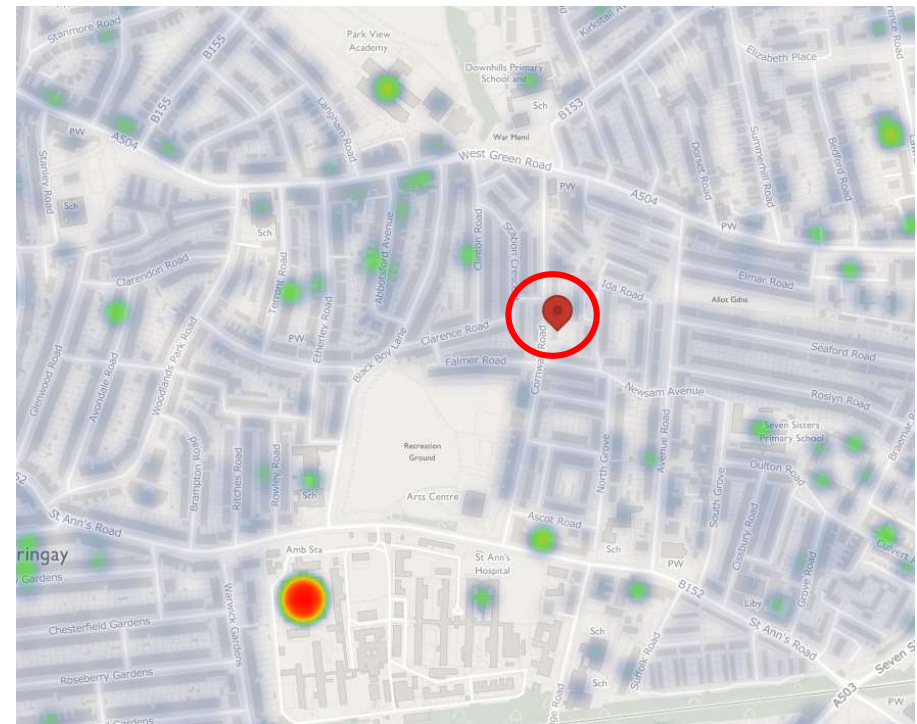
Heating infrastructure

The London Heat Map (shown below) has been consulted to establish the possibility of connecting to heating infrastructure.



Existing and planned networks

A review of the London Heat Map demonstrates that there are no existing networks present within the connectable range of the scheme. A map of the existing and potential networks in the scheme's location is shown below.



There are no existing or potential networks within the vicinity of the scheme as per the London Heat Map, therefore a connection is not possible.

‘Be Clean’: Site Wide Networks and CHP Energy Assessment Cornwall Road

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Site-wide heat networks

In accordance with section 8.2 of the GLA guidance for Energy Planning, where it is demonstrable that a site wide network is not feasible then an individual heating strategy can be implemented. A site-wide communal heating system has been adopted for the proposed development.

Combined Heat and Power (CHP)

In accordance with section 8.3 of the GLA guidance for Energy Planning where connection to an area wide heat network will not be available in the foreseeable future i.e. 5 years following completion, or the development is of such a scale that it could be the catalyst for an area wide heat network, applicants should evaluate the feasibility of on-site CHP

GLA guidance stipulates that small, or purely residential developments of less than 350 dwellings will not be expected to include on-site CHP. CHP systems are best utilised where there is a consistent and high demand for heat. Because of the small electricity supplies and demand of this scheme, a CHP installed to meet the base heat load would typically require the export of electricity to the grid. The administrative burden of managing CHP electricity sales at a small scale without an active energy service companies (ESCOs) is prohibitive for smaller operators of residential developments.

The heat demand profile of this scheme is not suitable to CHP. The implemented fabric improvements from the ‘Be Lean’ scenario have also reduced the energy demand from space heating to hot water. For CHP systems to be economically viable they need to run for at least 5,000 hours per year. Therefore, a CHP system would most likely be oversized, and as a result less efficient and economic.

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Overheating and cooling

The aim of this section is to reduce the impact of the urban heat island effect in London and encourage the design of spaces to avoid overheating and excessive heat generation, and to mitigate overheating due to the impact of climate change.

Where design measures and the use of natural and/or mechanical ventilation are not enough to guarantee the occupant's comfort, in line with the cooling hierarchy the development's cooling strategy must include details of the active cooling plant being proposed, including efficiencies, and the ability to take advantage of free cooling and/or renewable cooling sources.

Where appropriate, the cooling strategy should investigate the opportunities to improve cooling efficiencies through the use of locally available sources such as ground cooling and river/dock water-cooling.

The Cooling Hierarchy

Major developments should reduce potential overheating and reliance on air conditioning systems and demonstrate this with the Cooling Hierarchy:

- 
1. Minimise internal heat generation through energy efficient design
 2. Reduce the amount of heat entering the building in summer (e.g. shading and fenestration)
 3. Manage the heat within the building through thermal mass, room height and green roofs
 4. Passive ventilation
 5. Mechanical ventilation
 6. Active cooling systems (ensuring the lowest carbon option)

Avoiding overheating: measures taken

The following measures have been taken in accordance with the cooling hierarchy to reduce overheating and the need for cooling:

1. Minimise internal heat generation through energy efficient design

Internal heat gains have been minimised where possible. Energy efficient appliances with A+ rating, will help reduce internal heat gain.

Energy efficient lighting will also be specified with an average lumen efficacy of more than 75 lumens per circuit watt for the development.

2. Reduce the amount of heat entering the building in summer (e.g. shading and fenestration)

Direct solar gains will be controlled in the following ways:

- Light-coloured reflective blinds will be specified to limit solar gain to all spaces.
- Solar control: The type of glazing has been optimised and reduced solar gain factors from low emissivity windows with a g-value of 0.5 have been specified for building.

Heat transfer and infiltration of the new build envelope has been controlled in the following ways:

- Insulation levels have been maximised for the new elements and the proposed resulting U-values are lower than required by Building Regulations. The build-ups therefore prevent the penetration of heat as much as practically possible. See the 'Be Lean' section of this report for target U-values.
- A reduced air permeability rate of $3 \text{ m}^3/(\text{hr.m}^2) @ 50 \text{ Pa}$ has been targeted for the development to minimise uncontrolled air infiltration. This will require attention to detailing and sealing. See 'Be Lean' section of this report for details of how this will be achieved.

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Avoiding overheating: measures taken (continued)

3. Manage the heat within the building through thermal mass and room height.

The following measures have been specified to manage heat accumulation within the building:

- Room heights – The proposed building has floor to ceiling heights of approximately 2.5m or higher. As the roof will be well insulated to achieve a U-value of 0.11 W/m²K, there will be minimal penetration of heat through the roof.
4. High thermal mass: dense building fabric materials such as concrete floors and masonry external walls have been specified. These materials act as 'thermal batteries'; they absorb heat gains during the day when the building is occupied and 'store' it for an extended period, thereby helping to stabilise daytime temperatures. At night this heat can be dissipated, which 'resets' the heating cycle. A 'ground coupled' system that uses the thermal storage capacity of the ground has not been specified as a passive ventilation approach has been selected instead.
5. Passive ventilation: Natural ventilation has been maximised wherever possible, with dual aspect rooms and at least two fully openable windows.
- Cross ventilation will be achieved by opening windows on two facades and ensuring there is a clear path for airflow.
 - Night time passive cooling will also be utilised. This will work in tandem with high thermal mass materials specified. The larger temperature differential that exists between internal and external temperatures at night will allow effective stack ventilation and purging of heat accumulated within the structure during the day.

6. Mechanical ventilation: Passive ventilation will not be adequate to cool the building to the required temperature. Mechanical ventilation will be utilised in the following forms:
- The mechanical systems will have the following efficiencies which are in compliance with the Domestic Building Services Compliance Guide
 - The apartments contain one toilet and have been modelled with an SFP of 0.53 W/l/s and a heat recovery efficiency of 89%.

Overheating risk

The overheating risk considering all the above described passive measures have been assessed for the scheme:

Areas	Overheating risk from SAP
Unit 1 – Block 1	Medium
Unit 2 – Block 1	Medium
Unit 3 – Block 1	Slight
Unit 1 – Block 2	Slight
Unit 2 – Block 2	Slight
Unit 3 – Block 2	Slight
Unit 4 – Block 2	Slight
Unit 5 – Block 2	Slight
Unit 6 – Block 2	Slight

According to the GLA guidance on preparing energy assessments (April 2020) Section 9, a dynamic modelling to assess the risk of overheating should be carried out. This has been undertaken as a separate report by Eight Associates (July 2020) and confirms that all rooms comply with TM 59.

'Be Green': Renewable Energy

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Renewable energy feasibility

In line with London Plan Policy SI2, the feasibility of renewable energy technologies has been considered. A detailed site-specific analysis and associated carbon saving calculations has also been provided for renewable energy technologies considered feasible.

Renewable energy technology comparison

Each technology has been assessed under 5 broader categories. There are key criteria for each category on which the technology is evaluated. The key criteria have been given a weighting based on a tick-system, a graphical representation of this is shown below:

✓✓✓✓✓ = 1 scored out of a possible 5

The weighting of each of the criteria within the categories is shown below:

- Local, site-specific impact: (Maximum score of 4)
 - Local planning criteria = ✓✓
 - Land used by all components = ✓
 - Noise impact from operation = ✓
- Suitability and design impact: (Maximum score of 4)
 - Interaction on the current building design = ✓✓
 - Building orientation suitability = ✓
 - Buildability of installation = ✓
- Economic viability: (Maximum score of 5)
 - Capital cost of all components = ✓✓
 - Grants and funding available = ✓
 - Payback periods (years) 3-5, 5-10, 10-15 = ✓✓

- Operation and maintenance: (Maximum score of 3)
 - Servicing requirements (low or high) = ✓
 - Maintenance costs (low or high) = ✓
 - Resource use from future maintenance (low or high) = ✓
- CO₂ and sustainability: (Maximum score of 10)
 - Carbon saving per year = ✓✓✓✓
 - Impact of future grid decarbonisation (gas vs. electric) = ✓✓
 - Local air quality/pollution = ✓✓
 - Resource use of installation = ✓✓

Key comments on each of the criteria and the corresponding score will be provided in a table (example below) for each of the technologies. The score for each of the criteria will be summed and each of the technologies will then be ranked. The assessment of each technology is undertaken on the following pages.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability
	✓✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓	✓✓✓✓✓
					✓✓✓✓✓

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Biomass & Biofuel – Rejected

Biomass is normally considered a carbon 'neutral' fuel, as the carbon dioxide emitted on burning has been recently absorbed from the atmosphere by photosynthesis. Although some form of fossil fuel derived inputs is required in the production and transportation of the fuel.

Wood is seen as a by-product of other industries and the small quantity of energy for drying, sawing, pelleting and delivery are typically discounted. Biomass from coppicing is likely to have external energy inputs from fertiliser, cutting, drying etc. and these may need to be considered. In this toolkit, all biomass fuels are considered to have zero net carbon emissions.

Biomass can be burnt directly to provide heat in buildings. Wood from forests, urban tree pruning, farmed coppices or farm and factory waste, is the most common fuel and is used commercially in the form of wood chips or pellets. Biomass boilers can also be designed to burn smokeless to comply with the Clean Air Acts.

Boilers can be fed automatically by screw drives from fuel hoppers. This typically involves daily addition of bagged fuels.

A biomass boiler could be installed on site for supplementary LTHW heating; however, a major factor influencing the suitability of a biomass boiler is the availability of the biomass fuel. A local and reliable fuel source would be essential for the biomass boiler to be an efficient replacement for a conventional boiler system. Therefore, a very comprehensive feasibility assessment needs to be undertaken to understand the practicalities of such a system.

It is estimated that the heating and hot water demand of the site is too large to meet the required CO2 emissions reduction if a biomass boiler was a standalone system. Therefore, a biomass boiler would need to be combined with energy demand reduction measures and/or CHP. In order to meet the 35% CO2 emissions reduction a biomass boiler would need to be installed. The likely installed cost would be

circa £20,000. The additional cost of providing and storing the biofuel also needs to be accounted for. The site is likely to be unsuitable for biomass boilers due to site constraints such as limited space for storage of the biomass fuel. A detailed feasibility study would be required to investigate the suitability.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability
Biomass Boiler	 Local air quality impacts, increased transport usage on the restricted site, increased plant space.	 Increase in plant space required, orientation fine, slightly increased buildability issues.	 Increased capital costs of installation, typical payback of 8 years	 Increased maintenance relative to gas boiler, resource use not significantly increased if well serviced.	 Very low carbon intensity of feedstock if properly procured. Decarbonisation impact not applicable, air quality issues.

'Be Green': Renewable Energy

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Photovoltaic Panels (PV) – Accepted

Photovoltaic systems convert energy from the sun into electricity through semi-conductor cells. Systems consist of semi-conductor cells connected and mounted into modules. Modules are connected to an inverter to turn the direct current (DC) output into alternating current (AC) electricity for use in buildings.

Photovoltaic panels supply electricity to the building and are attached to electricity gird or to any other electrical load. Excess electricity can be exported to the National Grid when the generated power exceeds the local need. PV systems require only daylight, not sunlight to generate electricity (although more electricity is produced with more sunlight), so energy can still be produced in overcast or cloudy conditions.

The cost of PV cells is heavily dependent on the size of the array. There are significant cost reductions available for larger installations.

The most suitable location for mounting photovoltaic panels is on roofs as they usually have the greatest exposure to the sun. However, a significant portion of the roof will be required for the location of the ASHPs. It is proposed to have four PV panels with a peak output of 0.33kWp each per unit. This equates to 3.96kWp (20.4m²) for Block 1 and 7.92kWp (40.8m²) for Block 2.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability
Photovoltaic	✓✓✓✓ No local air quality impacts, use of unutilised roof space, no noise issues.	✓✓✓✓ Can be added to the roof, good orientation, and slightly increased buildability issues for wiring and metering.	✓✓✓✓✓ Increased capital costs of installation, typical payback of 8–10 years, Feed in Tariff available.	✓✓✓ Limited servicing and maintenance i.e. 1 visit per year, inverter will require replacement.	✓✓✓✓✓ High carbon saving from electricity, uses minimal grid electricity, no local air impact, high embodied energy of panels.

'Be Green': Renewable Energy

Energy Assessment

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Solar Thermal – Rejected

Solar water heating systems use the energy from the sun to heat water for non-domestic hot water needs. The systems use a heat collector, generally mounted on the roof in which a fluid is heated by the sun. This fluid is used to heat up water that is stored in either a separate hot water cylinder or a twin coil hot water cylinder inside the building. The systems work very successfully in all parts of the UK, as they can work in diffuse light conditions.

Like photovoltaic panels the most suitable location for mounting solar hot water panels is on roofs as they usually have the greatest exposure to the sun.

It is estimated that the CO2 emissions reduction that would be produced by solar hot water as a standalone system would not be adequate to achieve the required CO2 emissions reduction target. Therefore, a solar hot water system would need to be combined with more energy efficiency strategies, a CHP or additional renewable technologies to achieve the carbon reduction target. Therefore, solar thermal system has not been specified.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability
Solar Thermal	✓✓✓✓ No local air quality impacts, use of unutilised roof space, no noise issues.	✓✓✓✓ Can be added to the roof, good orientation, and slightly increased buildability issues for piping and cylinders.	✓✓✓✓ Increased capital costs of installation, typical payback of 8 years, Renewable Heat Incentive available.	✓✓✓ Limited servicing and maintenance i.e. 1 visit every two years, heat transfer fluid requires replacing every 10 years.	✓✓✓✓✓ Lower carbon saving as primarily displacing gas, uses minimal grid electricity, no local air impact, medium embodied energy of panels.

'Be Green': Renewable Energy

Energy Assessment

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Wind Energy – Rejected

Wind energy is a cost-effective method of renewable power generation. Wind turbines can produce electricity without carbon dioxide emissions in ranges from watts to megawatt outputs. The most common design is for three blades mounted on a horizontal axis, which is free to rotate into the wind on a tall tower.

The blades drive a generator either directly or via a gearbox to produce electricity. The electricity can either be linked to the grid or charge batteries. An inverter is required to convert the electricity from direct current (DC) to alternating current (AC) for feeding into the grid.

Modern quiet wind turbines are becoming viable in low density areas where ease of maintenance and immediate connection to the grid or direct use of the electricity in a building, may make them cost effective, despite lower wind speeds than open areas.

Wind turbines are generally less suited to dense urban areas as their output will be affected by potentially lower and more disrupted wind speeds, and their use of much more cost-effective machines may be prohibited by their proximity to some building types. Small turbines can be used in inner city areas mounted on buildings, although there are relatively few installations.

Typically, a 2kW turbine can provide 4,000 kWh of electrical power annually. To achieve the required CO₂ emissions reduction target approximately 2kW would be required as a standalone solution. The indicative cost of multiple smaller roof mounted turbine is £2,500/kW so achieving the required CO₂ emissions reduction would cost approximately £5,000.

A detailed wind resource evaluation would be required for the site to fully understand the generation potential and payback period. Also, it is likely that planning restrictions and resistance from groups within the local community could also dramatically affect the viability of wind energy for the project. Therefore, wind energy is not considered viable for this scheme.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability
Wind Energy	 No local air quality impacts, use of unutilised roof space, minor noise issues.	 Can be added to the roof, relatively limited wind speeds in local area, increased buildability issues for wiring and metering.	 Medium capital costs of installation, typical payback of 5 years, Feed in Tariff available.	 Limited servicing and maintenance, costs of 2–3% typical.	  High carbon saving from electricity, output limited from urban installation, consumes little grid electricity, no local air impact, low embodied energy of panels.

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Ground Source Heat Pump – GSHP – Rejected

Geo-thermal energy is essentially heat collected from the ground. Heat obtained from the ground may be considered it as a source of heating and cooling within the UK by the use of a geo-thermal heat pump or ground source heat pumps.

A ground source heat pump is a device for converting energy in the form of low-level heat to heat at a usable temperature. The heat pump consists of five main parts: ground collector loop/or bores, heat exchanger, compressor, condenser heat exchanger and expansion valve.

At approximately 1.2–1.5 metres down below ground level the temperature is a constant 10 to 12°C. Any bores would need to be sunk to an effective depth of 50 – 120m and a ground feasibility report would be required to ascertain if this method of heat source were viable.

From the bores pre-insulated pipework is laid in the ground to the heat exchanger device. The system is filled with water and antifreeze. The cooled water is pumped around the loop / bore gathering energy as it circulates. The water that has been heated to 10–12°C is returned to the ground source heat exchanger where the energy is transferred to the refrigerant gas. For every 1kW of energy used to compress the refrigerant, the process 'gives up' 4 kW of energy for use in the system being used to heat the building.

Typical costs for an installation of this scale are in the region of £100,000 with general installation costs being approx. £1500–2000 /kW of energy produced.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability
GSHP	 No local air quality impacts, not visible so conservation friendly, no noise issues, however the constrained site may prohibit its installation.	 Increased buildability issues for pipework and heating emitters internally.	 High capital costs of installation, typical payback of 15 years where gas is displaced, Renewable Heat Incentive available.	 Limited servicing and maintenance i.e. 1 visit per year, mechanical parts may require replacement over lifespan.	  Limited carbon saving from gas displacement, consumes some electricity so benefits from decarbonisation, no local air impact, high embodied energy of equipment.

'Be Green': Renewable Energy

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Air Source Heat Pump – Accepted

Air source heat pump systems work on the same principle as a ground source heat pump although they use the outside air as the heat source.

The coefficients of performance given by air source heat pump systems are inferior to that of ground source systems due to varying air temperatures. In the depth of winter, the energy efficiency of an air source system will be lower than that of a ground source system, and it is likely that more back-up heat will be required if an air source unit is fitted. This back-up heat often comes from a direct electric heater. They operate over a varying temperatures range of -15°C to $+25^{\circ}\text{C}$, however, the performance will reduce to below the required 3 to 1 carbon saving ratio in winter, and they also require a defrosting mechanism to melt ice that forms on the air heat exchanger.

ASHPs are cheaper to install than ground source heat pumps but carbon dioxide emission savings will typically be less than that of a ground source heat pump. Typical costs for an installation of this scale are in the region of £60,000.

Air source heat pumps would provide a suitable HVAC solution for commercial spaces, such as offices which have relatively low heating demands as well as a regular need for cooling given the higher internal gains of these use classes. Having a system which is able to both, heat and cool provides versatility and reduces the amount installed plant.

The residential space has a relatively large domestic hot water demand which could be met with heat pumps if combined with another heating source to achieve the required DHW temperatures. The scheme could meet 80% of its hot water heating consumption via air source heat pumps, with the remaining 20% demand being met by electric immersion heater. Long-term plant coverage should be maximised through either of the seeded or 'biodiverse' roof types, to maximise the evapotranspiration performance of the green roof. It is acknowledged that the 'biodiverse' roof type would result in an initial lack of plant coverage but would be achieved once the indigenous plant species become established.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability
ASHP	✓✓✓✓ No local air quality impacts, use of unutilised roof space, over visual impact, no noise issues.	✓✓✓✓ Can be added to the roof, good airflow on roof, increased buildability issues for pipework and heating emitters internally.	✓✓✓✓✓ Medium-high capital costs of installation, typical payback >15 years where gas is displaced, Renewable Heat Incentive available.	✓✓✓ Limited servicing and maintenance i.e. 1 visit per year, mechanical parts may require replacement over lifespan.	✓✓✓✓✓ Limited carbon saving from gas displacement, less efficient in winter, consumes electricity so benefits from decarbonisation, no local air impact, high embodied energy of equipment.

'Be Green': Summary of Renewable Technologies Energy Assessment Cornwall Road

Summary comparison matrix

An assessment of the feasibility of each of the technologies is shown below.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability	Total Score
Biomass Boiler	✓✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	14 out of 26
Photovoltaic	✓✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	18 out of 26
Solar Thermal	✓✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	17 out of 26
Wind Energy	✓✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	14 out of 26
GSHP	✓✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	15 out of 26
ASHP	✓✓✓✓	✓✓✓✓	✓✓✓✓✓	✓✓✓	✓✓✓✓✓ ✓✓✓✓✓	17 out of 26

Renewable technology conclusion & specifications

Photovoltaic panels, solar thermal panels and air source heat pumps have scored the best. It is assumed that wind energy would be considered unsuitable for the area and that the local residents would raise concerns over potential noise and turbulence.

Air source heat pumps have scored well due to their economic viability, low maintenance after installation, but primarily their CO₂ reduction potential. After the initial investment is made these systems keep the running costs to a minimum. Also, ASHP provides more versatility as it can provide both heating and hot water for this scheme.

Air source heat pumps and photovoltaic panels have been proposed for the scheme.

'Be Green': ASHP

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Air Source Heat Pump

A detailed summary of the lifecycle cost, revenue, and payback for ASHP is given below.

Lifecycle Cost

The lifecycle of the proposed system is 25 years. To calculate the lifecycle cost of the ASHP, the maintenance of the system and cost of electricity to run the pumps will be included.

Revenue and payback parameters

The following tables summarise the reduction in carbon emissions and the life cycle cost of the ASHP system compared to a gas boiler.

	Proposed System	
	Heating + Hot Water	Heating + Hot Water
System Type	Gas Boiler	Air Source Heat Pump
Installation Cost	15,000	60,000
Maintenance and replacement cost	15,000	10,000
Total	30,000	70,000
Extra Over cost:	40,000	

The heating system has been modelled to supply both the heating and the hot water demand. The scheme has a total heating and hot water demand of 52,683 kWh per year using a gas boiler. The cost of gas is 5 p/kWh; therefore, the annual operational cost would be £2,634. With the use of an air source heat pump with 2.90 COP, the heating and hot water demand is reduced to 16,386 kWh per year. The cost of electricity is 13 p/kWh, therefore the annual operational cost would be £2,048

It should be noted that the figures above are based on SAP modelling for CO₂ compliance. Compliance models are not well suited to investment appraisals because they do not accurately estimate energy consumption. It is estimated that the lifecycle saving for ASHP will be greater than boiler under 'real-life' operating conditions and consumption.

Moreover, the servicing strategy has been proposed based on sustainability aspirations and compliance with GLA requirements, which is intended to supersede simple economic payback appraisals for purposes of energy strategies.

Summary performance calculations

Cost Performance Criteria	Value
Extra Cost Over Life Cycle (£)	40,000
Predicted Annual Savings (£)	586
Payback Period (years)	68.3

'Be Green': Photovoltaic Energy Assessment Cornwall Road

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Photovoltaic panels

A photovoltaic panel system of 11.88 kWp (36 panels of 330W each) has been specified for the whole development, a detailed summary of the lifecycle cost, revenue and payback for the photovoltaic panels is presented in this section.

Location

There are 196m² of available roof. The proposed PV panel system will cover a total of 61.2m². PV panels will be located on the flat roof, facing south with 30 degrees tilt, as shown in the image.

Lifecycle Cost

The lifecycle of the proposed high efficiency panels is 25 years. To calculate the lifecycle cost of the panels, the maintenance of the system and replacement cost will be included. The total costs for the proposed system's lifetime are:

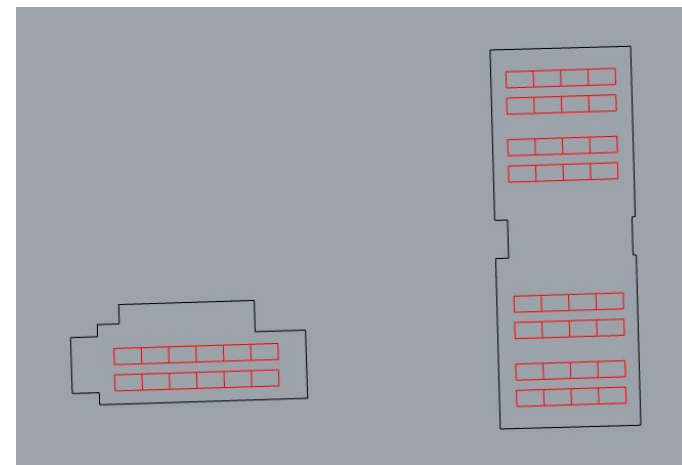
- Capital cost = £14,300
- Maintenance cost = £1,900
- Operational costs = £600
- Total costs = 16,800

Revenue and payback parameters

- The cost of electricity to be displaced is 12.5p/kWh.
- The 11.88 kWp system is estimated to generate 10,260 kWh/yr. Based on the assumption that 50% of the electricity will be used on site, an offset savings of £641/year will be achieved.
- With the current system, a tariff of 5.38p/kWh will be received for export, which gives an additional savings of £276.

Summary performance calculations

Energy and Carbon Performance Criteria	Value
Predicted Annual Energy Saved (kWh/yr)	10,260
Annual Carbon Emissions Reductions (kg CO ₂ /year) using SAP10.0.0 carbon factors	2,391
CO ₂ Emissions Reduction (%) with SAP10.0.0	20.2%
Cost Performance Criteria	Value
Extra Cost Over Life Cycle (£)	16,800
Predicted Annual Savings (£)	917
Payback Period (years)	18.3



Annual Cost

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Controls

The proposed scheme sets out to address demand side response to energy efficiency, including smart meters, to provide more consumption data to inform control which will allow the running of some equipment at a lower capacity during times of peak demand. The design team will also explore the possibility of smart controls, to optimise heating and power systems at a later stage of the project.

Running costs

Maximum operational energy expenses come from heating and hot water. The scheme is being serviced by a system breakup of 80% hot water demand being met by air source heat pumps and 20% from electric immersion heater.

The scheme wide demand figures below have been derived from SAP file

Electricity demand	kWh/year
Heating	7,434
Hot water	8,952
Lighting	2,744
Auxiliary	1,647
Electricity generation (PV panels)	-10,260
Unregulated	11,572
Total	22,089
Fuel	Price
Electricity	13p/kWh
Fuel	Cost/year
Electricity	£2,872
Annual cost per flat	£319 /flat/year

Conclusion

Energy Assessment

Cornwall Road

Summary

The baseline carbon emissions for the whole scheme are 13.15 tonnes CO₂/yr (using SAP 2012 carbon dioxide emission factors) and 11.86 tonnes CO₂/yr (using SAP10.0 carbon dioxide emission factors).

As demonstrated, the scheme will reduce carbon emissions by 58.5% (using SAP 2012 carbon dioxide emission factors) and 80.0% (using SAP10.0 carbon dioxide emission factors) over existing building and Part L1A, with the further inclusion of the proposed ASHP and photovoltaic panels.

Therefore, the scheme meets Building Regulations and exceeds the target of 35% carbon reduction over Part L building Regulations as set out in London Plan Policy SI2 and Haringey's policy SP4.

The carbon offset payment to meet zero carbon is £6,984.

GLA's Energy Hierarchy: Regulated carbon emissions Calculated using SAP 2012 carbon dioxide emission factors				
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	13.15	11.61	–	5.46
CO ₂ emissions saving (tCO ₂ /yr)	–	1.54	–	6.16
Saving from each stage (%)	–	11.7	–	46.8
Total CO ₂ emissions saving (tCO ₂ /yr)		7.70		
58.5% total carbon emissions savings over existing building and Part L1A achieved (using SAP 2012 emission factors)				
GLA's Energy Hierarchy: Regulated carbon emissions Calculated using SAP10.0 carbon dioxide emission factors				
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	11.86	10.13	–	2.45
CO ₂ emissions saving (tCO ₂ /yr)	–	1.73	–	7.68
Saving from each stage (%)	–	14.5	–	64.8
Total CO ₂ emissions saving (tCO ₂ /yr)		9.41		
80.0% total carbon emissions savings over existing building and Part L1A achieved (using SAP10.0 emission factors)				

Appendix A – Input Sheet

Energy Assessment

Cornwall Road

Building fabric: passive design measures

Element	Part L1A required U-value W/m ² K	Proposed / assumed U-value W/m ² K
Ground floor	0.25	0.11
Wall	0.30	0.14
Wall – Corridor	0.30	0.14
Roof	0.20	0.11
Window	2.00	1.3 (g-value 0.5)
Door	2.00	1.4
Air Permeability in m ³ /hr/m ² @ 50 Pa		
Whole Building	10	3

Thermal Bridging:

The scheme will be designed in line with the accredited construction details (ACD) and therefore it has been indicatively modelled with the accredited thermal bridge Psi-values for the following junctions:

- Lintels (E2)
- Sill (E3)
- Jambs (E4)
- Ground floor (E5)
- Party floor between dwellings (E7)
- Corners (E16)
- Corners inverted (E17)

A bespoke thermal bridging calculation will be required for the following junctions in order to achieve the specified Psi-values:

- Flat Roof with Parapet (E15); 0.30 W/mK
- Balcony (E23); 0.30 W/mK

The default psi-value has been used for the remaining junctions.

Thermal Mass:

Thermal mass of the scheme has been indicatively modelled as 250 kJ/m²K (medium).

Ventilation:

Mechanical ventilation with heat recovery has been specified for the apartments. All apartments contain one toilet. Therefore, each dwelling has been modelled with a SFP of 0.53 W/l/s and a heat recovery efficiency of 89%.

Heating:

Air source heat pump with a minimum COP of 2.90 will be proposed as the main heating system. Heat will be provided via radiators and will be controlled with a charging system linked to use of community with programmer and TRVs.

Hot Water:

Hot water will be provided by the air source heat pump, with a minimum COP of 2.90. A top-up electric immersion heater will provide less than 20% of the hot water demand.

Lighting:

High efficiency lighting has been specified for the dwellings with a minimum efficacy of 75 lumens/W.

Cooling

No cooling specified.

Photovoltaic panels

36 PV panels in total with a peak output of 0.33kWp per panel located on the flat roof facing south with 30°C.

Appendix B – SAP Energy Assessment Cornwall Road

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Further information

The emission figures and details of the calculations and methodology used to determine the figures provided within the report can be found in the following pages:

Baseline domestic – TER from the TER SAP worksheet

Be Lean domestic – DER from the Be Lean scenario DER SAP worksheet

Be Green domestic – DER from the Be Green scenario DER SAP worksheet

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Baseline –Domestic

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 1 - Block 1

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	50.81 (1a)	2.55 (2a)	129.57 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	129.57 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

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

Number of storeys in the dwelling (ns)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.4 (18)

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

Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.92 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.37 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

TER WorkSheet: New dwelling design stage

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

0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.37	0.4	0.42	0.44
------	------	------	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1	= 2.1		(26)
Windows Type 1			4.2	x 1/[1/(1.4)+0.04]	= 5.57		(27)
Windows Type 2			0.95	x 1/[1/(1.4)+0.04]	= 1.26		(27)
Windows Type 3			1.07	x 1/[1/(1.4)+0.04]	= 1.42		(27)
Windows Type 4			4.11	x 1/[1/(1.4)+0.04]	= 5.45		(27)
Floor			50.81	x 0.13	= 6.6053		(28)
Walls Type1	71.11	10.33	60.78	x 0.18	= 10.94		(29)
Walls Type2	21.75	2.1	19.65	x 0.18	= 3.54		(29)
Roof	4.67	0	4.67	x 0.13	= 0.61		(30)
Total area of elements, m²			148.34				(31)
Party ceiling			46.13				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 37.48 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 25525.83 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 15.32 (36)

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

Total fabric heat loss (33) + (36) = 52.81 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.24	26.05	25.87	25	24.83	24.08	24.08	23.94	24.37	24.83	25.16	25.51

 (38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

79.05	78.86	78.67	77.8	77.64	76.88	76.88	76.74	77.18	77.64	77.97	78.31
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

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

77.8

 (39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=

1.56	1.55	1.55	1.53	1.53	1.51	1.51	1.51	1.52	1.53	1.53	1.54
------	------	------	------	------	------	------	------	------	------	------	------

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

1.53

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

1.71

 (42)

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

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

74.91

 (43)

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

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

(44)m=

82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4
------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

898.88

 (44)

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

(45)m=

122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34
--------	--------	--------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1178.57

 (45)

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

(46)m=

18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

 (46)

Water storage loss:

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

0

 (47)

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

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

Water storage loss:

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

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0

 (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

$$(47) \times (51) \times (52) \times (53) =$$

0

 (54)

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

0

 (55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (56)

TER WorkSheet: New dwelling design stage

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

41.99	36.55	38.94	36.2	35.88	33.25	34.35	35.88	36.2	38.94	39.16	41.99
-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------

 (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=

164.18	143.42	149.22	132.35	128.14	112.85	108.12	120.53	121.86	138.77	148.13	160.33
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

164.18	143.42	149.22	132.35	128.14	112.85	108.12	120.53	121.86	138.77	148.13	160.33
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1627.89
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

51.13	44.67	46.4	41.02	39.64	34.78	33.12	37.12	37.53	42.93	46.02	49.84
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7

 (66)

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

(67)m=

13.39	11.89	9.67	7.32	5.47	4.62	4.99	6.49	8.71	11.06	12.91	13.76
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

68.72	66.47	62.37	56.97	53.29	48.31	44.51	49.89	52.13	57.7	63.92	67
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	----

 (72)

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

(73)m=

283.15	280.96	270.73	254.67	238.64	222.95	212.93	218.26	226.62	242.86	261.42	275.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	4.11	x	19.64	x	0.63	x	0.7	=	24.67	(76)
East	0.9x	0.77	x	4.11	x	38.42	x	0.63	x	0.7	=	48.26	(76)
East	0.9x	0.77	x	4.11	x	63.27	x	0.63	x	0.7	=	79.48	(76)
East	0.9x	0.77	x	4.11	x	92.28	x	0.63	x	0.7	=	115.91	(76)
East	0.9x	0.77	x	4.11	x	113.09	x	0.63	x	0.7	=	142.05	(76)
East	0.9x	0.77	x	4.11	x	115.77	x	0.63	x	0.7	=	145.42	(76)
East	0.9x	0.77	x	4.11	x	110.22	x	0.63	x	0.7	=	138.44	(76)
East	0.9x	0.77	x	4.11	x	94.68	x	0.63	x	0.7	=	118.92	(76)
East	0.9x	0.77	x	4.11	x	73.59	x	0.63	x	0.7	=	92.43	(76)
East	0.9x	0.77	x	4.11	x	45.59	x	0.63	x	0.7	=	57.26	(76)
East	0.9x	0.77	x	4.11	x	24.49	x	0.63	x	0.7	=	30.76	(76)
East	0.9x	0.77	x	4.11	x	16.15	x	0.63	x	0.7	=	20.29	(76)
South	0.9x	0.77	x	0.95	x	46.75	x	0.63	x	0.7	=	13.57	(78)
South	0.9x	0.77	x	1.07	x	46.75	x	0.63	x	0.7	=	15.29	(78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.63	x	0.7	=	22.23	(78)
South	0.9x	0.77	x	1.07	x	76.57	x	0.63	x	0.7	=	25.04	(78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.63	x	0.7	=	28.32	(78)
South	0.9x	0.77	x	1.07	x	97.53	x	0.63	x	0.7	=	31.89	(78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.63	x	0.7	=	32	(78)
South	0.9x	0.77	x	1.07	x	110.23	x	0.63	x	0.7	=	36.05	(78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.63	x	0.7	=	33.35	(78)
South	0.9x	0.77	x	1.07	x	114.87	x	0.63	x	0.7	=	37.56	(78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.63	x	0.7	=	32.1	(78)
South	0.9x	0.77	x	1.07	x	110.55	x	0.63	x	0.7	=	36.15	(78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.63	x	0.7	=	31.36	(78)
South	0.9x	0.77	x	1.07	x	108.01	x	0.63	x	0.7	=	35.32	(78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.63	x	0.7	=	30.45	(78)
South	0.9x	0.77	x	1.07	x	104.89	x	0.63	x	0.7	=	34.3	(78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.63	x	0.7	=	29.58	(78)
South	0.9x	0.77	x	1.07	x	101.89	x	0.63	x	0.7	=	33.32	(78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.63	x	0.7	=	23.98	(78)
South	0.9x	0.77	x	1.07	x	82.59	x	0.63	x	0.7	=	27.01	(78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.63	x	0.7	=	16.09	(78)
South	0.9x	0.77	x	1.07	x	55.42	x	0.63	x	0.7	=	18.12	(78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.63	x	0.7	=	11.73	(78)
South	0.9x	0.77	x	1.07	x	40.4	x	0.63	x	0.7	=	13.21	(78)
West	0.9x	0.77	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(80)
West	0.9x	0.77	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(80)
West	0.9x	0.77	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(80)
West	0.9x	0.77	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(80)
West	0.9x	0.77	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(80)

TER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(80)
West	0.9x	0.77	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(80)
West	0.9x	0.77	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(80)
West	0.9x	0.77	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(80)
West	0.9x	0.77	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(80)
West	0.9x	0.77	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(80)
West	0.9x	0.77	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	78.74	144.84	220.9	302.41	358.13	362.26	346.6	305.2	249.79	166.76	96.4	65.96	(86)
--------	-------	--------	-------	--------	--------	--------	-------	-------	--------	--------	------	-------	------

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

(84)m=	361.89	425.8	491.63	557.08	596.77	585.21	559.53	523.46	476.41	409.62	357.83	341.17	(84)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.73	0.57	0.62	0.84	0.97	0.99	1	(86)

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

(87)m=	19.35	19.54	19.86	20.28	20.65	20.88	20.97	20.95	20.77	20.29	19.74	19.32	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.65	19.65	19.65	19.66	19.67	19.68	19.68	19.68	19.67	19.67	19.66	19.66	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.99	0.97	0.93	0.82	0.62	0.42	0.47	0.76	0.95	0.99	1	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	17.5	17.78	18.25	18.85	19.33	19.6	19.67	19.66	19.5	18.87	18.08	17.46	(90)
--------	------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.51 (91)

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

(92)m=	18.43	18.67	19.07	19.58	20	20.25	20.33	20.32	20.14	19.59	18.92	18.4	(92)
--------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	18.43	18.67	19.07	19.58	20	20.25	20.33	20.32	20.14	19.59	18.92	18.4	(93)
--------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.92	0.83	0.67	0.49	0.55	0.79	0.95	0.99	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	359.11	419.52	475.93	514.59	495.7	391.64	276.87	286.25	377.98	388.39	352.89	339.08	(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=	1117.17	1085.82	988.56	830.61	644.31	434.6	286.41	300.52	466.5	697.79	921.63	1111.89	(97)
--------	---------	---------	--------	--------	--------	-------	--------	--------	-------	--------	--------	---------	------

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

(98)m=	564	447.75	381.4	227.53	110.56	0	0	0	0	230.2	409.49	574.97	
--------	-----	--------	-------	--------	--------	---	---	---	---	-------	--------	--------	--

TER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2945.9 (98)

Space heating requirement in kWh/m²/year 57.98 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.4 (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)

564	447.75	381.4	227.53	110.56	0	0	0	0	230.2	409.49	574.97
-----	--------	-------	--------	--------	---	---	---	---	-------	--------	--------

(211)_m = {[(98)_m × (204)] } × 100 ÷ (206) (211)

603.85	479.39	408.35	243.61	118.37	0	0	0	0	246.46	438.43	615.6
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	-------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 3154.07 (211)

Space heating fuel (secondary), kWh/month

= {[(98)_m × (201)] } × 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)

164.18	143.42	149.22	132.35	128.14	112.85	108.12	120.53	121.86	138.77	148.13	160.33
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater 80.3 (216)

(217)_m =

87.91	87.72	87.31	86.4	84.68	80.3	80.3	80.3	80.3	86.32	87.48	87.99
-------	-------	-------	------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)_m = (64)_m × 100 ÷ (217)_m

(219)_m =

186.77	163.49	170.9	153.17	151.31	140.54	134.65	150.1	151.76	160.76	169.34	182.22
--------	--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} = 1915.01 (219)

Annual totals

Space heating fuel used, main system 1 3154.07 kWh/year

Water heating fuel used 1915.01 kWh/year

Electricity for pumps, fans and electric keep-hot

central heating pump: 30 (230c)

boiler with a fan-assisted flue 45 (230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 75 (231)

Electricity for lighting 236.39 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.216	= 681.28 (261)

TER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	413.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1094.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	122.69	(268)
Total CO2, kg/year	sum of (265)...(271) =			1256.54	(272)
TER =				24.73	(273)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 2 - Block 1

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.18 (1a)	2.55 (2a)	130.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	130.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0	(9)
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Additional infiltration	[(9)-1]x0.1 =	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0	(11)
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if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)
---	---	------

If no draught lobby, enter 0.05, else enter 0	0	(13)
---	---	------

Percentage of windows and doors draught stripped	0	(14)
--	---	------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
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Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
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Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5	(17)
---	---	------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.4	(18)
--	-----	------

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

Number of sides sheltered	1	(19)
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Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
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Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37 (21)
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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
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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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TER WorkSheet: New dwelling design stage

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

0.48	0.47	0.46	0.41	0.4	0.35	0.35	0.35	0.37	0.4	0.42	0.44
------	------	------	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1	= 2.1		(26)
Windows Type 1			1.91	x 1/[1/(1.4)+0.04]	= 2.53		(27)
Windows Type 2			4.2	x 1/[1/(1.4)+0.04]	= 5.57		(27)
Windows Type 3			0.95	x 1/[1/(1.4)+0.04]	= 1.26		(27)
Windows Type 4			1.07	x 1/[1/(1.4)+0.04]	= 1.42		(27)
Windows Type 5			2.26	x 1/[1/(1.4)+0.04]	= 3		(27)
Floor			5.05	x 0.13	= 0.6565		(28)
Walls Type1	25.57	2.1	23.47	x 0.18	= 4.22		(29)
Walls Type2	66.62	10.39	56.23	x 0.18	= 10.12		(29)
Total area of elements, m²			97.24				(31)
Party floor			46.13				(32a)
Party ceiling			51.18				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 30.88 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 24330.15 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 10.45 (36)

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

TER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 41.33 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.4	26.22	26.03	25.16	25	24.24	24.24	24.1	24.53	25	25.33	25.67	(38)

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

(39)m=	67.73	67.54	67.36	66.49	66.33	65.57	65.57	65.43	65.86	66.33	66.66	67	
Average = Sum(39) _{1...12} / 12 =												66.49	(39)

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

(40)m=	1.32	1.32	1.32	1.3	1.3	1.28	1.28	1.28	1.29	1.3	1.3	1.31	
Average = Sum(40) _{1...12} / 12 =												1.3	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.72 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 75.17 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 × (43)													

(44)m=	82.68	79.68	76.67	73.66	70.66	67.65	67.65	70.66	73.66	76.67	79.68	82.68	
Total = Sum(44) _{1...12} =												901.99	(44)

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

(45)m=	122.62	107.24	110.66	96.48	92.57	79.88	74.02	84.94	85.96	100.18	109.35	118.75	
Total = Sum(45) _{1...12} =												1182.65	(45)

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

(46)m=	18.39	16.09	16.6	14.47	13.89	11.98	11.1	12.74	12.89	15.03	16.4	17.81	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0 (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) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

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Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

42.13	36.67	39.07	36.33	36.01	33.36	34.47	36.01	36.33	39.07	39.29	42.13
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
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 (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=

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

Output from water heater (annual) _{1...12}	1633.52
---	---------

 (64)

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

(65)m=

51.3	44.83	46.56	41.16	39.78	34.9	33.23	37.25	37.66	43.08	46.18	50.02
------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24

 (66)

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

(67)m=

13.47	11.97	9.73	7.37	5.51	4.65	5.02	6.53	8.77	11.13	12.99	13.85
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

150.3	151.86	147.93	139.56	129	119.07	112.44	110.88	114.81	123.18	133.74	143.67
-------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

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

(71)m=

-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

 (71)

Water heating gains (Table 5)

(72)m=

68.96	66.7	62.58	57.17	53.47	48.47	44.67	50.06	52.31	57.9	64.14	67.23
-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

 (72)

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

(73)m=

284.6	282.4	272.12	255.97	239.85	224.07	214	219.35	227.76	244.08	262.74	276.61
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 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.26	x	19.64	x	0.63	x	0.7	=	13.57	(76)
East	0.9x	0.77	x	2.26	x	38.42	x	0.63	x	0.7	=	26.54	(76)
East	0.9x	0.77	x	2.26	x	63.27	x	0.63	x	0.7	=	43.7	(76)
East	0.9x	0.77	x	2.26	x	92.28	x	0.63	x	0.7	=	63.74	(76)
East	0.9x	0.77	x	2.26	x	113.09	x	0.63	x	0.7	=	78.11	(76)
East	0.9x	0.77	x	2.26	x	115.77	x	0.63	x	0.7	=	79.96	(76)
East	0.9x	0.77	x	2.26	x	110.22	x	0.63	x	0.7	=	76.13	(76)
East	0.9x	0.77	x	2.26	x	94.68	x	0.63	x	0.7	=	65.39	(76)
East	0.9x	0.77	x	2.26	x	73.59	x	0.63	x	0.7	=	50.83	(76)
East	0.9x	0.77	x	2.26	x	45.59	x	0.63	x	0.7	=	31.49	(76)
East	0.9x	0.77	x	2.26	x	24.49	x	0.63	x	0.7	=	16.91	(76)
East	0.9x	0.77	x	2.26	x	16.15	x	0.63	x	0.7	=	11.16	(76)
South	0.9x	0.77	x	0.95	x	46.75	x	0.63	x	0.7	=	13.57	(78)
South	0.9x	0.77	x	1.07	x	46.75	x	0.63	x	0.7	=	15.29	(78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.63	x	0.7	=	22.23	(78)
South	0.9x	0.77	x	1.07	x	76.57	x	0.63	x	0.7	=	25.04	(78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.63	x	0.7	=	28.32	(78)
South	0.9x	0.77	x	1.07	x	97.53	x	0.63	x	0.7	=	31.89	(78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.63	x	0.7	=	32	(78)
South	0.9x	0.77	x	1.07	x	110.23	x	0.63	x	0.7	=	36.05	(78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.63	x	0.7	=	33.35	(78)
South	0.9x	0.77	x	1.07	x	114.87	x	0.63	x	0.7	=	37.56	(78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.63	x	0.7	=	32.1	(78)
South	0.9x	0.77	x	1.07	x	110.55	x	0.63	x	0.7	=	36.15	(78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.63	x	0.7	=	31.36	(78)
South	0.9x	0.77	x	1.07	x	108.01	x	0.63	x	0.7	=	35.32	(78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.63	x	0.7	=	30.45	(78)
South	0.9x	0.77	x	1.07	x	104.89	x	0.63	x	0.7	=	34.3	(78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.63	x	0.7	=	29.58	(78)
South	0.9x	0.77	x	1.07	x	101.89	x	0.63	x	0.7	=	33.32	(78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.63	x	0.7	=	23.98	(78)
South	0.9x	0.77	x	1.07	x	82.59	x	0.63	x	0.7	=	27.01	(78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.63	x	0.7	=	16.09	(78)
South	0.9x	0.77	x	1.07	x	55.42	x	0.63	x	0.7	=	18.12	(78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.63	x	0.7	=	11.73	(78)
South	0.9x	0.77	x	1.07	x	40.4	x	0.63	x	0.7	=	13.21	(78)
West	0.9x	0.77	x	1.91	x	19.64	x	0.63	x	0.7	=	11.46	(80)
West	0.9x	0.77	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(80)
West	0.9x	0.77	x	1.91	x	38.42	x	0.63	x	0.7	=	22.43	(80)

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West	0.9x	0.77	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(80)
West	0.9x	0.77	x	1.91	x	63.27	x	0.63	x	0.7	=	36.93	(80)
West	0.9x	0.77	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(80)
West	0.9x	0.77	x	1.91	x	92.28	x	0.63	x	0.7	=	53.87	(80)
West	0.9x	0.77	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(80)
West	0.9x	0.77	x	1.91	x	113.09	x	0.63	x	0.7	=	66.01	(80)
West	0.9x	0.77	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(80)
West	0.9x	0.77	x	1.91	x	115.77	x	0.63	x	0.7	=	67.58	(80)
West	0.9x	0.77	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(80)
West	0.9x	0.77	x	1.91	x	110.22	x	0.63	x	0.7	=	64.34	(80)
West	0.9x	0.77	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(80)
West	0.9x	0.77	x	1.91	x	94.68	x	0.63	x	0.7	=	55.26	(80)
West	0.9x	0.77	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(80)
West	0.9x	0.77	x	1.91	x	73.59	x	0.63	x	0.7	=	42.96	(80)
West	0.9x	0.77	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(80)
West	0.9x	0.77	x	1.91	x	45.59	x	0.63	x	0.7	=	26.61	(80)
West	0.9x	0.77	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(80)
West	0.9x	0.77	x	1.91	x	24.49	x	0.63	x	0.7	=	14.29	(80)
West	0.9x	0.77	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(80)
West	0.9x	0.77	x	1.91	x	16.15	x	0.63	x	0.7	=	9.43	(80)
West	0.9x	0.77	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	79.1	145.55	222.06	304.1	360.2	364.38	348.62	306.93	251.14	167.6	96.85	66.25	(83)
--------	------	--------	--------	-------	-------	--------	--------	--------	--------	-------	-------	-------	------

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

(84)m=	363.7	427.95	494.18	560.07	600.05	588.45	562.62	526.28	478.9	411.68	359.6	342.87	(84)
--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.83	0.66	0.5	0.55	0.8	0.96	0.99	1	(86)

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

(87)m=	19.63	19.82	20.12	20.5	20.79	20.95	20.99	20.98	20.87	20.47	19.98	19.6	(87)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(88)m=	19.82	19.83	19.83	19.84	19.84	19.86	19.86	19.86	19.85	19.84	19.84	19.83	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.99	0.97	0.91	0.77	0.56	0.38	0.42	0.71	0.94	0.99	1	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.03	18.3	18.73	19.27	19.65	19.82	19.85	19.85	19.75	19.25	18.55	17.99	(90)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.51 (91)

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

TER WorkSheet: New dwelling design stage

(92)m=

18.84	19.07	19.44	19.89	20.23	20.4	20.43	20.43	20.32	19.87	19.28	18.81
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m=

18.84	19.07	19.44	19.89	20.23	20.4	20.43	20.43	20.32	19.87	19.28	18.81
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm :

(94)m=

0.99	0.99	0.97	0.91	0.8	0.61	0.44	0.49	0.75	0.94	0.99	0.99
------	------	------	------	-----	------	------	------	------	------	------	------

 (94)

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=

361.1	421.6	476.95	509.82	477.37	360.4	247.77	258	360.22	387.38	354.64	340.95
-------	-------	--------	--------	--------	-------	--------	-----	--------	--------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=

985.14	957.36	871.68	731.03	565.71	379.98	251.18	263.48	409.89	615.14	811.79	978.96
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=

464.29	360.03	293.68	159.27	65.72	0	0	0	0	169.45	329.15	474.67
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

2316.27

 (98)

Space heating requirement in $kWh/m^2/year$

45.26

 (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) = $(202) \times [1 - (203)] =$

1

 (204)

Efficiency of main space heating system 1

93.4

 (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)

464.29	360.03	293.68	159.27	65.72	0	0	0	0	169.45	329.15	474.67
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

497.1	385.47	314.43	170.53	70.37	0	0	0	0	181.42	352.41	508.22
-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

2479.95

 (211)

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(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)

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

Efficiency of water heater

80.3

 (216)

(217)m=

87.52	87.27	86.72	85.51	83.45	80.3	80.3	80.3	80.3	85.55	87	87.61
-------	-------	-------	-------	-------	------	------	------	------	-------	----	-------

 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=

188.25	164.91	172.67	155.31	154.07	141.03	135.11	150.62	152.28	162.77	170.86	183.63
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1931.53

 (219)

TER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2479.95
Water heating fuel used		1931.53
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75 (231)
Electricity for lighting		237.95 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	535.67 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	417.21 (264)
Space and water heating	(261) + (262) + (263) + (264) =		952.88 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	123.49 (268)
Total CO2, kg/year	sum of (265)...(271) =		1115.3 (272)
TER =			21.79 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 3 - Block 1

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.18 (1a)	2.55 (2a)	130.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	130.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

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

Number of storeys in the dwelling (ns)	0	(9)
--	---	-----

Additional infiltration	[(9)-1]x0.1 =	0 (10)
-------------------------	---------------	--------

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0	(11)
--	---	------

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)
---	---	------

If no draught lobby, enter 0.05, else enter 0	0	(13)
---	---	------

Percentage of windows and doors draught stripped	0	(14)
--	---	------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
---------------------	-----------------------------	--------

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
-------------------	--	--------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5	(17)
---	---	------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.4	(18)
--	-----	------

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

Number of sides sheltered	1	(19)
---------------------------	---	------

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
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Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37 (21)
--	----------------------	-----------

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

TER WorkSheet: New dwelling design stage

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

0.48	0.47	0.46	0.41	0.4	0.35	0.35	0.35	0.37	0.4	0.42	0.44
------	------	------	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1	= 2.1		(26)
Windows Type 1			1.27	x 1/[1/(1.4)+0.04]	= 1.68		(27)
Windows Type 2			4.2	x 1/[1/(1.4)+0.04]	= 5.57		(27)
Windows Type 3			0.95	x 1/[1/(1.4)+0.04]	= 1.26		(27)
Windows Type 4			1.07	x 1/[1/(1.4)+0.04]	= 1.42		(27)
Windows Type 5			2.26	x 1/[1/(1.4)+0.04]	= 3		(27)
Walls Type1	25.57	2.1	23.47	x 0.18	= 4.22		(29)
Walls Type2	66.62	9.75	56.87	x 0.18	= 10.24		(29)
Roof	51.18	0	51.18	x 0.13	= 6.65		(30)
Total area of elements, m²			143.37				(31)
Party floor			51.18				(32a)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.14 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19819.62 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 25.39 (36)

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

Total fabric heat loss (33) + (36) = 61.54 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.4	26.22	26.03	25.16	25	24.24	24.24	24.1	24.53	25	25.33	25.67

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

87.94	87.75	87.57	86.69	86.53	85.77	85.77	85.63	86.07	86.53	86.86	87.21
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

86.69

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=

1.72	1.71	1.71	1.69	1.69	1.68	1.68	1.67	1.68	1.69	1.7	1.7
------	------	------	------	------	------	------	------	------	------	-----	-----

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

1.69

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.72

(42)

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

if TFA ≤ 13.9, N = 1

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

75.17

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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)

(44)m=

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

82.68	79.68	76.67	73.66	70.66	67.65	67.65	70.66	73.66	76.67	79.68	82.68
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

901.99

(44)

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

(45)m=

122.62	107.24	110.66	96.48	92.57	79.88	74.02	84.94	85.96	100.18	109.35	118.75
--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

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

1182.65

(45)

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

(46)m=

18.39	16.09	16.6	14.47	13.89	11.98	11.1	12.74	12.89	15.03	16.4	17.81
-------	-------	------	-------	-------	-------	------	-------	-------	-------	------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

TER WorkSheet: New dwelling design stage

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

42.13	36.67	39.07	36.33	36.01	33.36	34.47	36.01	36.33	39.07	39.29	42.13
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (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=

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1633.52
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

51.3	44.83	46.56	41.16	39.78	34.9	33.23	37.25	37.66	43.08	46.18	50.02
------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24

 (66)

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

(67)m=

13.57	12.05	9.8	7.42	5.55	4.68	5.06	6.58	8.83	11.21	13.08	13.95
-------	-------	-----	------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

150.3	151.86	147.93	139.56	129	119.07	112.44	110.88	114.81	123.18	133.74	143.67
-------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

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

(71)m=

-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

 (71)

Water heating gains (Table 5)

(72)m=

68.96	66.7	62.58	57.17	53.47	48.47	44.67	50.06	52.31	57.9	64.14	67.23
-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

 (72)

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

(73)m=

284.7	282.49	272.19	256.02	239.89	224.1	214.04	219.39	227.82	244.16	262.84	276.72
-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.26	x	19.64	x	0.63	x	0.7	=	13.57	(76)
East	0.9x	0.77	x	2.26	x	38.42	x	0.63	x	0.7	=	26.54	(76)
East	0.9x	0.77	x	2.26	x	63.27	x	0.63	x	0.7	=	43.7	(76)
East	0.9x	0.77	x	2.26	x	92.28	x	0.63	x	0.7	=	63.74	(76)
East	0.9x	0.77	x	2.26	x	113.09	x	0.63	x	0.7	=	78.11	(76)
East	0.9x	0.77	x	2.26	x	115.77	x	0.63	x	0.7	=	79.96	(76)
East	0.9x	0.77	x	2.26	x	110.22	x	0.63	x	0.7	=	76.13	(76)
East	0.9x	0.77	x	2.26	x	94.68	x	0.63	x	0.7	=	65.39	(76)
East	0.9x	0.77	x	2.26	x	73.59	x	0.63	x	0.7	=	50.83	(76)
East	0.9x	0.77	x	2.26	x	45.59	x	0.63	x	0.7	=	31.49	(76)
East	0.9x	0.77	x	2.26	x	24.49	x	0.63	x	0.7	=	16.91	(76)
East	0.9x	0.77	x	2.26	x	16.15	x	0.63	x	0.7	=	11.16	(76)
South	0.9x	0.77	x	0.95	x	46.75	x	0.63	x	0.7	=	13.57	(78)
South	0.9x	0.77	x	1.07	x	46.75	x	0.63	x	0.7	=	15.29	(78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.63	x	0.7	=	22.23	(78)
South	0.9x	0.77	x	1.07	x	76.57	x	0.63	x	0.7	=	25.04	(78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.63	x	0.7	=	28.32	(78)
South	0.9x	0.77	x	1.07	x	97.53	x	0.63	x	0.7	=	31.89	(78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.63	x	0.7	=	32	(78)
South	0.9x	0.77	x	1.07	x	110.23	x	0.63	x	0.7	=	36.05	(78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.63	x	0.7	=	33.35	(78)
South	0.9x	0.77	x	1.07	x	114.87	x	0.63	x	0.7	=	37.56	(78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.63	x	0.7	=	32.1	(78)
South	0.9x	0.77	x	1.07	x	110.55	x	0.63	x	0.7	=	36.15	(78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.63	x	0.7	=	31.36	(78)
South	0.9x	0.77	x	1.07	x	108.01	x	0.63	x	0.7	=	35.32	(78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.63	x	0.7	=	30.45	(78)
South	0.9x	0.77	x	1.07	x	104.89	x	0.63	x	0.7	=	34.3	(78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.63	x	0.7	=	29.58	(78)
South	0.9x	0.77	x	1.07	x	101.89	x	0.63	x	0.7	=	33.32	(78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.63	x	0.7	=	23.98	(78)
South	0.9x	0.77	x	1.07	x	82.59	x	0.63	x	0.7	=	27.01	(78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.63	x	0.7	=	16.09	(78)
South	0.9x	0.77	x	1.07	x	55.42	x	0.63	x	0.7	=	18.12	(78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.63	x	0.7	=	11.73	(78)
South	0.9x	0.77	x	1.07	x	40.4	x	0.63	x	0.7	=	13.21	(78)
West	0.9x	0.77	x	1.27	x	19.64	x	0.63	x	0.7	=	7.62	(80)
West	0.9x	0.77	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(80)
West	0.9x	0.77	x	1.27	x	38.42	x	0.63	x	0.7	=	14.91	(80)
West	0.9x	0.77	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(80)
West	0.9x	0.77	x	1.27	x	63.27	x	0.63	x	0.7	=	24.56	(80)

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West	0.9x	0.77	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(80)
West	0.9x	0.77	x	1.27	x	92.28	x	0.63	x	0.7	=	35.82	(80)
West	0.9x	0.77	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(80)
West	0.9x	0.77	x	1.27	x	113.09	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(80)
West	0.9x	0.77	x	1.27	x	115.77	x	0.63	x	0.7	=	44.93	(80)
West	0.9x	0.77	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(80)
West	0.9x	0.77	x	1.27	x	110.22	x	0.63	x	0.7	=	42.78	(80)
West	0.9x	0.77	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(80)
West	0.9x	0.77	x	1.27	x	94.68	x	0.63	x	0.7	=	36.75	(80)
West	0.9x	0.77	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(80)
West	0.9x	0.77	x	1.27	x	73.59	x	0.63	x	0.7	=	28.56	(80)
West	0.9x	0.77	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(80)
West	0.9x	0.77	x	1.27	x	45.59	x	0.63	x	0.7	=	17.69	(80)
West	0.9x	0.77	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(80)
West	0.9x	0.77	x	1.27	x	24.49	x	0.63	x	0.7	=	9.5	(80)
West	0.9x	0.77	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(80)
West	0.9x	0.77	x	1.27	x	16.15	x	0.63	x	0.7	=	6.27	(80)
West	0.9x	0.77	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	75.26	138.03	209.69	286.05	338.08	341.74	327.06	288.42	236.74	158.68	92.06	63.09	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	359.96	420.52	481.88	542.08	577.97	565.84	541.1	507.81	464.57	402.84	354.9	339.81	(84)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.96	0.9	0.78	0.63	0.68	0.87	0.97	0.99	1	(86)

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

(87)m=	19.15	19.34	19.67	20.11	20.52	20.82	20.94	20.92	20.69	20.15	19.57	19.12	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.53	19.53	19.53	19.55	19.55	19.56	19.56	19.56	19.55	19.55	19.54	19.54	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.99	0.98	0.94	0.85	0.67	0.45	0.51	0.79	0.96	0.99	1	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	17.14	17.42	17.9	18.53	19.08	19.44	19.54	19.53	19.31	18.6	17.76	17.1	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	------	------

fLA = Living area ÷ (4) = 0.51 (91)

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

(92)m=	18.17	18.4	18.8	19.34	19.82	20.14	20.25	20.24	20.01	19.39	18.68	18.13	(92)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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(93)m=	18.17	18.4	18.8	19.34	19.82	20.14	20.25	20.24	20.01	19.39	18.68	18.13	(93)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=	0.99	0.99	0.97	0.94	0.86	0.72	0.55	0.6	0.82	0.95	0.99	0.99	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	357.15	414.6	468.05	506.88	496.04	405.36	295.07	302.88	382.72	384.31	350.15	337.66	(95)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1219.3	1184.44	1077.29	904.98	702.35	475.33	313.3	328.63	508.63	760.45	1006.17	1214.76	(97)
--------	--------	---------	---------	--------	--------	--------	-------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	641.44	517.33	453.27	286.63	153.49	0	0	0	0	279.85	472.34	652.56	
Total per year ($kWh/year$) = $Sum(98)_{1...5,9...12} =$												3456.91	(98)

Space heating requirement in $kWh/m^2/year$

67.54	(99)
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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

$$(204) = (202) \times [1 - (203)] =$$

1	(204)
---	-------

Efficiency of main space heating system 1

93.4	(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)

641.44	517.33	453.27	286.63	153.49	0	0	0	0	279.85	472.34	652.56
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$$

686.77	553.89	485.3	306.88	164.34	0	0	0	0	299.62	505.71	698.68
--------	--------	-------	--------	--------	---	---	---	---	--------	--------	--------

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

3701.19	(211)
---------	-------

Space heating fuel (secondary), $kWh/month$

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

(215)m=	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)

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

Efficiency of water heater

80.3	(216)
------	-------

(217)m=	88.13	87.99	87.66	86.94	85.5	80.3	80.3	80.3	80.3	86.77	87.76	88.21	(217)
---------	-------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, $kWh/month$

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	186.93	163.55	170.81	152.76	150.39	141.03	135.11	150.62	152.28	160.47	169.38	182.39
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1915.73	(219)
---------	-------

Annual totals

Space heating fuel used, main system 1

$kWh/year$

$kWh/year$	3701.19
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Water heating fuel used		1915.73	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =		75 (231)
Electricity for lighting		239.68	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	799.46 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	413.8 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1213.25 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	124.4 (268)
Total CO2, kg/year	sum of (265)...(271) =		1376.57 (272)
TER =			26.9 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 1 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	79.98 (1a)	2.55 (2a)	203.95 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.98 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	203.95 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15 (8)
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If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0	(9)
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Additional infiltration	[(9)-1]x0.1 =	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0	(11)
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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)
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If no draught lobby, enter 0.05, else enter 0	0	(13)
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Percentage of windows and doors draught stripped	0	(14)
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Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
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Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
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Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5	(17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.4	(18)
--	-----	------

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

Number of sides sheltered	1	(19)
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Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
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Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37 (21)
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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
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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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TER WorkSheet: New dwelling design stage

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

0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1	= 2.1		(26)
Windows Type 1			1.5	x 1/[1/(1.4)+0.04]	= 1.99		(27)
Windows Type 2			0.8	x 1/[1/(1.4)+0.04]	= 1.06		(27)
Windows Type 3			1.56	x 1/[1/(1.4)+0.04]	= 2.07		(27)
Windows Type 4			4.23	x 1/[1/(1.4)+0.04]	= 5.61		(27)
Windows Type 5			0.81	x 1/[1/(1.4)+0.04]	= 1.07		(27)
Floor			79.98	x 0.13	= 10.3974		(28)
Walls Type1	20.5	0	20.5	x 0.18	= 3.69		(29)
Walls Type2	71.23	13.37	57.86	x 0.18	= 10.41		(29)
Roof	7.48	0	7.48	x 0.13	= 0.97		(30)
Total area of elements, m²			179.19				(31)
Party ceiling			72.49				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 42.52 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 31002.52 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 16.04 (36)

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

TER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 58.55 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.03	40.75	40.46	39.15	38.9	37.75	37.75	37.54	38.19	38.9	39.4	39.92	(38)

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

(39)m=	99.58	99.3	99.02	97.7	97.45	96.3	96.3	96.09	96.74	97.45	97.95	98.47	
Average = Sum(39) _{1...12} / 12 =												97.7	(39)

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

(40)m=	1.25	1.24	1.24	1.22	1.22	1.2	1.2	1.2	1.21	1.22	1.22	1.23	
Average = Sum(40) _{1...12} / 12 =												1.22	(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 2.46 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 92.68 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 × (43)													

(44)m=	101.95	98.24	94.54	90.83	87.12	83.42	83.42	87.12	90.83	94.54	98.24	101.95	
Total = Sum(44) _{1...12} =												1112.21	(44)

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

(45)m=	151.19	132.23	136.45	118.96	114.15	98.5	91.28	104.74	105.99	123.52	134.83	146.42	
Total = Sum(45) _{1...12} =												1458.28	(45)

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

(46)m=	22.68	19.84	20.47	17.84	17.12	14.78	13.69	15.71	15.9	18.53	20.23	21.96	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0 (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) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

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Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
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 (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=

0	0	0	0	0	0	0	0	0	0	0	0
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 (59)

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

(61)m=

50.96	45.22	48.18	44.79	44.4	41.14	42.51	44.4	44.79	48.18	48.45	50.96
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 (61)

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

(62)m=

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
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 (64)

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

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

63.01	55.27	57.41	50.75	49.05	43.04	40.98	45.93	46.44	53.12	56.94	61.42
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12

 (66)

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

(67)m=

20.95	18.61	15.14	11.46	8.57	7.23	7.81	10.16	13.63	17.31	20.2	21.54
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 (67)

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

(68)m=

219.4	221.68	215.94	203.72	188.31	173.82	164.14	161.86	167.6	179.81	195.23	209.72
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 (68)

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

(69)m=

35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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 (70)

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

(71)m=

-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5
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 (71)

Water heating gains (Table 5)

(72)m=

84.69	82.25	77.17	70.49	65.93	59.77	55.08	61.73	64.5	71.39	79.09	82.56
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 (72)

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

(73)m=

387.98	385.48	371.18	348.61	325.74	303.76	289.96	296.68	308.67	331.45	357.46	376.75
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 (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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.81	x	10.63	x	0.63	x	0.7	=	5.26 (74)
North	0.9x	0.77	x	0.81	x	20.32	x	0.63	x	0.7	=	10.06 (74)
North	0.9x	0.77	x	0.81	x	34.53	x	0.63	x	0.7	=	17.1 (74)
North	0.9x	0.77	x	0.81	x	55.46	x	0.63	x	0.7	=	27.46 (74)
North	0.9x	0.77	x	0.81	x	74.72	x	0.63	x	0.7	=	36.99 (74)
North	0.9x	0.77	x	0.81	x	79.99	x	0.63	x	0.7	=	39.6 (74)
North	0.9x	0.77	x	0.81	x	74.68	x	0.63	x	0.7	=	36.97 (74)
North	0.9x	0.77	x	0.81	x	59.25	x	0.63	x	0.7	=	29.33 (74)
North	0.9x	0.77	x	0.81	x	41.52	x	0.63	x	0.7	=	20.55 (74)
North	0.9x	0.77	x	0.81	x	24.19	x	0.63	x	0.7	=	11.98 (74)
North	0.9x	0.77	x	0.81	x	13.12	x	0.63	x	0.7	=	6.49 (74)
North	0.9x	0.77	x	0.81	x	8.86	x	0.63	x	0.7	=	4.39 (74)
East	0.9x	0.77	x	1.56	x	19.64	x	0.63	x	0.7	=	18.73 (76)
East	0.9x	0.77	x	4.23	x	19.64	x	0.63	x	0.7	=	25.39 (76)
East	0.9x	0.77	x	1.56	x	38.42	x	0.63	x	0.7	=	36.63 (76)
East	0.9x	0.77	x	4.23	x	38.42	x	0.63	x	0.7	=	49.67 (76)
East	0.9x	0.77	x	1.56	x	63.27	x	0.63	x	0.7	=	60.33 (76)
East	0.9x	0.77	x	4.23	x	63.27	x	0.63	x	0.7	=	81.8 (76)
East	0.9x	0.77	x	1.56	x	92.28	x	0.63	x	0.7	=	87.99 (76)
East	0.9x	0.77	x	4.23	x	92.28	x	0.63	x	0.7	=	119.29 (76)
East	0.9x	0.77	x	1.56	x	113.09	x	0.63	x	0.7	=	107.84 (76)
East	0.9x	0.77	x	4.23	x	113.09	x	0.63	x	0.7	=	146.2 (76)
East	0.9x	0.77	x	1.56	x	115.77	x	0.63	x	0.7	=	110.39 (76)
East	0.9x	0.77	x	4.23	x	115.77	x	0.63	x	0.7	=	149.66 (76)
East	0.9x	0.77	x	1.56	x	110.22	x	0.63	x	0.7	=	105.09 (76)
East	0.9x	0.77	x	4.23	x	110.22	x	0.63	x	0.7	=	142.48 (76)
East	0.9x	0.77	x	1.56	x	94.68	x	0.63	x	0.7	=	90.27 (76)
East	0.9x	0.77	x	4.23	x	94.68	x	0.63	x	0.7	=	122.39 (76)
East	0.9x	0.77	x	1.56	x	73.59	x	0.63	x	0.7	=	70.17 (76)
East	0.9x	0.77	x	4.23	x	73.59	x	0.63	x	0.7	=	95.13 (76)
East	0.9x	0.77	x	1.56	x	45.59	x	0.63	x	0.7	=	43.47 (76)
East	0.9x	0.77	x	4.23	x	45.59	x	0.63	x	0.7	=	58.94 (76)
East	0.9x	0.77	x	1.56	x	24.49	x	0.63	x	0.7	=	23.35 (76)
East	0.9x	0.77	x	4.23	x	24.49	x	0.63	x	0.7	=	31.66 (76)
East	0.9x	0.77	x	1.56	x	16.15	x	0.63	x	0.7	=	15.4 (76)
East	0.9x	0.77	x	4.23	x	16.15	x	0.63	x	0.7	=	20.88 (76)
West	0.9x	0.77	x	1.5	x	19.64	x	0.63	x	0.7	=	9 (80)
West	0.9x	0.77	x	0.8	x	19.64	x	0.63	x	0.7	=	4.8 (80)
West	0.9x	0.77	x	1.5	x	38.42	x	0.63	x	0.7	=	17.61 (80)

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West	0.9x	0.77	x	0.8	x	38.42	x	0.63	x	0.7	=	9.39	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.63	x	0.7	=	29.01	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.63	x	0.7	=	15.47	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.63	x	0.7	=	42.3	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.63	x	0.7	=	22.56	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.63	x	0.7	=	51.84	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.63	x	0.7	=	27.65	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.63	x	0.7	=	53.07	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.63	x	0.7	=	28.3	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.63	x	0.7	=	50.53	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.63	x	0.7	=	26.95	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.63	x	0.7	=	43.4	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.63	x	0.7	=	23.15	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.63	x	0.7	=	33.73	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.63	x	0.7	=	17.99	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.63	x	0.7	=	20.9	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.63	x	0.7	=	11.15	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.63	x	0.7	=	11.23	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.63	x	0.7	=	5.99	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.63	x	0.7	=	7.4	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.63	x	0.7	=	3.95	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	63.19	123.37	203.7	299.61	370.52	381.03	362.02	308.55	237.58	146.43	78.72	52.02	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	451.17	508.84	574.88	648.22	696.26	684.78	651.99	605.23	546.25	477.87	436.17	428.77	(84)
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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.92	0.78	0.62	0.68	0.9	0.99	1	1	(86)

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

(87)m=	19.6	19.74	20	20.36	20.69	20.91	20.98	20.96	20.8	20.37	19.93	19.58	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.88	19.89	19.89	19.9	19.91	19.92	19.92	19.92	19.91	19.91	19.9	19.9	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.88	0.69	0.48	0.54	0.84	0.98	1	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.02	18.23	18.61	19.14	19.59	19.85	19.91	19.9	19.74	19.16	18.51	18	(90)
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fLA = Living area ÷ (4) = 0.39 (91)

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

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(92)m=

18.64	18.82	19.16	19.62	20.02	20.27	20.33	20.32	20.15	19.64	19.07	18.62
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m=

18.64	18.82	19.16	19.62	20.02	20.27	20.33	20.32	20.15	19.64	19.07	18.62
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm :

(94)m=

1	0.99	0.99	0.96	0.88	0.72	0.54	0.6	0.86	0.97	0.99	1
---	------	------	------	------	------	------	-----	------	------	------	---

 (94)

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=

449.83	505.99	567.05	621.76	615.56	495.49	349.84	361.57	467.54	465.9	433.74	427.77
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=

1428.37	1382.47	1253.17	1047.26	810.9	545.7	359.09	376.77	585.65	880.55	1172.25	1420.31
---------	---------	---------	---------	-------	-------	--------	--------	--------	--------	---------	---------

 (97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=

728.04	589	510.48	306.36	145.33	0	0	0	0	308.5	531.72	738.45
--------	-----	--------	--------	--------	---	---	---	---	-------	--------	--------

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

3857.89

 (98)

Space heating requirement in $kWh/m^2/year$

48.24

 (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) = $(202) \times [1 - (203)] =$

1

 (204)

Efficiency of main space heating system 1

93.4

 (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)

728.04	589	510.48	306.36	145.33	0	0	0	0	308.5	531.72	738.45
--------	-----	--------	--------	--------	---	---	---	---	-------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

779.49	630.62	546.55	328.01	155.6	0	0	0	0	330.3	569.3	790.63
--------	--------	--------	--------	-------	---	---	---	---	-------	-------	--------

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

4130.5

 (211)

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

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

0

 (215)

Water heating

Output from water heater (calculated above)

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

Efficiency of water heater

80.3

 (216)

(217)m=

87.99	87.84	87.48	86.61	84.83	80.3	80.3	80.3	80.3	86.51	87.58	88.06
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=

229.73	202.01	211.06	189.08	186.89	173.89	166.6	185.73	187.78	198.47	209.29	224.13
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

2364.67

 (219)

TER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		4130.5
Water heating fuel used		2364.67
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75 (231)
Electricity for lighting		370.06 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	892.19 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	510.77 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1402.96 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	192.06 (268)
Total CO2, kg/year	sum of (265)...(271) =		1633.94 (272)
TER =			20.43 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 2 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	79.98 (1a)	2.55 (2a)	203.95 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.98 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	203.95 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

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

Number of storeys in the dwelling (ns)	0	(9)
--	---	-----

Additional infiltration	[(9)-1]x0.1 =	0 (10)
-------------------------	---------------	--------

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0	(11)
--	---	------

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)
---	---	------

If no draught lobby, enter 0.05, else enter 0	0	(13)
---	---	------

Percentage of windows and doors draught stripped	0	(14)
--	---	------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
---------------------	-----------------------------	--------

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
-------------------	--	--------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5	(17)
---	---	------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.4	(18)
--	-----	------

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

Number of sides sheltered	1	(19)
---------------------------	---	------

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
----------------	-----------------------------	-----------

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37 (21)
--	----------------------	-----------

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

TER WorkSheet: New dwelling design stage

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

0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43
------	------	------	-----	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1	= 2.1		(26)
Windows Type 1			0.8	x 1/[1/(1.4)+0.04]	= 1.06		(27)
Windows Type 2			1.5	x 1/[1/(1.4)+0.04]	= 1.99		(27)
Windows Type 3			0.81	x 1/[1/(1.4)+0.04]	= 1.07		(27)
Windows Type 4			4.23	x 1/[1/(1.4)+0.04]	= 5.61		(27)
Windows Type 5			1.56	x 1/[1/(1.4)+0.04]	= 2.07		(27)
Floor			79.98	x 0.13	= 10.3974		(28)
Walls Type1	20.5	0	20.5	x 0.18	= 3.69		(29)
Walls Type2	71.23	12.56	58.67	x 0.18	= 10.56		(29)
Roof	7.44	0	7.44	x 0.13	= 0.97		(30)
Total area of elements, m²			179.15				(31)
Party ceiling			72.54				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.58 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 31161.06 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 15.27 (36)

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

TER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 56.85 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.03	40.75	40.46	39.15	38.9	37.75	37.75	37.54	38.19	38.9	39.4	39.92	(38)

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

(39)m=	97.88	97.6	97.32	96	95.75	94.6	94.6	94.39	95.04	95.75	96.25	96.77	
Average = Sum(39) _{1...12} / 12 =												96	(39)

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

(40)m=	1.22	1.22	1.22	1.2	1.2	1.18	1.18	1.18	1.19	1.2	1.2	1.21	
Average = Sum(40) _{1...12} / 12 =												1.2	(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 2.46 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 92.68 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 × (43)													

(44)m=	101.95	98.24	94.54	90.83	87.12	83.42	83.42	87.12	90.83	94.54	98.24	101.95	
Total = Sum(44) _{1...12} =												1112.21	(44)

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

(45)m=	151.19	132.23	136.45	118.96	114.15	98.5	91.28	104.74	105.99	123.52	134.83	146.42	
Total = Sum(45) _{1...12} =												1458.28	(45)

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

(46)m=	22.68	19.84	20.47	17.84	17.12	14.78	13.69	15.71	15.9	18.53	20.23	21.96	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0 (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) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

TER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

50.96	45.22	48.18	44.79	44.4	41.14	42.51	44.4	44.79	48.18	48.45	50.96
-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------

 (61)

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

(62)m=

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

2012.24

 (64)

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

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

63.01	55.27	57.41	50.75	49.05	43.04	40.98	45.93	46.44	53.12	56.94	61.42
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12

 (66)

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

(67)m=

21.3	18.92	15.39	11.65	8.71	7.35	7.94	10.32	13.86	17.6	20.54	21.89
------	-------	-------	-------	------	------	------	-------	-------	------	-------	-------

 (67)

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

(68)m=

219.4	221.68	215.94	203.72	188.31	173.82	164.14	161.86	167.6	179.81	195.23	209.72
-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (68)

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

(69)m=

35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (71)

Water heating gains (Table 5)

(72)m=

84.69	82.25	77.17	70.49	65.93	59.77	55.08	61.73	64.5	71.39	79.09	82.56
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (72)

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

(73)m=

388.33	385.78	371.43	348.8	325.88	303.88	290.09	296.85	308.89	331.73	357.79	377.11
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

TER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	4.23	x	19.64	x	0.63	x	0.7	=	25.39 (76)
East	0.9x	0.77	x	1.56	x	19.64	x	0.63	x	0.7	=	18.73 (76)
East	0.9x	0.77	x	4.23	x	38.42	x	0.63	x	0.7	=	49.67 (76)
East	0.9x	0.77	x	1.56	x	38.42	x	0.63	x	0.7	=	36.63 (76)
East	0.9x	0.77	x	4.23	x	63.27	x	0.63	x	0.7	=	81.8 (76)
East	0.9x	0.77	x	1.56	x	63.27	x	0.63	x	0.7	=	60.33 (76)
East	0.9x	0.77	x	4.23	x	92.28	x	0.63	x	0.7	=	119.29 (76)
East	0.9x	0.77	x	1.56	x	92.28	x	0.63	x	0.7	=	87.99 (76)
East	0.9x	0.77	x	4.23	x	113.09	x	0.63	x	0.7	=	146.2 (76)
East	0.9x	0.77	x	1.56	x	113.09	x	0.63	x	0.7	=	107.84 (76)
East	0.9x	0.77	x	4.23	x	115.77	x	0.63	x	0.7	=	149.66 (76)
East	0.9x	0.77	x	1.56	x	115.77	x	0.63	x	0.7	=	110.39 (76)
East	0.9x	0.77	x	4.23	x	110.22	x	0.63	x	0.7	=	142.48 (76)
East	0.9x	0.77	x	1.56	x	110.22	x	0.63	x	0.7	=	105.09 (76)
East	0.9x	0.77	x	4.23	x	94.68	x	0.63	x	0.7	=	122.39 (76)
East	0.9x	0.77	x	1.56	x	94.68	x	0.63	x	0.7	=	90.27 (76)
East	0.9x	0.77	x	4.23	x	73.59	x	0.63	x	0.7	=	95.13 (76)
East	0.9x	0.77	x	1.56	x	73.59	x	0.63	x	0.7	=	70.17 (76)
East	0.9x	0.77	x	4.23	x	45.59	x	0.63	x	0.7	=	58.94 (76)
East	0.9x	0.77	x	1.56	x	45.59	x	0.63	x	0.7	=	43.47 (76)
East	0.9x	0.77	x	4.23	x	24.49	x	0.63	x	0.7	=	31.66 (76)
East	0.9x	0.77	x	1.56	x	24.49	x	0.63	x	0.7	=	23.35 (76)
East	0.9x	0.77	x	4.23	x	16.15	x	0.63	x	0.7	=	20.88 (76)
East	0.9x	0.77	x	1.56	x	16.15	x	0.63	x	0.7	=	15.4 (76)
South	0.9x	0.77	x	0.81	x	46.75	x	0.63	x	0.7	=	11.57 (78)
South	0.9x	0.77	x	0.81	x	76.57	x	0.63	x	0.7	=	18.95 (78)
South	0.9x	0.77	x	0.81	x	97.53	x	0.63	x	0.7	=	24.14 (78)
South	0.9x	0.77	x	0.81	x	110.23	x	0.63	x	0.7	=	27.29 (78)
South	0.9x	0.77	x	0.81	x	114.87	x	0.63	x	0.7	=	28.44 (78)
South	0.9x	0.77	x	0.81	x	110.55	x	0.63	x	0.7	=	27.37 (78)
South	0.9x	0.77	x	0.81	x	108.01	x	0.63	x	0.7	=	26.74 (78)
South	0.9x	0.77	x	0.81	x	104.89	x	0.63	x	0.7	=	25.97 (78)
South	0.9x	0.77	x	0.81	x	101.89	x	0.63	x	0.7	=	25.22 (78)
South	0.9x	0.77	x	0.81	x	82.59	x	0.63	x	0.7	=	20.44 (78)
South	0.9x	0.77	x	0.81	x	55.42	x	0.63	x	0.7	=	13.72 (78)
South	0.9x	0.77	x	0.81	x	40.4	x	0.63	x	0.7	=	10 (78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.63	x	0.7	=	4.8 (80)
West	0.9x	0.77	x	1.5	x	19.64	x	0.63	x	0.7	=	9 (80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.63	x	0.7	=	9.39 (80)

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West	0.9x	0.77	x	1.5	x	38.42	x	0.63	x	0.7	=	17.61	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.63	x	0.7	=	15.47	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.63	x	0.7	=	29.01	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.63	x	0.7	=	22.56	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.63	x	0.7	=	42.3	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.63	x	0.7	=	27.65	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.63	x	0.7	=	51.84	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.63	x	0.7	=	28.3	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.63	x	0.7	=	53.07	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.63	x	0.7	=	26.95	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.63	x	0.7	=	50.53	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.63	x	0.7	=	23.15	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.63	x	0.7	=	43.4	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.63	x	0.7	=	17.99	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.63	x	0.7	=	33.73	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.63	x	0.7	=	11.15	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.63	x	0.7	=	20.9	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.63	x	0.7	=	5.99	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.63	x	0.7	=	11.23	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.63	x	0.7	=	3.95	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.63	x	0.7	=	7.4	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	69.5	132.26	210.75	299.44	361.97	368.79	351.79	305.18	242.25	154.89	85.94	57.63	(83)
--------	------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	457.82	518.04	582.18	648.24	687.85	672.67	641.88	602.03	551.14	486.63	443.73	434.74	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.92	0.78	0.62	0.67	0.89	0.98	1	1	(86)

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

(87)m=	19.64	19.78	20.03	20.38	20.7	20.91	20.98	20.97	20.81	20.4	19.96	19.62	(87)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	------

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

(88)m=	19.9	19.9	19.91	19.92	19.92	19.93	19.93	19.94	19.93	19.92	19.92	19.91	(88)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.96	0.88	0.69	0.48	0.54	0.83	0.98	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	18.08	18.29	18.67	19.18	19.61	19.87	19.93	19.92	19.77	19.21	18.57	18.06	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.39 (91)

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

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(92)m=

18.7	18.88	19.21	19.65	20.04	20.28	20.34	20.33	20.18	19.68	19.12	18.68
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m=

18.7	18.88	19.21	19.65	20.04	20.28	20.34	20.33	20.18	19.68	19.12	18.68
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm :

(94)m=

1	0.99	0.99	0.96	0.89	0.73	0.54	0.59	0.85	0.97	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (94)

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=

456.39	514.94	573.81	621.31	608.78	488.51	345.03	357.28	468.07	473.47	441.09	433.68
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=

1409.08	1364.15	1236.41	1032.28	798.53	537.24	353.8	371.25	577.62	869.19	1156.52	1400.76
---------	---------	---------	---------	--------	--------	-------	--------	--------	--------	---------	---------

 (97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=

708.8	570.67	492.97	295.9	141.17	0	0	0	0	294.42	515.11	719.51
-------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------

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

3738.56

 (98)

Space heating requirement in $kWh/m^2/year$

46.74

 (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) = $(202) \times [1 - (203)] =$

1

 (204)

Efficiency of main space heating system 1

93.4

 (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)

708.8	570.67	492.97	295.9	141.17	0	0	0	0	294.42	515.11	719.51
-------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

758.89	611	527.81	316.81	151.15	0	0	0	0	315.23	551.51	770.35
--------	-----	--------	--------	--------	---	---	---	---	--------	--------	--------

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

4002.74

 (211)

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

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

0

 (215)

Water heating

Output from water heater (calculated above)

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

Efficiency of water heater

80.3

 (216)

(217)m=

87.95	87.78	87.4	86.52	84.76	80.3	80.3	80.3	80.3	86.4	87.51	88.02
-------	-------	------	-------	-------	------	------	------	------	------	-------	-------

 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=

229.86	202.15	211.23	189.26	187.05	173.89	166.6	185.73	187.78	198.73	209.44	224.25
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

2365.99

 (219)

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Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		4002.74
Water heating fuel used		2365.99
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75 (231)
Electricity for lighting		376.17 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	864.59 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	511.05 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1375.65 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	195.23 (268)
Total CO2, kg/year	sum of (265)...(271) =		1609.8 (272)
TER =			20.13 (273)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 3 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a)	2.55 (2a)	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
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Window infiltration	0 (15)
---------------------	--------

Infiltration rate	0 (16)
-------------------	--------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5 (17)
---	--------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.41 (18)
--	-----------

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

Number of sides sheltered	1 (19)
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Shelter factor	0.92 (20)
----------------	-----------

Infiltration rate incorporating shelter factor	0.38 (21)
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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 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (24d)

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

(25)m= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1	= 2.1		(26)
Windows Type 1			0.79	x 1/[1/(1.4)+ 0.04]	= 1.05		(27)
Windows Type 2			0.48	x 1/[1/(1.4)+ 0.04]	= 0.64		(27)
Windows Type 3			1.56	x 1/[1/(1.4)+ 0.04]	= 2.07		(27)
Windows Type 4			0.8	x 1/[1/(1.4)+ 0.04]	= 1.06		(27)
Windows Type 5			1.55	x 1/[1/(1.4)+ 0.04]	= 2.05		(27)
Windows Type 6			7.18	x 1/[1/(1.4)+ 0.04]	= 9.52		(27)
Windows Type 7			0.48	x 1/[1/(1.4)+ 0.04]	= 0.64		(27)
Floor			0.91	x 0.13	= 0.1183		(28)
Walls Type1	73.79	16	57.79	x 0.18	= 10.4		(29)
Walls Type2	20.5	2.1	18.4	x 0.18	= 3.31		(29)
Roof	0.91	0	0.91	x 0.13	= 0.12		(30)
Total area of elements, m²			96.11				(31)
Party floor			72.5				(32a)
Party ceiling			72.5				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 37.26 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 27552.49 (34)

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

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

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can be used instead of a detailed calculation.

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

11.37 (36)

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

Total fabric heat loss

(33) + (36) =

48.63 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
37.72	37.44	37.16	35.87	35.63	34.51	34.51	34.3	34.94	35.63	36.12	36.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

86.35	86.07	85.8	84.51	84.27	83.14	83.14	82.94	83.58	84.27	84.75	85.26
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

84.51 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=

1.19	1.19	1.18	1.17	1.16	1.15	1.15	1.14	1.15	1.16	1.17	1.18
------	------	------	------	------	------	------	------	------	------	------	------

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

1.17 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.31 (42)

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

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

88.95 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84

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

1067.4 (44)

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

(45)m=

145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

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

1399.53 (45)

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

(46)m=

21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(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

$$(47) \times (51) \times (52) \times (53) =$$

0
0

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---

(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=	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---

(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=	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---

(59)

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

(61)m=	49.86	43.4	46.23	42.99	42.61	39.48	40.8	42.61	42.99	46.23	46.5	49.86
--------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	------	-------

(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=	194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

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

(63)

Output from water heater

(64)m=	194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual)^{1...12}

1933.08

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	60.71	53.05	55.1	48.71	47.08	41.3	39.33	44.08	44.57	50.98	54.65	59.19
--------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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=	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

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

(67)m=	18.11	16.08	13.08	9.9	7.4	6.25	6.75	8.78	11.78	14.96	17.46	18.61
--------	-------	-------	-------	-----	-----	------	------	------	-------	-------	-------	-------

(67)

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

(68)m=	203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

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

(70)

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

(71)m=	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=	81.6	78.94	74.06	67.65	63.28	57.36	52.86	59.24	61.9	68.52	75.9	79.56
--------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	363.35	360.77	347.58	326.69	305.54	285.06	272.1	278.4	289.38	310.47	334.63	352.85
--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------

(73)

6. Solar gains:

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

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.63	x	0.7	=	1.56	(74)
North	0.9x	0.77	x	1.55	x	10.63	x	0.63	x	0.7	=	5.04	(74)
North	0.9x	0.77	x	7.18	x	10.63	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.63	x	0.7	=	2.98	(74)
North	0.9x	0.77	x	1.55	x	20.32	x	0.63	x	0.7	=	9.63	(74)
North	0.9x	0.77	x	7.18	x	20.32	x	0.63	x	0.7	=	44.59	(74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.63	x	0.7	=	5.07	(74)
North	0.9x	0.77	x	1.55	x	34.53	x	0.63	x	0.7	=	16.36	(74)
North	0.9x	0.77	x	7.18	x	34.53	x	0.63	x	0.7	=	75.77	(74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.63	x	0.7	=	8.14	(74)
North	0.9x	0.77	x	1.55	x	55.46	x	0.63	x	0.7	=	26.27	(74)
North	0.9x	0.77	x	7.18	x	55.46	x	0.63	x	0.7	=	121.71	(74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.63	x	0.7	=	10.96	(74)
North	0.9x	0.77	x	1.55	x	74.72	x	0.63	x	0.7	=	35.39	(74)
North	0.9x	0.77	x	7.18	x	74.72	x	0.63	x	0.7	=	163.95	(74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.63	x	0.7	=	11.73	(74)
North	0.9x	0.77	x	1.55	x	79.99	x	0.63	x	0.7	=	37.89	(74)
North	0.9x	0.77	x	7.18	x	79.99	x	0.63	x	0.7	=	175.51	(74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.63	x	0.7	=	10.95	(74)
North	0.9x	0.77	x	1.55	x	74.68	x	0.63	x	0.7	=	35.37	(74)
North	0.9x	0.77	x	7.18	x	74.68	x	0.63	x	0.7	=	163.86	(74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.63	x	0.7	=	8.69	(74)
North	0.9x	0.77	x	1.55	x	59.25	x	0.63	x	0.7	=	28.06	(74)
North	0.9x	0.77	x	7.18	x	59.25	x	0.63	x	0.7	=	130	(74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.63	x	0.7	=	6.09	(74)
North	0.9x	0.77	x	1.55	x	41.52	x	0.63	x	0.7	=	19.67	(74)
North	0.9x	0.77	x	7.18	x	41.52	x	0.63	x	0.7	=	91.1	(74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.63	x	0.7	=	3.55	(74)
North	0.9x	0.77	x	1.55	x	24.19	x	0.63	x	0.7	=	11.46	(74)
North	0.9x	0.77	x	7.18	x	24.19	x	0.63	x	0.7	=	53.08	(74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.63	x	0.7	=	1.92	(74)
North	0.9x	0.77	x	1.55	x	13.12	x	0.63	x	0.7	=	6.21	(74)
North	0.9x	0.77	x	7.18	x	13.12	x	0.63	x	0.7	=	28.78	(74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.63	x	0.7	=	1.3	(74)
North	0.9x	0.77	x	1.55	x	8.86	x	0.63	x	0.7	=	4.2	(74)
North	0.9x	0.77	x	7.18	x	8.86	x	0.63	x	0.7	=	19.45	(74)
East	0.9x	0.77	x	1.56	x	19.64	x	0.63	x	0.7	=	9.36	(76)
East	0.9x	0.77	x	0.8	x	19.64	x	0.63	x	0.7	=	4.8	(76)
East	0.9x	0.77	x	1.56	x	38.42	x	0.63	x	0.7	=	18.32	(76)

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East	0.9x	0.77	x	0.8	x	38.42	x	0.63	x	0.7	=	9.39	(76)
East	0.9x	0.77	x	1.56	x	63.27	x	0.63	x	0.7	=	30.17	(76)
East	0.9x	0.77	x	0.8	x	63.27	x	0.63	x	0.7	=	15.47	(76)
East	0.9x	0.77	x	1.56	x	92.28	x	0.63	x	0.7	=	44	(76)
East	0.9x	0.77	x	0.8	x	92.28	x	0.63	x	0.7	=	22.56	(76)
East	0.9x	0.77	x	1.56	x	113.09	x	0.63	x	0.7	=	53.92	(76)
East	0.9x	0.77	x	0.8	x	113.09	x	0.63	x	0.7	=	27.65	(76)
East	0.9x	0.77	x	1.56	x	115.77	x	0.63	x	0.7	=	55.19	(76)
East	0.9x	0.77	x	0.8	x	115.77	x	0.63	x	0.7	=	28.3	(76)
East	0.9x	0.77	x	1.56	x	110.22	x	0.63	x	0.7	=	52.55	(76)
East	0.9x	0.77	x	0.8	x	110.22	x	0.63	x	0.7	=	26.95	(76)
East	0.9x	0.77	x	1.56	x	94.68	x	0.63	x	0.7	=	45.14	(76)
East	0.9x	0.77	x	0.8	x	94.68	x	0.63	x	0.7	=	23.15	(76)
East	0.9x	0.77	x	1.56	x	73.59	x	0.63	x	0.7	=	35.08	(76)
East	0.9x	0.77	x	0.8	x	73.59	x	0.63	x	0.7	=	17.99	(76)
East	0.9x	0.77	x	1.56	x	45.59	x	0.63	x	0.7	=	21.73	(76)
East	0.9x	0.77	x	0.8	x	45.59	x	0.63	x	0.7	=	11.15	(76)
East	0.9x	0.77	x	1.56	x	24.49	x	0.63	x	0.7	=	11.68	(76)
East	0.9x	0.77	x	0.8	x	24.49	x	0.63	x	0.7	=	5.99	(76)
East	0.9x	0.77	x	1.56	x	16.15	x	0.63	x	0.7	=	7.7	(76)
East	0.9x	0.77	x	0.8	x	16.15	x	0.63	x	0.7	=	3.95	(76)
South	0.9x	0.77	x	0.48	x	46.75	x	0.63	x	0.7	=	6.86	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.63	x	0.7	=	11.23	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.63	x	0.7	=	14.31	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.63	x	0.7	=	16.17	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.63	x	0.7	=	16.85	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.63	x	0.7	=	16.22	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.63	x	0.7	=	15.84	(78)
South	0.9x	0.77	x	0.48	x	104.89	x	0.63	x	0.7	=	15.39	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.63	x	0.7	=	14.95	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.63	x	0.7	=	12.11	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.63	x	0.7	=	8.13	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.63	x	0.7	=	5.93	(78)
West	0.9x	0.77	x	0.79	x	19.64	x	0.63	x	0.7	=	23.71	(80)
West	0.9x	0.77	x	0.79	x	38.42	x	0.63	x	0.7	=	46.38	(80)
West	0.9x	0.77	x	0.79	x	63.27	x	0.63	x	0.7	=	76.38	(80)
West	0.9x	0.77	x	0.79	x	92.28	x	0.63	x	0.7	=	111.4	(80)
West	0.9x	0.77	x	0.79	x	113.09	x	0.63	x	0.7	=	136.52	(80)
West	0.9x	0.77	x	0.79	x	115.77	x	0.63	x	0.7	=	139.75	(80)
West	0.9x	0.77	x	0.79	x	110.22	x	0.63	x	0.7	=	133.05	(80)
West	0.9x	0.77	x	0.79	x	94.68	x	0.63	x	0.7	=	114.29	(80)

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West	0.9x	0.77	x	0.79	x	73.59	x	0.63	x	0.7	=	88.83	(80)
West	0.9x	0.77	x	0.79	x	45.59	x	0.63	x	0.7	=	55.03	(80)
West	0.9x	0.77	x	0.79	x	24.49	x	0.63	x	0.7	=	29.56	(80)
West	0.9x	0.77	x	0.79	x	16.15	x	0.63	x	0.7	=	19.5	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	74.66	142.52	233.52	350.24	445.24	464.61	438.58	364.72	273.71	168.12	92.28	62.02	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	438.01	503.29	581.09	676.93	750.78	749.67	710.68	643.12	563.09	478.59	426.91	414.87	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.85	0.67	0.51	0.58	0.84	0.98	1	1	(86)

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

(87)m=	19.71	19.86	20.14	20.51	20.81	20.96	20.99	20.98	20.87	20.47	20.03	19.69	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.93	19.93	19.93	19.95	19.95	19.96	19.96	19.97	19.96	19.95	19.94	19.94	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.39	0.45	0.77	0.97	0.99	1	(89)
--------	---	------	------	------	-----	------	------	------	------	------	------	---	------

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

(90)m=	18.21	18.44	18.84	19.38	19.77	19.94	19.96	19.96	19.85	19.33	18.69	18.19	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.37

(91)

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

(92)m=	18.77	18.97	19.32	19.8	20.16	20.32	20.34	20.34	20.23	19.76	19.19	18.75	(92)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.77	18.97	19.32	19.8	20.16	20.32	20.34	20.34	20.23	19.76	19.19	18.75	(93)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.81	0.61	0.43	0.5	0.79	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	-----	------	------	------	---	------

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

(95)m=	436.31	499.28	568.89	630.81	608.51	456.65	308.56	321.5	446.04	460.75	423.65	413.63	(95)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1249.25	1210.72	1099.99	921.2	712.75	475.38	311.31	326.87	512.39	771.67	1024.49	1240.24	(97)
--------	---------	---------	---------	-------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	604.82	478.09	395.14	209.08	77.56	0	0	0	0	231.32	432.6	615	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	-------	-----	------

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

3043.62

(98)

Space heating requirement in kWh/m²/year

41.98

(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(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)

604.82	478.09	395.14	209.08	77.56	0	0	0	0	231.32	432.6	615
--------	--------	--------	--------	-------	---	---	---	---	--------	-------	-----

(211)m = {[[(98)m x (204)] } x 100 ÷ (206) (211)

647.56	511.87	423.07	223.86	83.04	0	0	0	0	247.67	463.17	658.45
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 3258.7 (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
---------	---	---	---	---	---	---	---	---	---	---	---

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

Water heating

Output from water heater (calculated above)

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Efficiency of water heater 80.3 (216)

(217)m= 87.71 87.51 87.01 85.77 83.45 80.3 80.3 80.3 80.3 85.91 87.23 87.79 (217)

(219)m=	222.28	194.61	203.64	183.23	182.34	166.89	159.89	178.24	180.21	191.82	201.65	216.86
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

Total = Sum(219a)_{1...12} = 2281.67 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	3258.7	
Water heating fuel used	2281.67	

Electricity for pumps, fans and electric keep-hot

central heating pump: 30 (230c)

boiler with a fan-assisted flue 45 (230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 75 (231)

Electricity for lighting 319.78 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	703.88 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	492.84 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1196.72 (265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	165.97	(268)
Total CO2, kg/year		sum of (265)...(271) =		1401.61	(272)
TER	=			19.33	(273)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 4 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a)	2.55 (2a)	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				30	0.16 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)					0.41 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.38 (21)

Infiltration rate modified for monthly wind speed

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 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (24d)

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

(25)m= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1	= 2.1		(26)
Windows Type 1			0.8	x 1/[1/(1.4)+0.04]	= 1.06		(27)
Windows Type 2			0.48	x 1/[1/(1.4)+0.04]	= 0.64		(27)
Windows Type 3			1.57	x 1/[1/(1.4)+0.04]	= 2.08		(27)
Windows Type 4			3.62	x 1/[1/(1.4)+0.04]	= 4.8		(27)
Windows Type 5			0.81	x 1/[1/(1.4)+0.04]	= 1.07		(27)
Windows Type 6			0.48	x 1/[1/(1.4)+0.04]	= 0.64		(27)
Floor			2.74	x 0.13	= 0.3562		(28)
Walls Type1	20.34	2.1	18.24	x 0.18	= 3.28		(29)
Walls Type2	78.25	14.42	63.83	x 0.18	= 11.49		(29)
Roof	2.74	0	2.74	x 0.13	= 0.36		(30)
Total area of elements, m²			104.07				(31)
Party floor			72.54				(32a)
Party ceiling			72.54				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.7 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 28729.96 (34)

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

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

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can be used instead of a detailed calculation.

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

14.91 (36)

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

Total fabric heat loss

(33) + (36) =

51.62 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
37.72	37.44	37.16	35.87	35.63	34.51	34.51	34.3	34.94	35.63	36.12	36.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

89.33	89.05	88.78	87.49	87.25	86.12	86.12	85.92	86.56	87.25	87.73	88.24
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

87.49 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=

1.23	1.23	1.22	1.21	1.2	1.19	1.19	1.19	1.19	1.2	1.21	1.22
------	------	------	------	-----	------	------	------	------	-----	------	------

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

1.21 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.31 (42)

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

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

88.95 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84

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

1067.4 (44)

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

(45)m=

145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
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Total = Sum(45)_{1...12} =

1399.53 (45)

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

(46)m=

21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(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

$$(47) \times (51) \times (52) \times (53) =$$

0
0

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

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

(61)m=

49.86	43.4	46.23	42.99	42.61	39.48	40.8	42.61	42.99	46.23	46.5	49.86
-------	------	-------	-------	-------	-------	------	-------	-------	-------	------	-------

(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=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

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

1933.08

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

60.71	53.05	55.1	48.71	47.08	41.3	39.33	44.08	44.57	50.98	54.65	59.19
-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

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

(67)m=

18.24	16.2	13.18	9.98	7.46	6.3	6.8	8.84	11.87	15.07	17.59	18.75
-------	------	-------	------	------	-----	-----	------	-------	-------	-------	-------

(67)

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

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

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

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

81.6	78.94	74.06	67.65	63.28	57.36	52.86	59.24	61.9	68.52	75.9	79.56
------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

363.48	360.88	347.67	326.76	305.6	285.11	272.15	278.47	289.46	310.58	334.76	352.98
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.63	x	0.7	=	4.68	(74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.63	x	0.7	=	8.94	(74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.63	x	0.7	=	15.2	(74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.63	x	0.7	=	24.41	(74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.63	x	0.7	=	32.88	(74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.63	x	0.7	=	35.2	(74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.63	x	0.7	=	32.86	(74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.63	x	0.7	=	26.07	(74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.63	x	0.7	=	18.27	(74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.63	x	0.7	=	10.65	(74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.63	x	0.7	=	5.77	(74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.63	x	0.7	=	3.9	(74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.63	x	0.7	=	28.27	(76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.63	x	0.7	=	55.3	(76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.63	x	0.7	=	91.08	(76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.63	x	0.7	=	132.83	(76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.63	x	0.7	=	162.79	(76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.63	x	0.7	=	166.64	(76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.63	x	0.7	=	158.65	(76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.63	x	0.7	=	136.28	(76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.63	x	0.7	=	105.93	(76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.63	x	0.7	=	65.62	(76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.63	x	0.7	=	35.25	(76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.63	x	0.7	=	23.25	(76)
South	0.9x	0.77	x	0.81	x	46.75	x	0.63	x	0.7	=	11.57	(78)
South	0.9x	0.77	x	0.48	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	0.81	x	76.57	x	0.63	x	0.7	=	18.95	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	0.81	x	97.53	x	0.63	x	0.7	=	24.14	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	0.81	x	110.23	x	0.63	x	0.7	=	27.29	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	0.81	x	114.87	x	0.63	x	0.7	=	28.44	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	0.81	x	110.55	x	0.63	x	0.7	=	27.37	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	0.81	x	108.01	x	0.63	x	0.7	=	26.74	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	0.81	x	104.89	x	0.63	x	0.7	=	25.97	(78)

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South	0.9x	0.77	x	0.48	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	0.81	x	101.89	x	0.63	x	0.7	=	25.22	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	0.81	x	82.59	x	0.63	x	0.7	=	20.44	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	0.81	x	55.42	x	0.63	x	0.7	=	13.72	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	0.81	x	40.4	x	0.63	x	0.7	=	10	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.63	x	0.7	=	17.78	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.63	x	0.7	=	14.41	(80)
West	0.9x	0.77	x	3.62	x	19.64	x	0.63	x	0.7	=	21.73	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.63	x	0.7	=	28.18	(80)
West	0.9x	0.77	x	3.62	x	38.42	x	0.63	x	0.7	=	42.51	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.63	x	0.7	=	46.41	(80)
West	0.9x	0.77	x	3.62	x	63.27	x	0.63	x	0.7	=	70	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.63	x	0.7	=	67.68	(80)
West	0.9x	0.77	x	3.62	x	92.28	x	0.63	x	0.7	=	102.09	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.63	x	0.7	=	82.95	(80)
West	0.9x	0.77	x	3.62	x	113.09	x	0.63	x	0.7	=	125.12	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.63	x	0.7	=	84.91	(80)
West	0.9x	0.77	x	3.62	x	115.77	x	0.63	x	0.7	=	128.08	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.63	x	0.7	=	80.84	(80)
West	0.9x	0.77	x	3.62	x	110.22	x	0.63	x	0.7	=	121.94	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.63	x	0.7	=	69.44	(80)
West	0.9x	0.77	x	3.62	x	94.68	x	0.63	x	0.7	=	104.74	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.63	x	0.7	=	53.98	(80)
West	0.9x	0.77	x	3.62	x	73.59	x	0.63	x	0.7	=	81.41	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.63	x	0.7	=	33.44	(80)
West	0.9x	0.77	x	3.62	x	45.59	x	0.63	x	0.7	=	50.44	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.63	x	0.7	=	17.96	(80)
West	0.9x	0.77	x	3.62	x	24.49	x	0.63	x	0.7	=	27.09	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.63	x	0.7	=	11.85	(80)
West	0.9x	0.77	x	3.62	x	16.15	x	0.63	x	0.7	=	17.87	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 101.23 187.58 289.75 402.82 482.73 490.85 468.57 408.67 329.65 216.93 124.18 84.64 (83)

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

(84)m= 464.71 548.47 637.42 729.58 788.32 775.96 740.72 687.13 619.11 527.51 458.94 437.63 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

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

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(86)m=	1	0.99	0.98	0.94	0.84	0.67	0.5	0.56	0.81	0.97	0.99	1	(86)
--------	---	------	------	------	------	------	-----	------	------	------	------	---	------

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

(87)m=	19.69	19.86	20.15	20.52	20.81	20.96	20.99	20.99	20.88	20.49	20.02	19.66	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.89	19.9	19.9	19.91	19.92	19.93	19.93	19.92	19.92	19.91	19.91	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.92	0.79	0.57	0.38	0.44	0.74	0.95	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.16	18.42	18.84	19.37	19.74	19.9	19.93	19.93	19.83	19.33	18.66	18.13	(90)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

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

(92)m=	18.73	18.96	19.33	19.8	20.14	20.29	20.32	20.32	20.22	19.77	19.17	18.7	(92)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	18.73	18.96	19.33	19.8	20.14	20.29	20.32	20.32	20.22	19.77	19.17	18.7	(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=	0.99	0.99	0.97	0.92	0.8	0.61	0.43	0.48	0.76	0.95	0.99	1	(94)

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

(95)m=	462.39	542.39	619.28	670.17	630.13	469.96	317.61	331.57	470.3	501.31	454.3	435.96	(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=	1288.74	1251.71	1138.88	953.45	736.03	490.4	320.64	336.85	529.99	799.66	1058.56	1279.41	(97)
--------	---------	---------	---------	--------	--------	-------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	614.81	476.66	386.58	203.97	78.79	0	0	0	0	221.97	435.07	627.53	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3045.38	(98)
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Space heating requirement in kWh/m²/year

42.01	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
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Fraction of space heat from main system(s) (202) = 1 – (201) =

1	(202)
---	-------

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

1	(204)
---	-------

Efficiency of main space heating system 1

93.4	(206)
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Efficiency of secondary/supplementary heating system, %

0	(208)
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

(211)m = {[(98)m x (204)]} x 100 ÷ (206)	614.81	476.66	386.58	203.97	78.79	0	0	0	0	221.97	435.07	627.53	(211)
--	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	-------

(211)m = {[(98)m x (204)]} x 100 ÷ (206)	658.25	510.35	413.9	218.38	84.36	0	0	0	0	237.66	465.81	671.87	(211)
--	--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------	-------

Total (kWh/year) = Sum(211) _{1...5,10...12} =	3260.58	(211)
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Space heating fuel (secondary), kWh/month
 $= \{[(98)m \times (201)]\} \times 100 \div (208)$

(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)

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
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Efficiency of water heater 80.3 (216)

(217)m=

87.74	87.5	86.96	85.71	83.48	80.3	80.3	80.3	80.3	85.8	87.24	87.83
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(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.2	194.63	203.76	183.36	182.26	166.89	159.89	178.24	180.21	192.05	201.63	216.77	
Total = Sum(219a) _{1...12} =													2281.88 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

3260.58

Water heating fuel used

2281.88

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 75 (231)

Electricity for lighting 322.14 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	704.29 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	492.89 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1197.17 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	167.19 (268)
Total CO2, kg/year	sum of (265)...(271) =		1403.29 (272)

TER = 19.36 (273)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 5 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a)	2.55 (2a)	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.41 (18)

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

Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.92 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.38 (21)

Infiltration rate modified for monthly wind speed

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
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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
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (24d)

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

(25)m= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1	= 2.1		(26)
Windows Type 1			0.79	x 1/[1/(1.4)+ 0.04]	= 1.05		(27)
Windows Type 2			0.48	x 1/[1/(1.4)+ 0.04]	= 0.64		(27)
Windows Type 3			1.56	x 1/[1/(1.4)+ 0.04]	= 2.07		(27)
Windows Type 4			0.8	x 1/[1/(1.4)+ 0.04]	= 1.06		(27)
Windows Type 5			1.55	x 1/[1/(1.4)+ 0.04]	= 2.05		(27)
Windows Type 6			7.18	x 1/[1/(1.4)+ 0.04]	= 9.52		(27)
Windows Type 7			0.48	x 1/[1/(1.4)+ 0.04]	= 0.64		(27)
Floor			0.91	x 0.13	= 0.1183		(28)
Walls Type1	73.79	16	57.79	x 0.18	= 10.4		(29)
Walls Type2	20.5	2.1	18.4	x 0.18	= 3.31		(29)
Roof Type1	0.91	0	0.91	x 0.13	= 0.12		(30)
Roof Type2	72.5	0	72.5	x 0.13	= 9.42		(30)
Total area of elements, m²			168.61				(31)
Party floor			72.5				(32a)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 46.69 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 20954.99 (34)

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

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

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can be used instead of a detailed calculation.

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

24.3 (36)

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

Total fabric heat loss

(33) + (36) =

70.99 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
37.72	37.44	37.16	35.87	35.63	34.51	34.51	34.3	34.94	35.63	36.12	36.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

108.71	108.43	108.15	106.86	106.62	105.5	105.5	105.29	105.93	106.62	107.11	107.62
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Average = Sum(39)_{1...12} /12=

106.86 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=

1.5	1.5	1.49	1.47	1.47	1.46	1.46	1.45	1.46	1.47	1.48	1.48
-----	-----	------	------	------	------	------	------	------	------	------	------

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

1.47 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.31 (42)

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

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

88.95 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84

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

1067.4 (44)

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

(45)m=

145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

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

1399.53 (45)

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

(46)m=

21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(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

$$(47) \times (51) \times (52) \times (53) =$$

0
0

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

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

(61)m=

49.86	43.4	46.23	42.99	42.61	39.48	40.8	42.61	42.99	46.23	46.5	49.86
-------	------	-------	-------	-------	-------	------	-------	-------	-------	------	-------

(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=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual)^{1...12}

1933.08

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

60.71	53.05	55.1	48.71	47.08	41.3	39.33	44.08	44.57	50.98	54.65	59.19
-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

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

(67)m=

18.11	16.08	13.08	9.9	7.4	6.25	6.75	8.78	11.78	14.96	17.46	18.61
-------	-------	-------	-----	-----	------	------	------	-------	-------	-------	-------

(67)

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

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

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

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

81.6	78.94	74.06	67.65	63.28	57.36	52.86	59.24	61.9	68.52	75.9	79.56
------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

363.35	360.77	347.58	326.69	305.54	285.06	272.1	278.4	289.38	310.47	334.63	352.85
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------

(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.63	x	0.7	=	1.56 (74)
North	0.9x	0.77	x	1.55	x	10.63	x	0.63	x	0.7	=	5.04 (74)
North	0.9x	0.77	x	7.18	x	10.63	x	0.63	x	0.7	=	23.33 (74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.63	x	0.7	=	2.98 (74)
North	0.9x	0.77	x	1.55	x	20.32	x	0.63	x	0.7	=	9.63 (74)
North	0.9x	0.77	x	7.18	x	20.32	x	0.63	x	0.7	=	44.59 (74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.63	x	0.7	=	5.07 (74)
North	0.9x	0.77	x	1.55	x	34.53	x	0.63	x	0.7	=	16.36 (74)
North	0.9x	0.77	x	7.18	x	34.53	x	0.63	x	0.7	=	75.77 (74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.63	x	0.7	=	8.14 (74)
North	0.9x	0.77	x	1.55	x	55.46	x	0.63	x	0.7	=	26.27 (74)
North	0.9x	0.77	x	7.18	x	55.46	x	0.63	x	0.7	=	121.71 (74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.63	x	0.7	=	10.96 (74)
North	0.9x	0.77	x	1.55	x	74.72	x	0.63	x	0.7	=	35.39 (74)
North	0.9x	0.77	x	7.18	x	74.72	x	0.63	x	0.7	=	163.95 (74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.63	x	0.7	=	11.73 (74)
North	0.9x	0.77	x	1.55	x	79.99	x	0.63	x	0.7	=	37.89 (74)
North	0.9x	0.77	x	7.18	x	79.99	x	0.63	x	0.7	=	175.51 (74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.63	x	0.7	=	10.95 (74)
North	0.9x	0.77	x	1.55	x	74.68	x	0.63	x	0.7	=	35.37 (74)
North	0.9x	0.77	x	7.18	x	74.68	x	0.63	x	0.7	=	163.86 (74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.63	x	0.7	=	8.69 (74)
North	0.9x	0.77	x	1.55	x	59.25	x	0.63	x	0.7	=	28.06 (74)
North	0.9x	0.77	x	7.18	x	59.25	x	0.63	x	0.7	=	130 (74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.63	x	0.7	=	6.09 (74)
North	0.9x	0.77	x	1.55	x	41.52	x	0.63	x	0.7	=	19.67 (74)
North	0.9x	0.77	x	7.18	x	41.52	x	0.63	x	0.7	=	91.1 (74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.63	x	0.7	=	3.55 (74)
North	0.9x	0.77	x	1.55	x	24.19	x	0.63	x	0.7	=	11.46 (74)
North	0.9x	0.77	x	7.18	x	24.19	x	0.63	x	0.7	=	53.08 (74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.63	x	0.7	=	1.92 (74)
North	0.9x	0.77	x	1.55	x	13.12	x	0.63	x	0.7	=	6.21 (74)
North	0.9x	0.77	x	7.18	x	13.12	x	0.63	x	0.7	=	28.78 (74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.63	x	0.7	=	1.3 (74)
North	0.9x	0.77	x	1.55	x	8.86	x	0.63	x	0.7	=	4.2 (74)
North	0.9x	0.77	x	7.18	x	8.86	x	0.63	x	0.7	=	19.45 (74)
East	0.9x	0.77	x	1.56	x	19.64	x	0.63	x	0.7	=	9.36 (76)
East	0.9x	0.77	x	0.8	x	19.64	x	0.63	x	0.7	=	4.8 (76)
East	0.9x	0.77	x	1.56	x	38.42	x	0.63	x	0.7	=	18.32 (76)

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East	0.9x	0.77	x	0.8	x	38.42	x	0.63	x	0.7	=	9.39	(76)
East	0.9x	0.77	x	1.56	x	63.27	x	0.63	x	0.7	=	30.17	(76)
East	0.9x	0.77	x	0.8	x	63.27	x	0.63	x	0.7	=	15.47	(76)
East	0.9x	0.77	x	1.56	x	92.28	x	0.63	x	0.7	=	44	(76)
East	0.9x	0.77	x	0.8	x	92.28	x	0.63	x	0.7	=	22.56	(76)
East	0.9x	0.77	x	1.56	x	113.09	x	0.63	x	0.7	=	53.92	(76)
East	0.9x	0.77	x	0.8	x	113.09	x	0.63	x	0.7	=	27.65	(76)
East	0.9x	0.77	x	1.56	x	115.77	x	0.63	x	0.7	=	55.19	(76)
East	0.9x	0.77	x	0.8	x	115.77	x	0.63	x	0.7	=	28.3	(76)
East	0.9x	0.77	x	1.56	x	110.22	x	0.63	x	0.7	=	52.55	(76)
East	0.9x	0.77	x	0.8	x	110.22	x	0.63	x	0.7	=	26.95	(76)
East	0.9x	0.77	x	1.56	x	94.68	x	0.63	x	0.7	=	45.14	(76)
East	0.9x	0.77	x	0.8	x	94.68	x	0.63	x	0.7	=	23.15	(76)
East	0.9x	0.77	x	1.56	x	73.59	x	0.63	x	0.7	=	35.08	(76)
East	0.9x	0.77	x	0.8	x	73.59	x	0.63	x	0.7	=	17.99	(76)
East	0.9x	0.77	x	1.56	x	45.59	x	0.63	x	0.7	=	21.73	(76)
East	0.9x	0.77	x	0.8	x	45.59	x	0.63	x	0.7	=	11.15	(76)
East	0.9x	0.77	x	1.56	x	24.49	x	0.63	x	0.7	=	11.68	(76)
East	0.9x	0.77	x	0.8	x	24.49	x	0.63	x	0.7	=	5.99	(76)
East	0.9x	0.77	x	1.56	x	16.15	x	0.63	x	0.7	=	7.7	(76)
East	0.9x	0.77	x	0.8	x	16.15	x	0.63	x	0.7	=	3.95	(76)
South	0.9x	0.77	x	0.48	x	46.75	x	0.63	x	0.7	=	6.86	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.63	x	0.7	=	11.23	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.63	x	0.7	=	14.31	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.63	x	0.7	=	16.17	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.63	x	0.7	=	16.85	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.63	x	0.7	=	16.22	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.63	x	0.7	=	15.84	(78)
South	0.9x	0.77	x	0.48	x	104.89	x	0.63	x	0.7	=	15.39	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.63	x	0.7	=	14.95	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.63	x	0.7	=	12.11	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.63	x	0.7	=	8.13	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.63	x	0.7	=	5.93	(78)
West	0.9x	0.77	x	0.79	x	19.64	x	0.63	x	0.7	=	23.71	(80)
West	0.9x	0.77	x	0.79	x	38.42	x	0.63	x	0.7	=	46.38	(80)
West	0.9x	0.77	x	0.79	x	63.27	x	0.63	x	0.7	=	76.38	(80)
West	0.9x	0.77	x	0.79	x	92.28	x	0.63	x	0.7	=	111.4	(80)
West	0.9x	0.77	x	0.79	x	113.09	x	0.63	x	0.7	=	136.52	(80)
West	0.9x	0.77	x	0.79	x	115.77	x	0.63	x	0.7	=	139.75	(80)
West	0.9x	0.77	x	0.79	x	110.22	x	0.63	x	0.7	=	133.05	(80)
West	0.9x	0.77	x	0.79	x	94.68	x	0.63	x	0.7	=	114.29	(80)

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West	0.9x	0.77	x	0.79	x	73.59	x	0.63	x	0.7	=	88.83	(80)
West	0.9x	0.77	x	0.79	x	45.59	x	0.63	x	0.7	=	55.03	(80)
West	0.9x	0.77	x	0.79	x	24.49	x	0.63	x	0.7	=	29.56	(80)
West	0.9x	0.77	x	0.79	x	16.15	x	0.63	x	0.7	=	19.5	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	74.66	142.52	233.52	350.24	445.24	464.61	438.58	364.72	273.71	168.12	92.28	62.02	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	438.01	503.29	581.09	676.93	750.78	749.67	710.68	643.12	563.09	478.59	426.91	414.87	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.76	0.61	0.68	0.9	0.98	1	1	(86)

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

(87)m=	19.32	19.48	19.79	20.22	20.61	20.87	20.96	20.94	20.72	20.22	19.7	19.3	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------

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

(88)m=	19.69	19.69	19.69	19.71	19.71	19.72	19.72	19.72	19.72	19.71	19.7	19.7	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------

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

(89)m=	1	0.99	0.98	0.95	0.85	0.66	0.45	0.52	0.83	0.97	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	17.48	17.72	18.17	18.79	19.33	19.64	19.71	19.7	19.49	18.8	18.05	17.46	(90)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =

0.37

(91)

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

(92)m=	18.17	18.38	18.77	19.32	19.81	20.1	20.18	20.16	19.95	19.33	18.66	18.14	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.17	18.38	18.77	19.32	19.81	20.1	20.18	20.16	19.95	19.33	18.66	18.14	(93)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.86	0.69	0.51	0.58	0.84	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	436.02	499.08	569.91	640.33	644.15	518.94	364.21	374.41	474.61	463.37	423.47	413.36	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1507.54	1461.35	1327.18	1113.88	864.34	579.97	377.22	396.18	619.31	930.82	1238.49	1500.49	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	797.21	646.65	563.41	340.96	163.82	0	0	0	0	347.78	586.82	808.82	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

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

4255.47

(98)

Space heating requirement in kWh/m²/year

58.7

(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(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)

797.21	646.65	563.41	340.96	163.82	0	0	0	0	347.78	586.82	808.82	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												(211)
853.54	692.34	603.22	365.05	175.4	0	0	0	0	372.36	628.28	865.98	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												4556.18
												(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	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0
												(215)

Water heating

Output from water heater (calculated above)

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38	
Efficiency of water heater												80.3
(217)m =	88.22	88.09	87.76	86.95	85.24	80.3	80.3	80.3	80.3	86.89	87.85	88.28
(217)m = (64)m x 100 ÷ (217)m												(217)
(219)m =	221	193.33	201.91	180.75	178.51	166.89	159.89	178.24	180.21	189.65	200.22	215.65
Total = Sum(219a) _{1...12} =												2266.25
												(219)

Annual totals

Space heating fuel used, main system 1		kWh/year		kWh/year
				4556.18
Water heating fuel used				2266.25
Electricity for pumps, fans and electric keep-hot				
central heating pump:			30	(230c)
boiler with a fan-assisted flue			45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =		75	(231)
Electricity for lighting			319.78	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	984.13
Space heating (secondary)	(215) x	0.519	=	0
Water heating	(219) x	0.216	=	489.51
Space and water heating	(261) + (262) + (263) + (264) =			1473.64

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	165.97	(268)
Total CO2, kg/year		sum of (265)...(271) =		1678.54	(272)
TER	=			23.15	(273)

DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 6 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a)	2.55 (2a)	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

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

Number of storeys in the dwelling (ns)	0	(9)
--	---	-----

Additional infiltration	[(9)-1]x0.1 =	0 (10)
-------------------------	---------------	--------

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0	(11)
--	---	------

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)
---	---	------

If no draught lobby, enter 0.05, else enter 0	0	(13)
---	---	------

Percentage of windows and doors draught stripped	0	(14)
--	---	------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
---------------------	-----------------------------	--------

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
-------------------	--	--------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	5	(17)
---	---	------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.41	(18)
--	------	------

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

Number of sides sheltered	1	(19)
---------------------------	---	------

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
----------------	-----------------------------	-----------

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.38 (21)
--	----------------------	-----------

Infiltration rate modified for monthly wind speed

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 (23a)

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

0 (23b)

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

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (24d)

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

(25)m= 0.62 0.61 0.61 0.59 0.58 0.57 0.57 0.56 0.57 0.58 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1	= 2.1		(26)
Windows Type 1			0.8	x 1/[1/(1.4)+ 0.04]	= 1.06		(27)
Windows Type 2			0.48	x 1/[1/(1.4)+ 0.04]	= 0.64		(27)
Windows Type 3			1.57	x 1/[1/(1.4)+ 0.04]	= 2.08		(27)
Windows Type 4			3.62	x 1/[1/(1.4)+ 0.04]	= 4.8		(27)
Windows Type 5			0.81	x 1/[1/(1.4)+ 0.04]	= 1.07		(27)
Windows Type 6			0.48	x 1/[1/(1.4)+ 0.04]	= 0.64		(27)
Floor			2.74	x 0.13	= 0.3562		(28)
Walls Type1	20.34	2.1	18.24	x 0.18	= 3.28		(29)
Walls Type2	78.25	14.42	63.83	x 0.18	= 11.49		(29)
Roof Type1	2.74	0	2.74	x 0.13	= 0.36		(30)
Roof Type2	72.54	0	72.54	x 0.13	= 9.43		(30)
Total area of elements, m²			176.61				(31)
Party floor			72.54				(32a)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 46.13 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 22128.82 (34)

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

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

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can be used instead of a detailed calculation.

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

27.92 (36)

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

Total fabric heat loss

(33) + (36) =

74.06 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
37.72	37.44	37.16	35.87	35.63	34.51	34.51	34.3	34.94	35.63	36.12	36.63

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

111.77	111.49	111.22	109.93	109.69	108.56	108.56	108.36	109	109.69	110.17	110.69
--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------

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

109.93 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=

1.54	1.54	1.53	1.52	1.51	1.5	1.5	1.49	1.5	1.51	1.52	1.53
------	------	------	------	------	-----	-----	------	-----	------	------	------

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

1.52 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.31 (42)

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

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

88.95 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84

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

1067.4 (44)

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

(45)m=

145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

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

1399.53 (45)

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

(46)m=

21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

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

(61)m=

49.86	43.4	46.23	42.99	42.61	39.48	40.8	42.61	42.99	46.23	46.5	49.86
-------	------	-------	-------	-------	-------	------	-------	-------	-------	------	-------

(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=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

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

1933.08

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

60.71	53.05	55.1	48.71	47.08	41.3	39.33	44.08	44.57	50.98	54.65	59.19
-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

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

(67)m=

18.24	16.2	13.18	9.98	7.46	6.3	6.8	8.84	11.87	15.07	17.59	18.75
-------	------	-------	------	------	-----	-----	------	-------	-------	-------	-------

(67)

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

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

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

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

81.6	78.94	74.06	67.65	63.28	57.36	52.86	59.24	61.9	68.52	75.9	79.56
------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

363.48	360.88	347.67	326.76	305.6	285.11	272.15	278.47	289.46	310.58	334.76	352.98
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.63	x	0.7	=	4.68	(74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.63	x	0.7	=	8.94	(74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.63	x	0.7	=	15.2	(74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.63	x	0.7	=	24.41	(74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.63	x	0.7	=	32.88	(74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.63	x	0.7	=	35.2	(74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.63	x	0.7	=	32.86	(74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.63	x	0.7	=	26.07	(74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.63	x	0.7	=	18.27	(74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.63	x	0.7	=	10.65	(74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.63	x	0.7	=	5.77	(74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.63	x	0.7	=	3.9	(74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.63	x	0.7	=	28.27	(76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.63	x	0.7	=	55.3	(76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.63	x	0.7	=	91.08	(76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.63	x	0.7	=	132.83	(76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.63	x	0.7	=	162.79	(76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.63	x	0.7	=	166.64	(76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.63	x	0.7	=	158.65	(76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.63	x	0.7	=	136.28	(76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.63	x	0.7	=	105.93	(76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.63	x	0.7	=	65.62	(76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.63	x	0.7	=	35.25	(76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.63	x	0.7	=	23.25	(76)
South	0.9x	0.77	x	0.81	x	46.75	x	0.63	x	0.7	=	11.57	(78)
South	0.9x	0.77	x	0.48	x	46.75	x	0.63	x	0.7	=	20.57	(78)
South	0.9x	0.77	x	0.81	x	76.57	x	0.63	x	0.7	=	18.95	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.63	x	0.7	=	33.7	(78)
South	0.9x	0.77	x	0.81	x	97.53	x	0.63	x	0.7	=	24.14	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.63	x	0.7	=	42.92	(78)
South	0.9x	0.77	x	0.81	x	110.23	x	0.63	x	0.7	=	27.29	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.63	x	0.7	=	48.51	(78)
South	0.9x	0.77	x	0.81	x	114.87	x	0.63	x	0.7	=	28.44	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.63	x	0.7	=	50.55	(78)
South	0.9x	0.77	x	0.81	x	110.55	x	0.63	x	0.7	=	27.37	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.63	x	0.7	=	48.65	(78)
South	0.9x	0.77	x	0.81	x	108.01	x	0.63	x	0.7	=	26.74	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.63	x	0.7	=	47.53	(78)
South	0.9x	0.77	x	0.81	x	104.89	x	0.63	x	0.7	=	25.97	(78)

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South	0.9x	0.77	x	0.48	x	104.89	x	0.63	x	0.7	=	46.16	(78)
South	0.9x	0.77	x	0.81	x	101.89	x	0.63	x	0.7	=	25.22	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.63	x	0.7	=	44.84	(78)
South	0.9x	0.77	x	0.81	x	82.59	x	0.63	x	0.7	=	20.44	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.63	x	0.7	=	36.34	(78)
South	0.9x	0.77	x	0.81	x	55.42	x	0.63	x	0.7	=	13.72	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.63	x	0.7	=	24.39	(78)
South	0.9x	0.77	x	0.81	x	40.4	x	0.63	x	0.7	=	10	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.63	x	0.7	=	17.78	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.63	x	0.7	=	14.41	(80)
West	0.9x	0.77	x	3.62	x	19.64	x	0.63	x	0.7	=	21.73	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.63	x	0.7	=	28.18	(80)
West	0.9x	0.77	x	3.62	x	38.42	x	0.63	x	0.7	=	42.51	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.63	x	0.7	=	46.41	(80)
West	0.9x	0.77	x	3.62	x	63.27	x	0.63	x	0.7	=	70	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.63	x	0.7	=	67.68	(80)
West	0.9x	0.77	x	3.62	x	92.28	x	0.63	x	0.7	=	102.09	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.63	x	0.7	=	82.95	(80)
West	0.9x	0.77	x	3.62	x	113.09	x	0.63	x	0.7	=	125.12	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.63	x	0.7	=	84.91	(80)
West	0.9x	0.77	x	3.62	x	115.77	x	0.63	x	0.7	=	128.08	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.63	x	0.7	=	80.84	(80)
West	0.9x	0.77	x	3.62	x	110.22	x	0.63	x	0.7	=	121.94	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.63	x	0.7	=	69.44	(80)
West	0.9x	0.77	x	3.62	x	94.68	x	0.63	x	0.7	=	104.74	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.63	x	0.7	=	53.98	(80)
West	0.9x	0.77	x	3.62	x	73.59	x	0.63	x	0.7	=	81.41	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.63	x	0.7	=	33.44	(80)
West	0.9x	0.77	x	3.62	x	45.59	x	0.63	x	0.7	=	50.44	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.63	x	0.7	=	17.96	(80)
West	0.9x	0.77	x	3.62	x	24.49	x	0.63	x	0.7	=	27.09	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.63	x	0.7	=	11.85	(80)
West	0.9x	0.77	x	3.62	x	16.15	x	0.63	x	0.7	=	17.87	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 101.23 187.58 289.75 402.82 482.73 490.85 468.57 408.67 329.65 216.93 124.18 84.64 (83)

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

(84)m= 464.71 548.47 637.42 729.58 788.32 775.96 740.72 687.13 619.11 527.51 458.94 437.63 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

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

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(86)m=	1	0.99	0.99	0.96	0.89	0.76	0.6	0.66	0.87	0.98	0.99	1	(86)
--------	---	------	------	------	------	------	-----	------	------	------	------	---	------

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

(87)m=	19.3	19.49	19.81	20.23	20.61	20.87	20.96	20.94	20.74	20.24	19.7	19.28	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(88)m=	19.66	19.66	19.66	19.68	19.68	19.69	19.69	19.68	19.68	19.67	19.67	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.94	0.84	0.65	0.44	0.5	0.8	0.96	0.99	1	(89)
--------	---	------	------	------	------	------	------	-----	-----	------	------	---	------

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

(90)m=	17.44	17.71	18.17	18.79	19.3	19.6	19.68	19.67	19.48	18.81	18.02	17.4	(90)
--------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------	------

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

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

(92)m=	18.13	18.37	18.78	19.33	19.79	20.07	20.16	20.14	19.95	19.34	18.64	18.1	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	18.13	18.37	18.78	19.33	19.79	20.07	20.16	20.14	19.95	19.34	18.64	18.1	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.94	0.85	0.68	0.5	0.56	0.81	0.96	0.99	1	(94)

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

(95)m=	462.06	542.3	621.17	682.27	667.56	531.46	372.65	385.17	504.41	505.47	454.17	435.65	(95)
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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=	1546.03	1501.86	1366.03	1146.3	887.41	594.38	385.96	405.77	637.56	958.93	1271.88	1538.54	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	806.47	644.82	554.18	334.1	163.57	0	0	0	0	337.37	588.75	820.55	(98)
--------	--------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	4249.8	(98)
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Space heating requirement in kWh/m²/year

58.62	(99)
-------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
---	-------

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

1	(202)
---	-------

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

1	(204)
---	-------

Efficiency of main space heating system 1

93.4	(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)

(211)m = {[(98)m x (204)]} x 100 ÷ (206)	806.47	644.82	554.18	334.1	163.57	0	0	0	0	337.37	588.75	820.55	(211)
--	--------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------	-------

(211)m = {[(98)m x (204)]} x 100 ÷ (206)

(211)m = {[(98)m x (204)]} x 100 ÷ (206)	863.46	690.39	593.34	357.71	175.13	0	0	0	0	361.21	630.35	878.53	(211)
--	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	-------

Total (kWh/year) = Sum(211) _{1...5,10...12} =	4550.11	(211)
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Space heating fuel (secondary), kWh/month
 $= \{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=	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)

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
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Efficiency of water heater 80.3 (216)

(217)m=	88.24	88.09	87.73	86.9	85.23	80.3	80.3	80.3	80.3	86.82	87.86	88.31	(217)
---------	-------	-------	-------	------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.95	193.34	201.98	180.84	178.52	166.89	159.89	178.24	180.21	189.8	200.21	215.59	
Total = Sum(219a) _{1...12} =												2266.47	(219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

4550.11

Water heating fuel used

2266.47

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

322.14

(232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	982.82	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	489.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1472.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	167.19	(268)
Total CO2, kg/year			sum of (265)...(271) =		1678.5	(272)

TER =

23.15 (273)

Appendix B – SAP Energy Assessment Cornwall Road

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Be Lean –Domestic

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 1 - Block 1

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	50.81 (1a)	2.55 (2a)	129.57 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	129.57 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

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

Number of storeys in the dwelling (ns)	0 (9)
--	-------

Additional infiltration	[(9)-1]x0.1 = 0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
--	--------

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
---	--------

If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
--	--------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] = 0 (15)
---------------------	------------------------------------

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) = 0 (16)
-------------------	---

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
---	--------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
--	-----------

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

Number of sides sheltered	1 (19)
---------------------------	--------

Shelter factor	0.92 (20)
----------------	-----------

Infiltration rate incorporating shelter factor	0.14 (21)
--	-----------

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

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

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

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

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

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

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

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

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

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

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			4.2	x 1/[1/(1.3)+0.04]	= 5.19		(27)
Windows Type 2			0.95	x 1/[1/(1.3)+0.04]	= 1.17		(27)
Windows Type 3			1.07	x 1/[1/(1.3)+0.04]	= 1.32		(27)
Windows Type 4			4.11	x 1/[1/(1.3)+0.04]	= 5.08		(27)
Floor			50.81	x 0.11	= 5.5891		(28)
Walls Type1	71.11	10.33	60.78	x 0.14	= 8.51		(29)
Walls Type2	21.75	2.1	19.65	x 0.13	= 2.59		(29)
Roof	4.67	0	4.67	x 0.11	= 0.51		(30)
Total area of elements, m²			148.34				(31)
Party ceiling			46.13				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.91 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 25525.83 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 17.33 (36)

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

Total fabric heat loss (33) + (36) = 50.24 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12.77	12.62	12.47	11.73	11.58	10.84	10.84	10.69	11.14	11.58	11.88	12.18

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

63.01	62.86	62.72	61.98	61.83	61.09	61.09	60.94	61.38	61.83	62.12	62.42
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$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.94

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=

1.24	1.24	1.23	1.22	1.22	1.2	1.2	1.2	1.21	1.22	1.22	1.23
------	------	------	------	------	-----	-----	-----	------	------	------	------

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

1.22

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

1.71

(42)

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

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

74.91

(43)

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

(44)m=

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

82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4
------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

898.88

(44)

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

(45)m=

122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34
--------	--------	--------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1178.57

(45)

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

(46)m=

18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

DER WorkSheet: New dwelling design stage

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

41.99	36.55	38.94	36.2	35.88	33.25	34.35	35.88	36.2	38.94	39.16	41.99
-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------

 (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=

164.18	143.42	149.22	132.35	128.14	112.85	108.12	120.53	121.86	138.77	148.13	160.33
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

164.18	143.42	149.22	132.35	128.14	112.85	108.12	120.53	121.86	138.77	148.13	160.33
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1627.89
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

51.13	44.67	46.4	41.02	39.64	34.78	33.12	37.12	37.53	42.93	46.02	49.84
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7

 (66)

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

(67)m=

13.39	11.89	9.67	7.32	5.47	4.62	4.99	6.49	8.71	11.06	12.91	13.76
-------	-------	------	------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

68.72	66.47	62.37	56.97	53.29	48.31	44.51	49.89	52.13	57.7	63.92	67
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	----

 (72)

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

(73)m=

283.15	280.96	270.73	254.67	238.64	222.95	212.93	218.26	226.62	242.86	261.42	275.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	4.11	x	19.64	x	0.5	x	0.7	=	19.58	(76)
East	0.9x	0.77	x	4.11	x	38.42	x	0.5	x	0.7	=	38.3	(76)
East	0.9x	0.77	x	4.11	x	63.27	x	0.5	x	0.7	=	63.08	(76)
East	0.9x	0.77	x	4.11	x	92.28	x	0.5	x	0.7	=	91.99	(76)
East	0.9x	0.77	x	4.11	x	113.09	x	0.5	x	0.7	=	112.74	(76)
East	0.9x	0.77	x	4.11	x	115.77	x	0.5	x	0.7	=	115.41	(76)
East	0.9x	0.77	x	4.11	x	110.22	x	0.5	x	0.7	=	109.87	(76)
East	0.9x	0.77	x	4.11	x	94.68	x	0.5	x	0.7	=	94.38	(76)
East	0.9x	0.77	x	4.11	x	73.59	x	0.5	x	0.7	=	73.36	(76)
East	0.9x	0.77	x	4.11	x	45.59	x	0.5	x	0.7	=	45.45	(76)
East	0.9x	0.77	x	4.11	x	24.49	x	0.5	x	0.7	=	24.41	(76)
East	0.9x	0.77	x	4.11	x	16.15	x	0.5	x	0.7	=	16.1	(76)
South	0.9x	0.77	x	0.95	x	46.75	x	0.5	x	0.7	=	10.77	(78)
South	0.9x	0.77	x	1.07	x	46.75	x	0.5	x	0.7	=	12.13	(78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.5	x	0.7	=	17.64	(78)
South	0.9x	0.77	x	1.07	x	76.57	x	0.5	x	0.7	=	19.87	(78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.5	x	0.7	=	22.47	(78)
South	0.9x	0.77	x	1.07	x	97.53	x	0.5	x	0.7	=	25.31	(78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.5	x	0.7	=	25.4	(78)
South	0.9x	0.77	x	1.07	x	110.23	x	0.5	x	0.7	=	28.61	(78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.5	x	0.7	=	26.47	(78)
South	0.9x	0.77	x	1.07	x	114.87	x	0.5	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.5	x	0.7	=	25.47	(78)
South	0.9x	0.77	x	1.07	x	110.55	x	0.5	x	0.7	=	28.69	(78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.5	x	0.7	=	24.89	(78)
South	0.9x	0.77	x	1.07	x	108.01	x	0.5	x	0.7	=	28.03	(78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.5	x	0.7	=	24.17	(78)
South	0.9x	0.77	x	1.07	x	104.89	x	0.5	x	0.7	=	27.22	(78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.5	x	0.7	=	23.48	(78)
South	0.9x	0.77	x	1.07	x	101.89	x	0.5	x	0.7	=	26.44	(78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.5	x	0.7	=	19.03	(78)
South	0.9x	0.77	x	1.07	x	82.59	x	0.5	x	0.7	=	21.43	(78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.5	x	0.7	=	12.77	(78)
South	0.9x	0.77	x	1.07	x	55.42	x	0.5	x	0.7	=	14.38	(78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.5	x	0.7	=	9.31	(78)
South	0.9x	0.77	x	1.07	x	40.4	x	0.5	x	0.7	=	10.48	(78)
West	0.9x	0.77	x	4.2	x	19.64	x	0.5	x	0.7	=	20.01	(80)
West	0.9x	0.77	x	4.2	x	38.42	x	0.5	x	0.7	=	39.14	(80)
West	0.9x	0.77	x	4.2	x	63.27	x	0.5	x	0.7	=	64.46	(80)
West	0.9x	0.77	x	4.2	x	92.28	x	0.5	x	0.7	=	94.01	(80)
West	0.9x	0.77	x	4.2	x	113.09	x	0.5	x	0.7	=	115.21	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	4.2	x	115.77	x	0.5	x	0.7	=	117.94	(80)
West	0.9x	0.77	x	4.2	x	110.22	x	0.5	x	0.7	=	112.28	(80)
West	0.9x	0.77	x	4.2	x	94.68	x	0.5	x	0.7	=	96.45	(80)
West	0.9x	0.77	x	4.2	x	73.59	x	0.5	x	0.7	=	74.97	(80)
West	0.9x	0.77	x	4.2	x	45.59	x	0.5	x	0.7	=	46.44	(80)
West	0.9x	0.77	x	4.2	x	24.49	x	0.5	x	0.7	=	24.95	(80)
West	0.9x	0.77	x	4.2	x	16.15	x	0.5	x	0.7	=	16.45	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	62.49	114.95	175.32	240.01	284.23	287.51	275.08	242.22	198.24	132.35	76.51	52.35	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	345.64	395.91	446.05	494.68	522.87	510.46	488.01	460.48	424.87	375.21	337.93	327.56	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.54	0.59	0.83	0.97	0.99	1	(86)

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

(87)m=	19.71	19.87	20.14	20.49	20.78	20.94	20.99	20.98	20.87	20.49	20.04	19.68	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.89	19.89	19.89	19.9	19.91	19.92	19.92	19.92	19.91	19.91	19.9	19.9	(88)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	------	------

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

(89)m=	1	0.99	0.98	0.93	0.82	0.61	0.41	0.46	0.75	0.95	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.19	18.42	18.81	19.31	19.69	19.88	19.91	19.91	19.81	19.32	18.67	18.15	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.51 (91)

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

(92)m=	18.96	19.16	19.49	19.91	20.24	20.42	20.46	20.45	20.35	19.91	19.36	18.93	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.81	19.01	19.34	19.76	20.09	20.27	20.31	20.3	20.2	19.76	19.21	18.78	(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=	0.99	0.99	0.97	0.93	0.82	0.64	0.46	0.51	0.77	0.95	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	343.48	391.08	433.6	458.66	431.04	327.32	223.49	233.13	328.01	355.94	333.86	325.95	(95)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	914.31	886.89	805.06	672.87	518.67	346.2	226.45	237.87	374.17	566.5	752.47	909.97	(97)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	------

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

(98)m=	424.7	333.18	276.36	154.23	65.2	0	0	0	0	156.65	301.4	434.52	
--------	-------	--------	--------	--------	------	---	---	---	---	--------	-------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2146.24 (98)

Space heating requirement in kWh/m²/year 42.24 (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		90.3	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
424.7	333.18	276.36	154.23	65.2	0	0	0	0	156.65	301.4	434.52	

(211)_m = {[(98)_m × (204)] } × 100 ÷ (206) (211)

470.32	368.97	306.05	170.8	72.2	0	0	0	0	173.48	333.78	481.19	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												2376.79 (211)

Space heating fuel (secondary), kWh/month
= {[(98)_m × (201)] } × 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)	164.18	143.42	149.22	132.35	128.14	112.85	108.12	120.53	121.86	138.77	148.13	160.33	
Efficiency of water heater	81												(216)
(217) _m =	87.5	87.28	86.81	85.75	83.91	81	81	81	81	85.68	87.01	87.59	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m													
(219)m=	187.64	164.31	171.9	154.34	152.7	139.33	133.49	148.81	150.45	161.96	170.25	183.04	
Total = Sum(219a) _{1...12} =												1918.19	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	2376.79	
Water heating fuel used	1918.19	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	104.72	(230a)
central heating pump:	30	(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	134.72 (231)
Electricity for lighting		236.39 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.216	= 513.39 (261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.33	(264)
Space and water heating	(261) + (262) + (263) + (264) =			927.72	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	69.92	(267)
Electricity for lighting	(232) x	0.519	=	122.69	(268)
Total CO2, kg/year	sum of (265)...(271) =			1120.32	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			22.05	(273)
El rating (section 14)				84	(274)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 2 - Block 1

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.18 (1a)	2.55 (2a)	130.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	130.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)					0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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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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DER WorkSheet: New dwelling design stage

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
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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) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

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

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

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

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

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

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

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

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

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

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			1.91	x 1/[1/(1.3)+0.04]	= 2.36		(27)
Windows Type 2			4.2	x 1/[1/(1.3)+0.04]	= 5.19		(27)
Windows Type 3			0.95	x 1/[1/(1.3)+0.04]	= 1.17		(27)
Windows Type 4			1.07	x 1/[1/(1.3)+0.04]	= 1.32		(27)
Windows Type 5			2.26	x 1/[1/(1.3)+0.04]	= 2.79		(27)
Floor			5.05	x 0.11	= 0.5555		(28)
Walls Type1	25.57	2.1	23.47	x 0.13	= 3.11		(29)
Walls Type2	66.62	10.39	56.23	x 0.14	= 7.87		(29)
Total area of elements, m²			97.24				(31)
Party floor			46.13				(32a)
Party ceiling			51.18				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 27.32 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 24330.15 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 12.68 (36)

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

DER WorkSheet: New dwelling design stage

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.86	12.71	12.56	11.82	11.67	10.92	10.92	10.77	11.22	11.67	11.97	12.26	(38)

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

(39)m=	52.86	52.71	52.56	51.82	51.67	50.92	50.92	50.77	51.22	51.67	51.97	52.26	
Average = Sum(39) _{1...12} / 12 =												51.78	(39)

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

(40)m=	1.03	1.03	1.03	1.01	1.01	0.99	0.99	0.99	1	1.01	1.02	1.02	
Average = Sum(40) _{1...12} / 12 =												1.01	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N (42)

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

if TFA ≤ 13.9, N = 1

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

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 × (43)													

(44)m=	82.68	79.68	76.67	73.66	70.66	67.65	67.65	70.66	73.66	76.67	79.68	82.68	
Total = Sum(44) _{1...12} =												901.99	(44)

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

(45)m=	122.62	107.24	110.66	96.48	92.57	79.88	74.02	84.94	85.96	100.18	109.35	118.75	
Total = Sum(45) _{1...12} =												1182.65	(45)

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

(46)m=	18.39	16.09	16.6	14.47	13.89	11.98	11.1	12.74	12.89	15.03	16.4	17.81	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel (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): (48)

Temperature factor from Table 2b (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a (52)

Temperature factor from Table 2b (53)

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

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

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (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=

0	0	0	0	0	0	0	0	0	0	0	0
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 (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=

0	0	0	0	0	0	0	0	0	0	0	0
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 (59)

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

(61)m=

42.13	36.67	39.07	36.33	36.01	33.36	34.47	36.01	36.33	39.07	39.29	42.13
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 (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=

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
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 (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
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 (63)

Output from water heater

(64)m=

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
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Output from water heater (annual)_{1...12}

1633.52 (64)

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

(65)m=

51.3	44.83	46.56	41.16	39.78	34.9	33.23	37.25	37.66	43.08	46.18	50.02
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24

 (66)

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

(67)m=

13.47	11.97	9.73	7.37	5.51	4.65	5.02	6.53	8.77	11.13	12.99	13.85
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 (67)

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

(68)m=

150.3	151.86	147.93	139.56	129	119.07	112.44	110.88	114.81	123.18	133.74	143.67
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 (68)

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

(69)m=

31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
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 (70)

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

(71)m=

-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69
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 (71)

Water heating gains (Table 5)

(72)m=

68.96	66.7	62.58	57.17	53.47	48.47	44.67	50.06	52.31	57.9	64.14	67.23
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 (72)

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

(73)m=

284.6	282.4	272.12	255.97	239.85	224.07	214	219.35	227.76	244.08	262.74	276.61
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 (73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.26	x	19.64	x	0.5	x	0.7	=	10.77	(76)
East	0.9x	0.77	x	2.26	x	38.42	x	0.5	x	0.7	=	21.06	(76)
East	0.9x	0.77	x	2.26	x	63.27	x	0.5	x	0.7	=	34.68	(76)
East	0.9x	0.77	x	2.26	x	92.28	x	0.5	x	0.7	=	50.58	(76)
East	0.9x	0.77	x	2.26	x	113.09	x	0.5	x	0.7	=	61.99	(76)
East	0.9x	0.77	x	2.26	x	115.77	x	0.5	x	0.7	=	63.46	(76)
East	0.9x	0.77	x	2.26	x	110.22	x	0.5	x	0.7	=	60.42	(76)
East	0.9x	0.77	x	2.26	x	94.68	x	0.5	x	0.7	=	51.9	(76)
East	0.9x	0.77	x	2.26	x	73.59	x	0.5	x	0.7	=	40.34	(76)
East	0.9x	0.77	x	2.26	x	45.59	x	0.5	x	0.7	=	24.99	(76)
East	0.9x	0.77	x	2.26	x	24.49	x	0.5	x	0.7	=	13.42	(76)
East	0.9x	0.77	x	2.26	x	16.15	x	0.5	x	0.7	=	8.85	(76)
South	0.9x	0.77	x	0.95	x	46.75	x	0.5	x	0.7	=	10.77	(78)
South	0.9x	0.77	x	1.07	x	46.75	x	0.5	x	0.7	=	12.13	(78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.5	x	0.7	=	17.64	(78)
South	0.9x	0.77	x	1.07	x	76.57	x	0.5	x	0.7	=	19.87	(78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.5	x	0.7	=	22.47	(78)
South	0.9x	0.77	x	1.07	x	97.53	x	0.5	x	0.7	=	25.31	(78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.5	x	0.7	=	25.4	(78)
South	0.9x	0.77	x	1.07	x	110.23	x	0.5	x	0.7	=	28.61	(78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.5	x	0.7	=	26.47	(78)
South	0.9x	0.77	x	1.07	x	114.87	x	0.5	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.5	x	0.7	=	25.47	(78)
South	0.9x	0.77	x	1.07	x	110.55	x	0.5	x	0.7	=	28.69	(78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.5	x	0.7	=	24.89	(78)
South	0.9x	0.77	x	1.07	x	108.01	x	0.5	x	0.7	=	28.03	(78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.5	x	0.7	=	24.17	(78)
South	0.9x	0.77	x	1.07	x	104.89	x	0.5	x	0.7	=	27.22	(78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.5	x	0.7	=	23.48	(78)
South	0.9x	0.77	x	1.07	x	101.89	x	0.5	x	0.7	=	26.44	(78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.5	x	0.7	=	19.03	(78)
South	0.9x	0.77	x	1.07	x	82.59	x	0.5	x	0.7	=	21.43	(78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.5	x	0.7	=	12.77	(78)
South	0.9x	0.77	x	1.07	x	55.42	x	0.5	x	0.7	=	14.38	(78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.5	x	0.7	=	9.31	(78)
South	0.9x	0.77	x	1.07	x	40.4	x	0.5	x	0.7	=	10.48	(78)
West	0.9x	0.77	x	1.91	x	19.64	x	0.5	x	0.7	=	9.1	(80)
West	0.9x	0.77	x	4.2	x	19.64	x	0.5	x	0.7	=	20.01	(80)
West	0.9x	0.77	x	1.91	x	38.42	x	0.5	x	0.7	=	17.8	(80)

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West	0.9x	0.77	x	4.2	x	38.42	x	0.5	x	0.7	=	39.14	(80)
West	0.9x	0.77	x	1.91	x	63.27	x	0.5	x	0.7	=	29.31	(80)
West	0.9x	0.77	x	4.2	x	63.27	x	0.5	x	0.7	=	64.46	(80)
West	0.9x	0.77	x	1.91	x	92.28	x	0.5	x	0.7	=	42.75	(80)
West	0.9x	0.77	x	4.2	x	92.28	x	0.5	x	0.7	=	94.01	(80)
West	0.9x	0.77	x	1.91	x	113.09	x	0.5	x	0.7	=	52.39	(80)
West	0.9x	0.77	x	4.2	x	113.09	x	0.5	x	0.7	=	115.21	(80)
West	0.9x	0.77	x	1.91	x	115.77	x	0.5	x	0.7	=	53.63	(80)
West	0.9x	0.77	x	4.2	x	115.77	x	0.5	x	0.7	=	117.94	(80)
West	0.9x	0.77	x	1.91	x	110.22	x	0.5	x	0.7	=	51.06	(80)
West	0.9x	0.77	x	4.2	x	110.22	x	0.5	x	0.7	=	112.28	(80)
West	0.9x	0.77	x	1.91	x	94.68	x	0.5	x	0.7	=	43.86	(80)
West	0.9x	0.77	x	4.2	x	94.68	x	0.5	x	0.7	=	96.45	(80)
West	0.9x	0.77	x	1.91	x	73.59	x	0.5	x	0.7	=	34.09	(80)
West	0.9x	0.77	x	4.2	x	73.59	x	0.5	x	0.7	=	74.97	(80)
West	0.9x	0.77	x	1.91	x	45.59	x	0.5	x	0.7	=	21.12	(80)
West	0.9x	0.77	x	4.2	x	45.59	x	0.5	x	0.7	=	46.44	(80)
West	0.9x	0.77	x	1.91	x	24.49	x	0.5	x	0.7	=	11.35	(80)
West	0.9x	0.77	x	4.2	x	24.49	x	0.5	x	0.7	=	24.95	(80)
West	0.9x	0.77	x	1.91	x	16.15	x	0.5	x	0.7	=	7.48	(80)
West	0.9x	0.77	x	4.2	x	16.15	x	0.5	x	0.7	=	16.45	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	62.78	115.51	176.24	241.35	285.88	289.19	276.68	243.6	199.32	133.02	76.87	52.58	(83)
--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------	------

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

(84)m=	347.38	397.92	448.36	497.32	525.73	513.26	490.68	462.94	427.08	377.09	339.61	329.2	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.62	0.45	0.5	0.76	0.95	0.99	1	(86)

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

(87)m=	19.99	20.15	20.39	20.69	20.89	20.98	21	21	20.94	20.67	20.27	19.97	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.06	20.06	20.06	20.07	20.08	20.09	20.09	20.09	20.08	20.08	20.07	20.07	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.97	0.9	0.76	0.54	0.36	0.4	0.68	0.93	0.99	1	(89)
--------	---	------	------	-----	------	------	------	-----	------	------	------	---	------

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

(90)m=	18.72	18.94	19.3	19.72	19.98	20.08	20.09	20.09	20.04	19.7	19.14	18.69	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) = 0.51 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	19.37	19.56	19.85	20.21	20.44	20.54	20.55	20.55	20.5	20.19	19.72	19.34	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(93)m=	19.22	19.41	19.7	20.06	20.29	20.39	20.4	20.4	20.35	20.04	19.57	19.19	(93)
--------	-------	-------	------	-------	-------	-------	------	------	-------	-------	-------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=	0.99	0.99	0.97	0.9	0.77	0.56	0.39	0.44	0.71	0.93	0.99	1	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	---	------

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	345.2	392.57	433.17	449.57	404.02	289.12	192.92	202.03	301.58	352.2	335.09	327.62	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	788.6	764.74	694.08	578.36	444.05	294.71	193.53	203.11	320.19	487.78	647.9	783.39	(97)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	329.89	250.1	194.11	92.72	29.78	0	0	0	0	100.87	225.22	339.09	
--------	--------	-------	--------	-------	-------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 1561.79 (98)

Space heating requirement in $kWh/m^2/year$

30.52 (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) = $(202) \times [1 - (203)] =$

1 (204)

Efficiency of main space heating system 1

90.3 (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)

329.89	250.1	194.11	92.72	29.78	0	0	0	0	100.87	225.22	339.09
--------	-------	--------	-------	-------	---	---	---	---	--------	--------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

365.33	276.96	214.96	102.68	32.98	0	0	0	0	111.71	249.41	375.52
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total ($kWh/year$) = $Sum(211)_{1..5,10..12} =$ 1729.56 (211)

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=	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)

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

Efficiency of water heater

81 (216)

(217)m=	86.97	86.67	86	84.58	82.6	81	81	81	81	84.66	86.36	87.08	(217)
---------	-------	-------	----	-------	------	----	----	----	----	-------	-------	-------	-------

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=	189.42	166.06	174.11	157.01	155.66	139.81	133.95	149.32	150.97	164.47	172.12	184.74	
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

Total = $Sum(219a)_{1..12} =$ 1937.65 (219)

DER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		1729.56
Water heating fuel used		1937.65
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	105.48	(230a)
central heating pump:	30	(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	135.48 (231)
Electricity for lighting		237.95 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	373.58 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	418.53 (264)
Space and water heating	(261) + (262) + (263) + (264) =		792.12 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	70.32 (267)
Electricity for lighting	(232) x	0.519 =	123.49 (268)
Total CO2, kg/year		sum of (265)...(271) =	985.93 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	19.26 (273)
El rating (section 14)			86 (274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 3 - Block 1

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.18 (1a)	2.55 (2a)	130.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	130.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)					0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

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

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

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

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

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

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

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

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

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

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			1.27	x 1/[1/(1.3)+0.04]	= 1.57		(27)
Windows Type 2			4.2	x 1/[1/(1.3)+0.04]	= 5.19		(27)
Windows Type 3			0.95	x 1/[1/(1.3)+0.04]	= 1.17		(27)
Windows Type 4			1.07	x 1/[1/(1.3)+0.04]	= 1.32		(27)
Windows Type 5			2.26	x 1/[1/(1.3)+0.04]	= 2.79		(27)
Walls Type1	25.57	2.1	23.47	x 0.13	= 3.1		(29)
Walls Type2	66.62	9.75	56.87	x 0.14	= 7.96		(29)
Roof	51.18	0	51.18	x 0.11	= 5.63		(30)
Total area of elements, m²			143.37				(31)
Party floor			51.18				(32a)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 31.68 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19819.62 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 27.62 (36)

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

Total fabric heat loss (33) + (36) = 59.3 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12.86	12.71	12.56	11.82	11.67	10.92	10.92	10.77	11.22	11.67	11.97	12.26

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

72.16	72.02	71.87	71.12	70.97	70.22	70.22	70.07	70.52	70.97	71.27	71.57
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

71.08

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=

1.41	1.41	1.4	1.39	1.39	1.37	1.37	1.37	1.38	1.39	1.39	1.4
------	------	-----	------	------	------	------	------	------	------	------	-----

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

1.39

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.72

(42)

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

if TFA ≤ 13.9, N = 1

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

75.17

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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)

(44)m=

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

82.68	79.68	76.67	73.66	70.66	67.65	67.65	70.66	73.66	76.67	79.68	82.68
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

901.99

(44)

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

(45)m=

122.62	107.24	110.66	96.48	92.57	79.88	74.02	84.94	85.96	100.18	109.35	118.75
--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

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

1182.65

(45)

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

(46)m=

18.39	16.09	16.6	14.47	13.89	11.98	11.1	12.74	12.89	15.03	16.4	17.81
-------	-------	------	-------	-------	-------	------	-------	-------	-------	------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)

DER WorkSheet: New dwelling design stage

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

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

42.13	36.67	39.07	36.33	36.01	33.36	34.47	36.01	36.33	39.07	39.29	42.13
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 (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=

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (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=

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1633.52
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

51.3	44.83	46.56	41.16	39.78	34.9	33.23	37.25	37.66	43.08	46.18	50.02
------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24

 (66)

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

(67)m=

13.57	12.05	9.8	7.42	5.55	4.68	5.06	6.58	8.83	11.21	13.08	13.95
-------	-------	-----	------	------	------	------	------	------	-------	-------	-------

 (67)

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

(68)m=

150.3	151.86	147.93	139.56	129	119.07	112.44	110.88	114.81	123.18	133.74	143.67
-------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

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

(71)m=

-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

 (71)

Water heating gains (Table 5)

(72)m=

68.96	66.7	62.58	57.17	53.47	48.47	44.67	50.06	52.31	57.9	64.14	67.23
-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

 (72)

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

(73)m=

284.7	282.49	272.19	256.02	239.89	224.1	214.04	219.39	227.82	244.16	262.84	276.72
-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.26	x	19.64	x	0.5	x	0.7	=	10.77	(76)
East	0.9x	0.77	x	2.26	x	38.42	x	0.5	x	0.7	=	21.06	(76)
East	0.9x	0.77	x	2.26	x	63.27	x	0.5	x	0.7	=	34.68	(76)
East	0.9x	0.77	x	2.26	x	92.28	x	0.5	x	0.7	=	50.58	(76)
East	0.9x	0.77	x	2.26	x	113.09	x	0.5	x	0.7	=	61.99	(76)
East	0.9x	0.77	x	2.26	x	115.77	x	0.5	x	0.7	=	63.46	(76)
East	0.9x	0.77	x	2.26	x	110.22	x	0.5	x	0.7	=	60.42	(76)
East	0.9x	0.77	x	2.26	x	94.68	x	0.5	x	0.7	=	51.9	(76)
East	0.9x	0.77	x	2.26	x	73.59	x	0.5	x	0.7	=	40.34	(76)
East	0.9x	0.77	x	2.26	x	45.59	x	0.5	x	0.7	=	24.99	(76)
East	0.9x	0.77	x	2.26	x	24.49	x	0.5	x	0.7	=	13.42	(76)
East	0.9x	0.77	x	2.26	x	16.15	x	0.5	x	0.7	=	8.85	(76)
South	0.9x	0.77	x	0.95	x	46.75	x	0.5	x	0.7	=	10.77	(78)
South	0.9x	0.77	x	1.07	x	46.75	x	0.5	x	0.7	=	12.13	(78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.5	x	0.7	=	17.64	(78)
South	0.9x	0.77	x	1.07	x	76.57	x	0.5	x	0.7	=	19.87	(78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.5	x	0.7	=	22.47	(78)
South	0.9x	0.77	x	1.07	x	97.53	x	0.5	x	0.7	=	25.31	(78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.5	x	0.7	=	25.4	(78)
South	0.9x	0.77	x	1.07	x	110.23	x	0.5	x	0.7	=	28.61	(78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.5	x	0.7	=	26.47	(78)
South	0.9x	0.77	x	1.07	x	114.87	x	0.5	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.5	x	0.7	=	25.47	(78)
South	0.9x	0.77	x	1.07	x	110.55	x	0.5	x	0.7	=	28.69	(78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.5	x	0.7	=	24.89	(78)
South	0.9x	0.77	x	1.07	x	108.01	x	0.5	x	0.7	=	28.03	(78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.5	x	0.7	=	24.17	(78)
South	0.9x	0.77	x	1.07	x	104.89	x	0.5	x	0.7	=	27.22	(78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.5	x	0.7	=	23.48	(78)
South	0.9x	0.77	x	1.07	x	101.89	x	0.5	x	0.7	=	26.44	(78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.5	x	0.7	=	19.03	(78)
South	0.9x	0.77	x	1.07	x	82.59	x	0.5	x	0.7	=	21.43	(78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.5	x	0.7	=	12.77	(78)
South	0.9x	0.77	x	1.07	x	55.42	x	0.5	x	0.7	=	14.38	(78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.5	x	0.7	=	9.31	(78)
South	0.9x	0.77	x	1.07	x	40.4	x	0.5	x	0.7	=	10.48	(78)
West	0.9x	0.77	x	1.27	x	19.64	x	0.5	x	0.7	=	6.05	(80)
West	0.9x	0.77	x	4.2	x	19.64	x	0.5	x	0.7	=	20.01	(80)
West	0.9x	0.77	x	1.27	x	38.42	x	0.5	x	0.7	=	11.83	(80)
West	0.9x	0.77	x	4.2	x	38.42	x	0.5	x	0.7	=	39.14	(80)
West	0.9x	0.77	x	1.27	x	63.27	x	0.5	x	0.7	=	19.49	(80)

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West	0.9x	0.77	x	4.2	x	63.27	x	0.5	x	0.7	=	64.46	(80)
West	0.9x	0.77	x	1.27	x	92.28	x	0.5	x	0.7	=	28.43	(80)
West	0.9x	0.77	x	4.2	x	92.28	x	0.5	x	0.7	=	94.01	(80)
West	0.9x	0.77	x	1.27	x	113.09	x	0.5	x	0.7	=	34.84	(80)
West	0.9x	0.77	x	4.2	x	113.09	x	0.5	x	0.7	=	115.21	(80)
West	0.9x	0.77	x	1.27	x	115.77	x	0.5	x	0.7	=	35.66	(80)
West	0.9x	0.77	x	4.2	x	115.77	x	0.5	x	0.7	=	117.94	(80)
West	0.9x	0.77	x	1.27	x	110.22	x	0.5	x	0.7	=	33.95	(80)
West	0.9x	0.77	x	4.2	x	110.22	x	0.5	x	0.7	=	112.28	(80)
West	0.9x	0.77	x	1.27	x	94.68	x	0.5	x	0.7	=	29.16	(80)
West	0.9x	0.77	x	4.2	x	94.68	x	0.5	x	0.7	=	96.45	(80)
West	0.9x	0.77	x	1.27	x	73.59	x	0.5	x	0.7	=	22.67	(80)
West	0.9x	0.77	x	4.2	x	73.59	x	0.5	x	0.7	=	74.97	(80)
West	0.9x	0.77	x	1.27	x	45.59	x	0.5	x	0.7	=	14.04	(80)
West	0.9x	0.77	x	4.2	x	45.59	x	0.5	x	0.7	=	46.44	(80)
West	0.9x	0.77	x	1.27	x	24.49	x	0.5	x	0.7	=	7.54	(80)
West	0.9x	0.77	x	4.2	x	24.49	x	0.5	x	0.7	=	24.95	(80)
West	0.9x	0.77	x	1.27	x	16.15	x	0.5	x	0.7	=	4.98	(80)
West	0.9x	0.77	x	4.2	x	16.15	x	0.5	x	0.7	=	16.45	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	59.73	109.55	166.42	227.03	268.32	271.22	259.57	228.9	187.89	125.94	73.07	50.08	(83)
--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------	------

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

(84)m=	344.43	392.04	438.61	483.05	508.21	495.33	473.61	448.3	415.72	370.1	335.91	326.79	(84)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.9	0.77	0.61	0.66	0.87	0.97	0.99	1	(86)

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

(87)m=	19.49	19.65	19.93	20.3	20.64	20.88	20.97	20.95	20.78	20.34	19.85	19.46	(87)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.76	19.76	19.76	19.77	19.77	19.78	19.78	19.79	19.78	19.77	19.77	19.76	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.95	0.86	0.67	0.46	0.51	0.8	0.96	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	-----	------	------	---	------

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

(90)m=	17.77	18.01	18.42	18.96	19.42	19.7	19.77	19.77	19.6	19.01	18.3	17.74	(90)
--------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	------	-------	------

fLA = Living area ÷ (4) = 0.51 (91)

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

(92)m=	18.65	18.85	19.19	19.64	20.04	20.3	20.38	20.37	20.2	19.69	19.09	18.62	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	------

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

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(93)m=	18.5	18.7	19.04	19.49	19.89	20.15	20.23	20.22	20.05	19.54	18.94	18.47	(93)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=	0.99	0.99	0.98	0.94	0.86	0.71	0.52	0.57	0.82	0.96	0.99	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	342.28	387.61	428.17	455.17	438.62	349.74	246.89	255.84	339.81	354.32	332.11	325.15	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1024.6	993.47	901.08	753.44	581.57	390.06	255.03	267.89	419.82	634.25	843.72	1020.98	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	507.65	407.14	351.84	214.75	106.35	0	0	0	0	208.27	368.36	517.7	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												2682.06	(98)

Space heating requirement in $kWh/m^2/year$

52.4	(99)
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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

$$(204) = (202) \times [1 - (203)] =$$

1	(204)
---	-------

Efficiency of main space heating system 1

90.3	(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)

507.65	407.14	351.84	214.75	106.35	0	0	0	0	208.27	368.36	517.7
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	-------

$$(211)m = \{[(98)m \times (204)]\} \times 100 \div (206)$$

562.18	450.87	389.64	237.82	117.78	0	0	0	0	230.64	407.93	573.31
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

2970.16	(211)
---------	-------

Space heating fuel (secondary), $kWh/month$

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

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

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

0	(215)
---	-------

Water heating

Output from water heater (calculated above)

164.75	143.91	149.73	132.81	128.58	113.24	108.5	120.95	122.28	139.25	148.64	160.88
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

Efficiency of water heater

81	(216)
----	-------

(217)m=	87.83	87.67	87.31	86.5	84.96	81	81	81	81	86.33	87.41	87.91	(217)
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Fuel for water heating, $kWh/month$

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	187.58	164.15	171.5	153.52	151.34	139.81	133.95	149.32	150.97	161.3	170.04	183.01
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$$\text{Total} = \text{Sum}(219a)_{1...12} =$$

1916.49	(219)
---------	-------

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year	2970.16
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DER WorkSheet: New dwelling design stage

Water heating fuel used		1916.49	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	105.48		(230a)
central heating pump:	30		(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	135.48	(231)
Electricity for lighting		239.68	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	641.56	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	413.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1055.52	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	70.32	(267)
Electricity for lighting	(232) x	0.519	=	124.4	(268)
Total CO2, kg/year		sum of (265)...(271) =		1250.23	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		24.43	(273)
EI rating (section 14)				83	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 1 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	79.98 (1a)	2.55 (2a)	203.95 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.98 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	203.95 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)					0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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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DER WorkSheet: New dwelling design stage

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

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

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

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

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

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

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

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

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

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

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			1.5	x 1/[1/(1.3)+ 0.04]	= 1.85		(27)
Windows Type 2			0.8	x 1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 3			1.56	x 1/[1/(1.3)+ 0.04]	= 1.93		(27)
Windows Type 4			4.23	x 1/[1/(1.3)+ 0.04]	= 5.23		(27)
Windows Type 5			0.81	x 1/[1/(1.3)+ 0.04]	= 1		(27)
Floor			79.98	x 0.11	= 8.7978		(28)
Walls Type1	20.5	0	20.5	x 0.13	= 2.71		(29)
Walls Type2	71.23	13.37	57.86	x 0.14	= 8.1		(29)
Roof	7.48	0	7.48	x 0.11	= 0.82		(30)
Total area of elements, m²			179.19				(31)
Party ceiling			72.49				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 37.29 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 31002.52 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 18.79 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 56.08 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.1	19.87	19.63	18.47	18.23	17.07	17.07	16.83	17.53	18.23	18.7	19.17	(38)

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

(39)m=	76.19	75.95	75.72	74.55	74.32	73.15	73.15	72.92	73.62	74.32	74.78	75.25	
Average = Sum(39) _{1...12} / 12 =												74.49	(39)

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

(40)m=	0.95	0.95	0.95	0.93	0.93	0.91	0.91	0.91	0.92	0.93	0.94	0.94	
Average = Sum(40) _{1...12} / 12 =												0.93	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.46 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 92.68 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 × (43)													

(44)m=	101.95	98.24	94.54	90.83	87.12	83.42	83.42	87.12	90.83	94.54	98.24	101.95	
Total = Sum(44) _{1...12} =												1112.21	(44)

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

(45)m=	151.19	132.23	136.45	118.96	114.15	98.5	91.28	104.74	105.99	123.52	134.83	146.42	
Total = Sum(45) _{1...12} =												1458.28	(45)

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

(46)m=	22.68	19.84	20.47	17.84	17.12	14.78	13.69	15.71	15.9	18.53	20.23	21.96	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0 (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) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

50.96	45.22	48.18	44.79	44.4	41.14	42.51	44.4	44.79	48.18	48.45	50.96
-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------

 (61)

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

(62)m=

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

Output from water heater (annual)_{1...12} 2012.24 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

63.01	55.27	57.41	50.75	49.05	43.04	40.98	45.93	46.44	53.12	56.94	61.42
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12

 (66)

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

(67)m=

20.95	18.61	15.14	11.46	8.57	7.23	7.81	10.16	13.63	17.31	20.2	21.54
-------	-------	-------	-------	------	------	------	-------	-------	-------	------	-------

 (67)

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

(68)m=

219.4	221.68	215.94	203.72	188.31	173.82	164.14	161.86	167.6	179.81	195.23	209.72
-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (68)

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

(69)m=

35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (71)

Water heating gains (Table 5)

(72)m=

84.69	82.25	77.17	70.49	65.93	59.77	55.08	61.73	64.5	71.39	79.09	82.56
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

387.98	385.48	371.18	348.61	325.74	303.76	289.96	296.68	308.67	331.45	357.46	376.75
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d			Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.81	x	10.63	x	0.5	x	0.7	=	4.18	(74)
North	0.9x	0.77	x	0.81	x	20.32	x	0.5	x	0.7	=	7.98	(74)
North	0.9x	0.77	x	0.81	x	34.53	x	0.5	x	0.7	=	13.57	(74)
North	0.9x	0.77	x	0.81	x	55.46	x	0.5	x	0.7	=	21.79	(74)
North	0.9x	0.77	x	0.81	x	74.72	x	0.5	x	0.7	=	29.36	(74)
North	0.9x	0.77	x	0.81	x	79.99	x	0.5	x	0.7	=	31.43	(74)
North	0.9x	0.77	x	0.81	x	74.68	x	0.5	x	0.7	=	29.34	(74)
North	0.9x	0.77	x	0.81	x	59.25	x	0.5	x	0.7	=	23.28	(74)
North	0.9x	0.77	x	0.81	x	41.52	x	0.5	x	0.7	=	16.31	(74)
North	0.9x	0.77	x	0.81	x	24.19	x	0.5	x	0.7	=	9.5	(74)
North	0.9x	0.77	x	0.81	x	13.12	x	0.5	x	0.7	=	5.15	(74)
North	0.9x	0.77	x	0.81	x	8.86	x	0.5	x	0.7	=	3.48	(74)
East	0.9x	0.77	x	1.56	x	19.64	x	0.5	x	0.7	=	14.86	(76)
East	0.9x	0.77	x	4.23	x	19.64	x	0.5	x	0.7	=	20.15	(76)
East	0.9x	0.77	x	1.56	x	38.42	x	0.5	x	0.7	=	29.07	(76)
East	0.9x	0.77	x	4.23	x	38.42	x	0.5	x	0.7	=	39.42	(76)
East	0.9x	0.77	x	1.56	x	63.27	x	0.5	x	0.7	=	47.88	(76)
East	0.9x	0.77	x	4.23	x	63.27	x	0.5	x	0.7	=	64.92	(76)
East	0.9x	0.77	x	1.56	x	92.28	x	0.5	x	0.7	=	69.83	(76)
East	0.9x	0.77	x	4.23	x	92.28	x	0.5	x	0.7	=	94.68	(76)
East	0.9x	0.77	x	1.56	x	113.09	x	0.5	x	0.7	=	85.58	(76)
East	0.9x	0.77	x	4.23	x	113.09	x	0.5	x	0.7	=	116.03	(76)
East	0.9x	0.77	x	1.56	x	115.77	x	0.5	x	0.7	=	87.61	(76)
East	0.9x	0.77	x	4.23	x	115.77	x	0.5	x	0.7	=	118.78	(76)
East	0.9x	0.77	x	1.56	x	110.22	x	0.5	x	0.7	=	83.41	(76)
East	0.9x	0.77	x	4.23	x	110.22	x	0.5	x	0.7	=	113.08	(76)
East	0.9x	0.77	x	1.56	x	94.68	x	0.5	x	0.7	=	71.65	(76)
East	0.9x	0.77	x	4.23	x	94.68	x	0.5	x	0.7	=	97.14	(76)
East	0.9x	0.77	x	1.56	x	73.59	x	0.5	x	0.7	=	55.69	(76)
East	0.9x	0.77	x	4.23	x	73.59	x	0.5	x	0.7	=	75.5	(76)
East	0.9x	0.77	x	1.56	x	45.59	x	0.5	x	0.7	=	34.5	(76)
East	0.9x	0.77	x	4.23	x	45.59	x	0.5	x	0.7	=	46.77	(76)
East	0.9x	0.77	x	1.56	x	24.49	x	0.5	x	0.7	=	18.53	(76)
East	0.9x	0.77	x	4.23	x	24.49	x	0.5	x	0.7	=	25.13	(76)
East	0.9x	0.77	x	1.56	x	16.15	x	0.5	x	0.7	=	12.22	(76)
East	0.9x	0.77	x	4.23	x	16.15	x	0.5	x	0.7	=	16.57	(76)
West	0.9x	0.77	x	1.5	x	19.64	x	0.5	x	0.7	=	7.15	(80)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	3.81	(80)
West	0.9x	0.77	x	1.5	x	38.42	x	0.5	x	0.7	=	13.98	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	7.46	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.5	x	0.7	=	23.02	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	12.28	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.5	x	0.7	=	33.57	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	17.91	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.5	x	0.7	=	41.15	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	21.94	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.5	x	0.7	=	42.12	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	22.46	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.5	x	0.7	=	40.1	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	21.39	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.5	x	0.7	=	34.45	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	18.37	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.5	x	0.7	=	26.77	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	14.28	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.5	x	0.7	=	16.59	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	8.85	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.5	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	4.75	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.5	x	0.7	=	5.88	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	3.13	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	50.15	97.91	161.67	237.79	294.06	302.4	287.32	244.88	188.56	116.21	62.47	41.29	(83)
--------	-------	-------	--------	--------	--------	-------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	438.13	483.39	532.85	586.4	619.81	606.16	577.28	541.56	497.22	447.66	419.93	418.04	(84)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.73	0.55	0.61	0.87	0.98	1	1	(86)

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

(87)m=	19.98	20.1	20.31	20.59	20.84	20.97	20.99	20.99	20.91	20.59	20.24	19.97	(87)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.12	20.13	20.13	20.14	20.14	20.16	20.16	20.16	20.15	20.14	20.14	20.13	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.96	0.86	0.65	0.45	0.5	0.81	0.98	1	1	(89)
--------	---	---	------	------	------	------	------	-----	------	------	---	---	------

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

(90)m=	18.75	18.92	19.23	19.65	19.98	20.13	20.15	20.15	20.07	19.65	19.14	18.74	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) = 0.39 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=

19.24	19.38	19.65	20.02	20.31	20.46	20.48	20.48	20.4	20.02	19.57	19.22
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (92)

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

(93)m=

19.09	19.23	19.5	19.87	20.16	20.31	20.33	20.33	20.25	19.87	19.42	19.07
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm :

(94)m=

1	1	0.99	0.96	0.86	0.67	0.47	0.52	0.81	0.97	0.99	1
---	---	------	------	------	------	------	------	------	------	------	---

 (94)

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=

437.07	481.1	526.18	561.12	534.93	403.12	271.64	283.96	405.02	435.18	417.8	417.27
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (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, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=

1126.58	1088.73	984.5	817.9	629.07	417.78	273.19	286.82	452.7	689.23	921.69	1119.02
---------	---------	-------	-------	--------	--------	--------	--------	-------	--------	--------	---------

 (97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=

513	408.32	341	184.89	70.04	0	0	0	0	189.02	362.8	522.11
-----	--------	-----	--------	-------	---	---	---	---	--------	-------	--------

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

2591.17

 (98)

Space heating requirement in $kWh/m^2/year$

32.4

 (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) = $(202) \times [1 - (203)] =$

1

 (204)

Efficiency of main space heating system 1

90.3

 (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)

513	408.32	341	184.89	70.04	0	0	0	0	189.02	362.8	522.11
-----	--------	-----	--------	-------	---	---	---	---	--------	-------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

568.1	452.19	377.63	204.75	77.57	0	0	0	0	209.32	401.78	578.19
-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

2869.52

 (211)

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

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

0

 (215)

Water heating

Output from water heater (calculated above)

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

Efficiency of water heater

81

 (216)

(217)m=

87.46	87.26	86.8	85.68	83.64	81	81	81	81	85.62	86.95	87.54
-------	-------	------	-------	-------	----	----	----	----	-------	-------	-------

 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=

231.13	203.35	212.71	191.13	189.56	172.39	165.16	184.12	186.15	200.53	210.79	225.47
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2372.5

 (219)

DER WorkSheet: New dwelling design stage

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2869.52
Water heating fuel used		2372.5
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	164.84	(230a)
central heating pump:	30	(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	194.84 (231)
Electricity for lighting		370.06 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	619.82 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	512.46 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1132.28 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	101.12 (267)
Electricity for lighting	(232) x	0.519 =	192.06 (268)
Total CO2, kg/year		sum of (265)...(271) =	1425.46 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	17.82 (273)
EI rating (section 14)			85 (274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 2 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	79.98 (1a)	2.55 (2a)	203.95 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.98 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	203.95 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)					0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

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

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

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

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

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

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

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

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

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

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x 1/[1/(1.3)+0.04]	= 0.99		(27)
Windows Type 2			1.5	x 1/[1/(1.3)+0.04]	= 1.85		(27)
Windows Type 3			0.81	x 1/[1/(1.3)+0.04]	= 1		(27)
Windows Type 4			4.23	x 1/[1/(1.3)+0.04]	= 5.23		(27)
Windows Type 5			1.56	x 1/[1/(1.3)+0.04]	= 1.93		(27)
Floor			79.98	x 0.11	= 8.7978		(28)
Walls Type1	20.5	0	20.5	x 0.13	= 2.71		(29)
Walls Type2	71.23	12.56	58.67	x 0.14	= 8.21		(29)
Roof	7.44	0	7.44	x 0.11	= 0.82		(30)
Total area of elements, m²			179.15				(31)
Party ceiling			72.54				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 31161.06 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 17.54 (36)

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

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 53.94 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.1	19.87	19.63	18.47	18.23	17.07	17.07	16.83	17.53	18.23	18.7	19.17	(38)

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

(39)m=	74.04	73.81	73.58	72.41	72.18	71.01	71.01	70.77	71.47	72.18	72.64	73.11	
Average = Sum(39) _{1...12} / 12 =												72.35	(39)

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

(40)m=	0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.88	0.89	0.9	0.91	0.91	
Average = Sum(40) _{1...12} / 12 =												0.9	(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 2.46 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 92.68 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 × (43)													

(44)m=	101.95	98.24	94.54	90.83	87.12	83.42	83.42	87.12	90.83	94.54	98.24	101.95	
Total = Sum(44) _{1...12} =												1112.21	(44)

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

(45)m=	151.19	132.23	136.45	118.96	114.15	98.5	91.28	104.74	105.99	123.52	134.83	146.42	
Total = Sum(45) _{1...12} =												1458.28	(45)

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

(46)m=	22.68	19.84	20.47	17.84	17.12	14.78	13.69	15.71	15.9	18.53	20.23	21.96	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0 (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) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

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

(61)m=

50.96	45.22	48.18	44.79	44.4	41.14	42.51	44.4	44.79	48.18	48.45	50.96
-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------

 (61)

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

(62)m=

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 Output from water heater (annual)_{1...12} 2012.24 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

63.01	55.27	57.41	50.75	49.05	43.04	40.98	45.93	46.44	53.12	56.94	61.42
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12

 (66)

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

(67)m=

21.3	18.92	15.39	11.65	8.71	7.35	7.94	10.32	13.86	17.6	20.54	21.89
------	-------	-------	-------	------	------	------	-------	-------	------	-------	-------

 (67)

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

(68)m=

219.4	221.68	215.94	203.72	188.31	173.82	164.14	161.86	167.6	179.81	195.23	209.72
-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (68)

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

(69)m=

35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (71)

Water heating gains (Table 5)

(72)m=

84.69	82.25	77.17	70.49	65.93	59.77	55.08	61.73	64.5	71.39	79.09	82.56
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

388.33	385.78	371.43	348.8	325.88	303.88	290.09	296.85	308.89	331.73	357.79	377.11
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d			Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	4.23	x	19.64	x	0.5	x	0.7	=	20.15	(76)	
East	0.9x	0.77	x	1.56	x	19.64	x	0.5	x	0.7	=	14.86	(76)	
East	0.9x	0.77	x	4.23	x	38.42	x	0.5	x	0.7	=	39.42	(76)	
East	0.9x	0.77	x	1.56	x	38.42	x	0.5	x	0.7	=	29.07	(76)	
East	0.9x	0.77	x	4.23	x	63.27	x	0.5	x	0.7	=	64.92	(76)	
East	0.9x	0.77	x	1.56	x	63.27	x	0.5	x	0.7	=	47.88	(76)	
East	0.9x	0.77	x	4.23	x	92.28	x	0.5	x	0.7	=	94.68	(76)	
East	0.9x	0.77	x	1.56	x	92.28	x	0.5	x	0.7	=	69.83	(76)	
East	0.9x	0.77	x	4.23	x	113.09	x	0.5	x	0.7	=	116.03	(76)	
East	0.9x	0.77	x	1.56	x	113.09	x	0.5	x	0.7	=	85.58	(76)	
East	0.9x	0.77	x	4.23	x	115.77	x	0.5	x	0.7	=	118.78	(76)	
East	0.9x	0.77	x	1.56	x	115.77	x	0.5	x	0.7	=	87.61	(76)	
East	0.9x	0.77	x	4.23	x	110.22	x	0.5	x	0.7	=	113.08	(76)	
East	0.9x	0.77	x	1.56	x	110.22	x	0.5	x	0.7	=	83.41	(76)	
East	0.9x	0.77	x	4.23	x	94.68	x	0.5	x	0.7	=	97.14	(76)	
East	0.9x	0.77	x	1.56	x	94.68	x	0.5	x	0.7	=	71.65	(76)	
East	0.9x	0.77	x	4.23	x	73.59	x	0.5	x	0.7	=	75.5	(76)	
East	0.9x	0.77	x	1.56	x	73.59	x	0.5	x	0.7	=	55.69	(76)	
East	0.9x	0.77	x	4.23	x	45.59	x	0.5	x	0.7	=	46.77	(76)	
East	0.9x	0.77	x	1.56	x	45.59	x	0.5	x	0.7	=	34.5	(76)	
East	0.9x	0.77	x	4.23	x	24.49	x	0.5	x	0.7	=	25.13	(76)	
East	0.9x	0.77	x	1.56	x	24.49	x	0.5	x	0.7	=	18.53	(76)	
East	0.9x	0.77	x	4.23	x	16.15	x	0.5	x	0.7	=	16.57	(76)	
East	0.9x	0.77	x	1.56	x	16.15	x	0.5	x	0.7	=	12.22	(76)	
South	0.9x	0.77	x	0.81	x	46.75	x	0.5	x	0.7	=	9.19	(78)	
South	0.9x	0.77	x	0.81	x	76.57	x	0.5	x	0.7	=	15.04	(78)	
South	0.9x	0.77	x	0.81	x	97.53	x	0.5	x	0.7	=	19.16	(78)	
South	0.9x	0.77	x	0.81	x	110.23	x	0.5	x	0.7	=	21.66	(78)	
South	0.9x	0.77	x	0.81	x	114.87	x	0.5	x	0.7	=	22.57	(78)	
South	0.9x	0.77	x	0.81	x	110.55	x	0.5	x	0.7	=	21.72	(78)	
South	0.9x	0.77	x	0.81	x	108.01	x	0.5	x	0.7	=	21.22	(78)	
South	0.9x	0.77	x	0.81	x	104.89	x	0.5	x	0.7	=	20.61	(78)	
South	0.9x	0.77	x	0.81	x	101.89	x	0.5	x	0.7	=	20.02	(78)	
South	0.9x	0.77	x	0.81	x	82.59	x	0.5	x	0.7	=	16.23	(78)	
South	0.9x	0.77	x	0.81	x	55.42	x	0.5	x	0.7	=	10.89	(78)	
South	0.9x	0.77	x	0.81	x	40.4	x	0.5	x	0.7	=	7.94	(78)	
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	3.81	(80)	
West	0.9x	0.77	x	1.5	x	19.64	x	0.5	x	0.7	=	7.15	(80)	
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	7.46	(80)	

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West	0.9x	0.77	x	1.5	x	38.42	x	0.5	x	0.7	=	13.98	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	12.28	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.5	x	0.7	=	23.02	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	17.91	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.5	x	0.7	=	33.57	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	21.94	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.5	x	0.7	=	41.15	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	22.46	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.5	x	0.7	=	42.12	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	21.39	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.5	x	0.7	=	40.1	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	18.37	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.5	x	0.7	=	34.45	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	14.28	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.5	x	0.7	=	26.77	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	8.85	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.5	x	0.7	=	16.59	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	4.75	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.5	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	3.13	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.5	x	0.7	=	5.88	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	55.16	104.97	167.26	237.65	287.27	292.69	279.2	242.21	192.26	122.93	68.21	45.74	(83)
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	-------	------

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

(84)m=	443.48	490.75	538.69	586.45	613.16	596.57	569.29	539.06	501.15	454.67	426	422.85	(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	
(86)m=	1	1	0.99	0.97	0.9	0.72	0.54	0.59	0.85	0.98	1	1	(86)

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

(87)m=	20.03	20.14	20.35	20.62	20.85	20.97	21	20.99	20.92	20.63	20.28	20.01	(87)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

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

(88)m=	20.15	20.15	20.15	20.16	20.17	20.18	20.18	20.18	20.17	20.17	20.16	20.16	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.96	0.86	0.65	0.44	0.49	0.79	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	18.84	19.01	19.3	19.71	20.01	20.16	20.18	20.18	20.11	19.72	19.22	18.82	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.39

(91)

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

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(92)m=

19.31	19.45	19.71	20.07	20.34	20.48	20.5	20.5	20.43	20.08	19.64	19.29
-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------

 (92)

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

(93)m=

19.16	19.3	19.56	19.92	20.19	20.33	20.35	20.35	20.28	19.93	19.49	19.14
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm :

(94)m=

1	0.99	0.99	0.95	0.86	0.66	0.47	0.51	0.8	0.97	0.99	1
---	------	------	------	------	------	------	------	-----	------	------	---

 (94)

Useful gains, hmG_m , $W = (94)m \times (84)m$

(95)m=

442.35	488.22	531.37	559.79	527.07	393.97	264.94	277.19	401.28	440.48	423.64	422.03
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]$

(97)m=

1099.94	1063.16	961.27	797.76	612.94	406.76	266.21	279.45	441.45	673.07	899.75	1092.11
---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------

 (97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=

489.25	386.36	319.84	171.33	63.89	0	0	0	0	173.05	342.8	498.54
--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------

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

2445.06

 (98)

Space heating requirement in $kWh/m^2/year$

30.57

 (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) = $(202) \times [1 - (203)] =$

1

 (204)

Efficiency of main space heating system 1

90.3

 (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)

489.25	386.36	319.84	171.33	63.89	0	0	0	0	173.05	342.8	498.54
--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------

(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

541.8	427.86	354.2	189.74	70.75	0	0	0	0	191.64	379.63	552.09
-------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------

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

2707.71

 (211)

Space heating fuel (secondary), $kWh/month$

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(215)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

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

0

 (215)

Water heating

Output from water heater (calculated above)

202.15	177.45	184.63	163.76	158.55	139.64	133.78	149.14	150.78	171.7	183.28	197.38
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

Efficiency of water heater

81

 (216)

(217)m=

87.37	87.15	86.66	85.5	83.47	81	81	81	81	85.42	86.83	87.45
-------	-------	-------	------	-------	----	----	----	----	-------	-------	-------

 (217)

Fuel for water heating, $kWh/month$

(219)m = $(64)m \times 100 \div (217)m$

(219)m=

231.38	203.62	213.05	191.52	189.94	172.39	165.16	184.12	186.15	201.01	211.09	225.7
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

2375.16

 (219)

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Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2707.71
Water heating fuel used		2375.16
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	164.84	(230a)
central heating pump:	30	(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	194.84 (231)
Electricity for lighting		376.17 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	584.87 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	513.03 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1097.9 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	101.12 (267)
Electricity for lighting	(232) x	0.519 =	195.23 (268)
Total CO2, kg/year		sum of (265)...(271) =	1394.25 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	17.43 (273)
El rating (section 14)			85 (274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 3 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a)	2.55 (2a)	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

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

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

Number of storeys in the dwelling (ns)	0	(9)
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Additional infiltration	[(9)-1]x0.1 =	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0	(11)
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if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)
---	---	------

If no draught lobby, enter 0.05, else enter 0	0	(13)
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Percentage of windows and doors draught stripped	0	(14)
--	---	------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
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Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
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Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3	(17)
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If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15	(18)
--	------	------

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

Number of sides sheltered	1	(19)
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Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
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Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14 (21)
--	----------------------	-----------

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

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

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

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

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

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

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

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

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

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

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x 1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 2			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Windows Type 3			1.57	x 1/[1/(1.3)+ 0.04]	= 1.94		(27)
Windows Type 4			0.81	x 1/[1/(1.3)+ 0.04]	= 1		(27)
Windows Type 5			1.56	x 1/[1/(1.3)+ 0.04]	= 1.93		(27)
Windows Type 6			7.23	x 1/[1/(1.3)+ 0.04]	= 8.93		(27)
Windows Type 7			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Floor			0.91	x 0.2	= 0.182		(28)
Walls Type1	73.79	16.13	57.66	x 0.13	= 7.64		(29)
Walls Type2	20.5	2.1	18.4	x 0.14	= 2.58		(29)
Roof	0.91	0	0.91	x 0.2	= 0.18		(30)
Total area of elements, m²			96.11				(31)
Party floor			72.5				(32a)
Party ceiling			72.5				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.46 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 27527.79 (34)

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

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

DER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

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

16.17 (36)

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

Total fabric heat loss

(33) + (36) =

49.62 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
18.22	18.01	17.8	16.74	16.53	15.47	15.47	15.26	15.89	16.53	16.95	17.37

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

67.84	67.63	67.42	66.36	66.15	65.09	65.09	64.88	65.52	66.15	66.57	67
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----

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

66.31 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=

0.94	0.93	0.93	0.92	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.92
------	------	------	------	------	-----	-----	------	-----	------	------	------

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

0.91 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.31 (42)

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

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

88.95 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84

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

1067.4 (44)

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

(45)m=

145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

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

1399.53 (45)

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

(46)m=

21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(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)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0

(54)

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

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

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

(61)m=

49.86	43.4	46.23	42.99	42.61	39.48	40.8	42.61	42.99	46.23	46.5	49.86
-------	------	-------	-------	-------	-------	------	-------	-------	-------	------	-------

(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=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(62)

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

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual)^{1...12}

1933.08

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

60.71	53.05	55.1	48.71	47.08	41.3	39.33	44.08	44.57	50.98	54.65	59.19
-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

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

(67)m=

18.1	16.08	13.08	9.9	7.4	6.25	6.75	8.78	11.78	14.95	17.45	18.61
------	-------	-------	-----	-----	------	------	------	-------	-------	-------	-------

(67)

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

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

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

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

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

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

81.6	78.94	74.06	67.65	63.28	57.36	52.86	59.24	61.9	68.52	75.9	79.56
------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

363.34	360.76	347.57	326.68	305.54	285.06	272.1	278.4	289.37	310.47	334.63	352.84
--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------

(73)

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.5	x	0.7	=	1.24 (74)
North	0.9x	0.77	x	1.56	x	10.63	x	0.5	x	0.7	=	4.02 (74)
North	0.9x	0.77	x	7.23	x	10.63	x	0.5	x	0.7	=	18.65 (74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.5	x	0.7	=	2.37 (74)
North	0.9x	0.77	x	1.56	x	20.32	x	0.5	x	0.7	=	7.69 (74)
North	0.9x	0.77	x	7.23	x	20.32	x	0.5	x	0.7	=	35.64 (74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.5	x	0.7	=	4.02 (74)
North	0.9x	0.77	x	1.56	x	34.53	x	0.5	x	0.7	=	13.07 (74)
North	0.9x	0.77	x	7.23	x	34.53	x	0.5	x	0.7	=	60.55 (74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.5	x	0.7	=	6.46 (74)
North	0.9x	0.77	x	1.56	x	55.46	x	0.5	x	0.7	=	20.99 (74)
North	0.9x	0.77	x	7.23	x	55.46	x	0.5	x	0.7	=	97.26 (74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.5	x	0.7	=	8.7 (74)
North	0.9x	0.77	x	1.56	x	74.72	x	0.5	x	0.7	=	28.27 (74)
North	0.9x	0.77	x	7.23	x	74.72	x	0.5	x	0.7	=	131.02 (74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.5	x	0.7	=	9.31 (74)
North	0.9x	0.77	x	1.56	x	79.99	x	0.5	x	0.7	=	30.26 (74)
North	0.9x	0.77	x	7.23	x	79.99	x	0.5	x	0.7	=	140.27 (74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.5	x	0.7	=	8.69 (74)
North	0.9x	0.77	x	1.56	x	74.68	x	0.5	x	0.7	=	28.26 (74)
North	0.9x	0.77	x	7.23	x	74.68	x	0.5	x	0.7	=	130.96 (74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.5	x	0.7	=	6.9 (74)
North	0.9x	0.77	x	1.56	x	59.25	x	0.5	x	0.7	=	22.42 (74)
North	0.9x	0.77	x	7.23	x	59.25	x	0.5	x	0.7	=	103.9 (74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.5	x	0.7	=	4.83 (74)
North	0.9x	0.77	x	1.56	x	41.52	x	0.5	x	0.7	=	15.71 (74)
North	0.9x	0.77	x	7.23	x	41.52	x	0.5	x	0.7	=	72.8 (74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.5	x	0.7	=	2.82 (74)
North	0.9x	0.77	x	1.56	x	24.19	x	0.5	x	0.7	=	9.15 (74)
North	0.9x	0.77	x	7.23	x	24.19	x	0.5	x	0.7	=	42.42 (74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.5	x	0.7	=	1.53 (74)
North	0.9x	0.77	x	1.56	x	13.12	x	0.5	x	0.7	=	4.96 (74)
North	0.9x	0.77	x	7.23	x	13.12	x	0.5	x	0.7	=	23 (74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.5	x	0.7	=	1.03 (74)
North	0.9x	0.77	x	1.56	x	8.86	x	0.5	x	0.7	=	3.35 (74)
North	0.9x	0.77	x	7.23	x	8.86	x	0.5	x	0.7	=	15.55 (74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.5	x	0.7	=	7.48 (76)
East	0.9x	0.77	x	0.81	x	19.64	x	0.5	x	0.7	=	3.86 (76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.5	x	0.7	=	14.63 (76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	0.81	x	38.42	x	0.5	x	0.7	=	7.55	(76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.5	x	0.7	=	24.09	(76)
East	0.9x	0.77	x	0.81	x	63.27	x	0.5	x	0.7	=	12.43	(76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.5	x	0.7	=	35.14	(76)
East	0.9x	0.77	x	0.81	x	92.28	x	0.5	x	0.7	=	18.13	(76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.5	x	0.7	=	43.07	(76)
East	0.9x	0.77	x	0.81	x	113.09	x	0.5	x	0.7	=	22.22	(76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.5	x	0.7	=	44.09	(76)
East	0.9x	0.77	x	0.81	x	115.77	x	0.5	x	0.7	=	22.74	(76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.5	x	0.7	=	41.97	(76)
East	0.9x	0.77	x	0.81	x	110.22	x	0.5	x	0.7	=	21.65	(76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.5	x	0.7	=	36.05	(76)
East	0.9x	0.77	x	0.81	x	94.68	x	0.5	x	0.7	=	18.6	(76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.5	x	0.7	=	28.02	(76)
East	0.9x	0.77	x	0.81	x	73.59	x	0.5	x	0.7	=	14.46	(76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.5	x	0.7	=	17.36	(76)
East	0.9x	0.77	x	0.81	x	45.59	x	0.5	x	0.7	=	8.96	(76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.5	x	0.7	=	9.33	(76)
East	0.9x	0.77	x	0.81	x	24.49	x	0.5	x	0.7	=	4.81	(76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.5	x	0.7	=	6.15	(76)
East	0.9x	0.77	x	0.81	x	16.15	x	0.5	x	0.7	=	3.17	(76)
South	0.9x	0.77	x	0.48	x	46.75	x	0.5	x	0.7	=	5.44	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.5	x	0.7	=	8.91	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.5	x	0.7	=	11.36	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.5	x	0.7	=	12.83	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.5	x	0.7	=	13.37	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.5	x	0.7	=	12.87	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.5	x	0.7	=	12.58	(78)
South	0.9x	0.77	x	0.48	x	104.89	x	0.5	x	0.7	=	12.21	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.5	x	0.7	=	11.86	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.5	x	0.7	=	9.61	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.5	x	0.7	=	6.45	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.5	x	0.7	=	4.7	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	19.05	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	37.28	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	61.39	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	89.53	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	109.72	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	112.32	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	106.93	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	91.85	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	71.4	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	44.23	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	23.76	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	15.67	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	59.74	114.06	186.91	280.34	356.37	371.86	351.04	291.93	219.09	134.55	73.84	49.63	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	423.09	474.82	534.48	607.03	661.91	656.93	623.14	570.33	508.46	445.02	408.47	402.47	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.83	0.62	0.46	0.52	0.8	0.97	1	1	(86)

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

(87)m=	20.04	20.17	20.39	20.69	20.91	20.99	21	21	20.94	20.66	20.3	20.02	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	------	-------	------

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

(88)m=	20.14	20.14	20.14	20.15	20.16	20.17	20.17	20.17	20.16	20.16	20.15	20.15	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.93	0.78	0.55	0.37	0.43	0.74	0.96	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.85	19.04	19.36	19.79	20.07	20.16	20.17	20.17	20.12	19.75	19.24	18.83	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.37

(91)

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

(92)m=	19.29	19.46	19.75	20.13	20.38	20.47	20.48	20.48	20.43	20.09	19.63	19.27	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.14	19.31	19.6	19.98	20.23	20.32	20.33	20.33	20.28	19.94	19.48	19.12	(93)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.78	0.56	0.39	0.45	0.75	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	421.67	471.45	523.67	562.29	517.63	367.28	242.2	253.88	379.19	426.2	405.48	401.45	(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=	1007.06	974.49	883	735.2	564.31	372.25	242.65	254.86	404.57	617.75	824.3	999.81	(97)
--------	---------	--------	-----	-------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(98)m=	435.52	338.04	267.34	124.49	34.73	0	0	0	0	142.52	301.54	445.18	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

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

2089.37

Space heating requirement in kWh/m²/year

28.82

(99)

DER WorkSheet: New dwelling design stage

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		90.3	(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)

435.52	338.04	267.34	124.49	34.73	0	0	0	0	142.52	301.54	445.18	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												(211)
482.31	374.35	296.06	137.87	38.46	0	0	0	0	157.83	333.94	493	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												2313.81 (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	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0 (215)

Water heating

Output from water heater (calculated above)

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38	
Efficiency of water heater												81 (216)
(217)m =	87.2	86.96	86.35	84.86	82.58	81	81	81	81	85.06	86.64	87.3 (217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m =	223.57	195.85	205.2	185.19	184.25	165.45	158.51	176.7	178.65	193.72	203.04	218.09
Total = Sum(219a) _{1...12} =												2288.22 (219)

Annual totals

Space heating fuel used, main system 1												2313.81 kWh/year
Water heating fuel used												2288.22 kWh/year
Electricity for pumps, fans and electric keep-hot												
mechanical ventilation - balanced, extract or positive input from outside										149.43		(230a)
central heating pump:										30		(230c)
Total electricity for the above, kWh/year											179.43	(231)
Electricity for lighting											319.72	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	499.78 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	494.26 (264)
Space and water heating	(261) + (262) + (263) + (264) =			994.04 (265)

DER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	93.12	(267)
Electricity for lighting	(232) x	0.519	=	165.93	(268)
Total CO2, kg/year		sum of (265)...(271) =		1253.09	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.28	(273)
El rating (section 14)				86	(274)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 4 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a)	2.55 (2a)	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)					0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

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

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

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

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

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

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

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

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

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

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x 1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 2			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Windows Type 3			1.57	x 1/[1/(1.3)+ 0.04]	= 1.94		(27)
Windows Type 4			3.62	x 1/[1/(1.3)+ 0.04]	= 4.47		(27)
Windows Type 5			0.81	x 1/[1/(1.3)+ 0.04]	= 1		(27)
Windows Type 6			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Floor			2.74	x 0.2	= 0.548		(28)
Walls Type1	20.34	2.1	18.24	x 0.13	= 2.42		(29)
Walls Type2	78.25	14.42	63.83	x 0.14	= 8.94		(29)
Roof	2.74	0	2.74	x 0.2	= 0.55		(30)
Total area of elements, m²			104.07				(31)
Party floor			72.54				(32a)
Party ceiling			72.54				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.21 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 28729.96 (34)

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

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

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can be used instead of a detailed calculation.

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

19.54 (36)

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

Total fabric heat loss

(33) + (36) =

52.75 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
18.22	18.01	17.8	16.74	16.53	15.47	15.47	15.26	15.89	16.53	16.95	17.37

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

70.97	70.76	70.55	69.49	69.28	68.22	68.22	68.01	68.64	69.28	69.7	70.12
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Average = Sum(39)_{1...12} /12=

69.44 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=

0.98	0.98	0.97	0.96	0.96	0.94	0.94	0.94	0.95	0.96	0.96	0.97
------	------	------	------	------	------	------	------	------	------	------	------

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

0.96 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.31 (42)

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

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

88.95 (43)

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

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

(44)m=

97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

1067.4 (44)

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

(45)m=

145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

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

1399.53 (45)

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

(46)m=

21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

49.86	43.4	46.23	42.99	42.61	39.48	40.8	42.61	42.99	46.23	46.5	49.86
-------	------	-------	-------	-------	-------	------	-------	-------	-------	------	-------

(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=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual)_{1...12}

1933.08

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

60.71	53.05	55.1	48.71	47.08	41.3	39.33	44.08	44.57	50.98	54.65	59.19
-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.24	16.2	13.18	9.98	7.46	6.3	6.8	8.84	11.87	15.07	17.59	18.75
-------	------	-------	------	------	-----	-----	------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

81.6	78.94	74.06	67.65	63.28	57.36	52.86	59.24	61.9	68.52	75.9	79.56
------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

363.48	360.88	347.67	326.76	305.6	285.11	272.15	278.47	289.46	310.58	334.76	352.98
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.5	x	0.7	=	3.71	(74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.5	x	0.7	=	7.1	(74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.5	x	0.7	=	12.06	(74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.5	x	0.7	=	19.37	(74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.5	x	0.7	=	26.1	(74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.5	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.5	x	0.7	=	26.08	(74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.5	x	0.7	=	20.69	(74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.5	x	0.7	=	14.5	(74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.5	x	0.7	=	8.45	(74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.5	x	0.7	=	4.58	(74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.5	x	0.7	=	3.1	(74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.5	x	0.7	=	22.44	(76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.5	x	0.7	=	43.89	(76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.5	x	0.7	=	72.28	(76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.5	x	0.7	=	105.42	(76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.5	x	0.7	=	129.2	(76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.5	x	0.7	=	132.26	(76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.5	x	0.7	=	125.91	(76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.5	x	0.7	=	108.16	(76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.5	x	0.7	=	84.07	(76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.5	x	0.7	=	52.08	(76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.5	x	0.7	=	27.98	(76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.5	x	0.7	=	18.45	(76)
South	0.9x	0.77	x	0.81	x	46.75	x	0.5	x	0.7	=	9.19	(78)
South	0.9x	0.77	x	0.48	x	46.75	x	0.5	x	0.7	=	16.33	(78)
South	0.9x	0.77	x	0.81	x	76.57	x	0.5	x	0.7	=	15.04	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.5	x	0.7	=	26.74	(78)
South	0.9x	0.77	x	0.81	x	97.53	x	0.5	x	0.7	=	19.16	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.5	x	0.7	=	34.07	(78)
South	0.9x	0.77	x	0.81	x	110.23	x	0.5	x	0.7	=	21.66	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.5	x	0.7	=	38.5	(78)
South	0.9x	0.77	x	0.81	x	114.87	x	0.5	x	0.7	=	22.57	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.5	x	0.7	=	40.12	(78)
South	0.9x	0.77	x	0.81	x	110.55	x	0.5	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.5	x	0.7	=	38.61	(78)
South	0.9x	0.77	x	0.81	x	108.01	x	0.5	x	0.7	=	21.22	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.5	x	0.7	=	37.73	(78)
South	0.9x	0.77	x	0.81	x	104.89	x	0.5	x	0.7	=	20.61	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	0.48	x	104.89	x	0.5	x	0.7	=	36.64	(78)
South	0.9x	0.77	x	0.81	x	101.89	x	0.5	x	0.7	=	20.02	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.5	x	0.7	=	35.59	(78)
South	0.9x	0.77	x	0.81	x	82.59	x	0.5	x	0.7	=	16.23	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.5	x	0.7	=	28.84	(78)
South	0.9x	0.77	x	0.81	x	55.42	x	0.5	x	0.7	=	10.89	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.5	x	0.7	=	19.36	(78)
South	0.9x	0.77	x	0.81	x	40.4	x	0.5	x	0.7	=	7.94	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.5	x	0.7	=	14.11	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	11.43	(80)
West	0.9x	0.77	x	3.62	x	19.64	x	0.5	x	0.7	=	17.24	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	22.37	(80)
West	0.9x	0.77	x	3.62	x	38.42	x	0.5	x	0.7	=	33.73	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	36.83	(80)
West	0.9x	0.77	x	3.62	x	63.27	x	0.5	x	0.7	=	55.56	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	53.72	(80)
West	0.9x	0.77	x	3.62	x	92.28	x	0.5	x	0.7	=	81.02	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	65.83	(80)
West	0.9x	0.77	x	3.62	x	113.09	x	0.5	x	0.7	=	99.3	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	67.39	(80)
West	0.9x	0.77	x	3.62	x	115.77	x	0.5	x	0.7	=	101.65	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	64.16	(80)
West	0.9x	0.77	x	3.62	x	110.22	x	0.5	x	0.7	=	96.78	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	55.11	(80)
West	0.9x	0.77	x	3.62	x	94.68	x	0.5	x	0.7	=	83.13	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	42.84	(80)
West	0.9x	0.77	x	3.62	x	73.59	x	0.5	x	0.7	=	64.61	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	26.54	(80)
West	0.9x	0.77	x	3.62	x	45.59	x	0.5	x	0.7	=	40.03	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	14.26	(80)
West	0.9x	0.77	x	3.62	x	24.49	x	0.5	x	0.7	=	21.5	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	9.4	(80)
West	0.9x	0.77	x	3.62	x	16.15	x	0.5	x	0.7	=	14.18	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 80.34 148.88 229.96 319.7 383.12 389.57 371.88 324.34 261.62 172.17 98.56 67.18 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 443.82 509.76 577.63 646.45 688.71 674.68 644.03 602.8 551.09 482.75 433.32 420.16 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(86)m=	1	0.99	0.98	0.94	0.82	0.63	0.46	0.51	0.78	0.97	0.99	1	(86)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.15	20.39	20.69	20.9	20.98	21	21	20.94	20.66	20.28	19.98	(87)
--------	-------	-------	-------	-------	------	-------	----	----	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.11	20.12	20.12	20.13	20.13	20.14	20.13	20.12	20.12	20.11	(88)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.55	0.37	0.42	0.71	0.95	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.77	18.99	19.33	19.76	20.02	20.12	20.13	20.13	20.08	19.73	19.18	18.74	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.37 \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	19.23	19.42	19.73	20.1	20.35	20.44	20.45	20.45	20.4	20.07	19.59	19.21	(92)
--------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.08	19.27	19.58	19.95	20.2	20.29	20.3	20.3	20.25	19.92	19.44	19.06	(93)
--------	-------	-------	-------	-------	------	-------	------	------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.92	0.78	0.57	0.39	0.44	0.72	0.95	0.99	1	(94)

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	441.97	504.9	562.41	592.29	536.82	381.96	252.11	264.41	397.91	457	429.29	418.85	(95)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm, W = [(39)m x ((93)m - (96)m)]

(97)m=	1049.07	1016.93	922.48	768.03	588.73	388.37	252.71	265.55	422.45	645.91	859.98	1041.72	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	451.68	344.08	267.89	126.53	38.62	0	0	0	0	140.54	310.1	463.42	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 2142.88 \quad (98)$$

Space heating requirement in kWh/m²/year

$$29.56 \quad (99)$$

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) x [1 - (203)] = 1 (204)

Efficiency of main space heating system 1 90.3 (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)

(211)m = {[(98)m x (204)]} x 100 ÷ (206)	451.68	344.08	267.89	126.53	38.62	0	0	0	0	140.54	310.1	463.42	(211)
--	--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------	-------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 2373.06 \quad (211)$$

DER WorkSheet: New dwelling design stage

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
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Total (kWh/year) =Sum(215)_{1...5,10...12} =

0 (215)

Water heating

Output from water heater (calculated above)

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
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Efficiency of water heater

81 (216)

(217)m=	87.28	86.99	86.35	84.9	82.72	81	81	81	81	85.03	86.7	87.38
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(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	223.38	195.77	205.19	185.11	183.93	165.45	158.51	176.7	178.65	193.79	202.89	217.88
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Total = Sum(219a)_{1...12} =

2287.26 (219)

Annual totals

Space heating fuel used, main system 1

2373.06

Water heating fuel used

2287.26

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

149.43 (230a)

central heating pump:

30 (230c)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

179.43 (231)

Electricity for lighting

322.14 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 512.58 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 494.05 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1006.63 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 93.12 (267)
Electricity for lighting	(232) x	0.519	= 167.19 (268)
Total CO2, kg/year		sum of (265)...(271) =	1266.94 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	17.48 (273)
El rating (section 14)			86 (274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 5 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a)	2.55 (2a)	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				0	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)					0 (9)
Additional infiltration					0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)
If no draught lobby, enter 0.05, else enter 0					0 (13)
Percentage of windows and doors draught stripped					0 (14)
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)					0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor				(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x 1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 2			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Windows Type 3			1.57	x 1/[1/(1.3)+ 0.04]	= 1.94		(27)
Windows Type 4			0.81	x 1/[1/(1.3)+ 0.04]	= 1		(27)
Windows Type 5			1.56	x 1/[1/(1.3)+ 0.04]	= 1.93		(27)
Windows Type 6			7.23	x 1/[1/(1.3)+ 0.04]	= 8.93		(27)
Windows Type 7			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Floor			0.91	x 0.2	= 0.182		(28)
Walls Type1	73.79	16.13	57.66	x 0.13	= 7.61		(29)
Walls Type2	20.5	2.1	18.4	x 0.14	= 2.58		(29)
Roof Type1	0.91	0	0.91	x 0.2	= 0.18		(30)
Roof Type2	72.5	0	72.5	x 0.11	= 7.97		(30)
Total area of elements, m²			168.61				(31)
Party floor			72.5				(32a)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 20930.29 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

23.35 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

64.75 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	18.22	18.01	17.8	16.74	16.53	15.47	15.47	15.26	15.89	16.53	16.95	17.37

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	82.97	82.76	82.55	81.49	81.28	80.22	80.22	80.01	80.64	81.28	81.7	82.13
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Average = Sum(39)_{1...12} /12=

81.44 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	1.14	1.14	1.14	1.12	1.12	1.11	1.11	1.1	1.11	1.12	1.13	1.13
--------	------	------	------	------	------	------	------	-----	------	------	------	------

Average = Sum(40)_{1...12} /12=

1.12 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.31 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84
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Total = Sum(44)_{1...12} =

1067.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
--------	-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

Total = Sum(45)_{1...12} =

1399.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(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)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

0
0

(54)

Enter (50) or (54) in (55)

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---

(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=	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---

(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=	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	49.86	43.4	46.23	42.99	42.61	39.48	40.8	42.61	42.99	46.23	46.5	49.86
--------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	------	-------

(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=	194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0
--------	---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=	194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual)^{1...12}

1933.08

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	60.71	53.05	55.1	48.71	47.08	41.3	39.33	44.08	44.57	50.98	54.65	59.19
--------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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=	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.1	16.08	13.08	9.9	7.4	6.25	6.75	8.78	11.78	14.95	17.45	18.61
--------	------	-------	-------	-----	-----	------	------	------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3
--------	---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=	81.6	78.94	74.06	67.65	63.28	57.36	52.86	59.24	61.9	68.52	75.9	79.56
--------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=	363.34	360.76	347.57	326.68	305.54	285.06	272.1	278.4	289.37	310.47	334.63	352.84
--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.5	x	0.7	=	1.24 (74)
North	0.9x	0.77	x	1.56	x	10.63	x	0.5	x	0.7	=	4.02 (74)
North	0.9x	0.77	x	7.23	x	10.63	x	0.5	x	0.7	=	18.65 (74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.5	x	0.7	=	2.37 (74)
North	0.9x	0.77	x	1.56	x	20.32	x	0.5	x	0.7	=	7.69 (74)
North	0.9x	0.77	x	7.23	x	20.32	x	0.5	x	0.7	=	35.64 (74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.5	x	0.7	=	4.02 (74)
North	0.9x	0.77	x	1.56	x	34.53	x	0.5	x	0.7	=	13.07 (74)
North	0.9x	0.77	x	7.23	x	34.53	x	0.5	x	0.7	=	60.55 (74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.5	x	0.7	=	6.46 (74)
North	0.9x	0.77	x	1.56	x	55.46	x	0.5	x	0.7	=	20.99 (74)
North	0.9x	0.77	x	7.23	x	55.46	x	0.5	x	0.7	=	97.26 (74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.5	x	0.7	=	8.7 (74)
North	0.9x	0.77	x	1.56	x	74.72	x	0.5	x	0.7	=	28.27 (74)
North	0.9x	0.77	x	7.23	x	74.72	x	0.5	x	0.7	=	131.02 (74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.5	x	0.7	=	9.31 (74)
North	0.9x	0.77	x	1.56	x	79.99	x	0.5	x	0.7	=	30.26 (74)
North	0.9x	0.77	x	7.23	x	79.99	x	0.5	x	0.7	=	140.27 (74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.5	x	0.7	=	8.69 (74)
North	0.9x	0.77	x	1.56	x	74.68	x	0.5	x	0.7	=	28.26 (74)
North	0.9x	0.77	x	7.23	x	74.68	x	0.5	x	0.7	=	130.96 (74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.5	x	0.7	=	6.9 (74)
North	0.9x	0.77	x	1.56	x	59.25	x	0.5	x	0.7	=	22.42 (74)
North	0.9x	0.77	x	7.23	x	59.25	x	0.5	x	0.7	=	103.9 (74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.5	x	0.7	=	4.83 (74)
North	0.9x	0.77	x	1.56	x	41.52	x	0.5	x	0.7	=	15.71 (74)
North	0.9x	0.77	x	7.23	x	41.52	x	0.5	x	0.7	=	72.8 (74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.5	x	0.7	=	2.82 (74)
North	0.9x	0.77	x	1.56	x	24.19	x	0.5	x	0.7	=	9.15 (74)
North	0.9x	0.77	x	7.23	x	24.19	x	0.5	x	0.7	=	42.42 (74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.5	x	0.7	=	1.53 (74)
North	0.9x	0.77	x	1.56	x	13.12	x	0.5	x	0.7	=	4.96 (74)
North	0.9x	0.77	x	7.23	x	13.12	x	0.5	x	0.7	=	23 (74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.5	x	0.7	=	1.03 (74)
North	0.9x	0.77	x	1.56	x	8.86	x	0.5	x	0.7	=	3.35 (74)
North	0.9x	0.77	x	7.23	x	8.86	x	0.5	x	0.7	=	15.55 (74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.5	x	0.7	=	7.48 (76)
East	0.9x	0.77	x	0.81	x	19.64	x	0.5	x	0.7	=	3.86 (76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.5	x	0.7	=	14.63 (76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	0.81	x	38.42	x	0.5	x	0.7	=	7.55	(76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.5	x	0.7	=	24.09	(76)
East	0.9x	0.77	x	0.81	x	63.27	x	0.5	x	0.7	=	12.43	(76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.5	x	0.7	=	35.14	(76)
East	0.9x	0.77	x	0.81	x	92.28	x	0.5	x	0.7	=	18.13	(76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.5	x	0.7	=	43.07	(76)
East	0.9x	0.77	x	0.81	x	113.09	x	0.5	x	0.7	=	22.22	(76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.5	x	0.7	=	44.09	(76)
East	0.9x	0.77	x	0.81	x	115.77	x	0.5	x	0.7	=	22.74	(76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.5	x	0.7	=	41.97	(76)
East	0.9x	0.77	x	0.81	x	110.22	x	0.5	x	0.7	=	21.65	(76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.5	x	0.7	=	36.05	(76)
East	0.9x	0.77	x	0.81	x	94.68	x	0.5	x	0.7	=	18.6	(76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.5	x	0.7	=	28.02	(76)
East	0.9x	0.77	x	0.81	x	73.59	x	0.5	x	0.7	=	14.46	(76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.5	x	0.7	=	17.36	(76)
East	0.9x	0.77	x	0.81	x	45.59	x	0.5	x	0.7	=	8.96	(76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.5	x	0.7	=	9.33	(76)
East	0.9x	0.77	x	0.81	x	24.49	x	0.5	x	0.7	=	4.81	(76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.5	x	0.7	=	6.15	(76)
East	0.9x	0.77	x	0.81	x	16.15	x	0.5	x	0.7	=	3.17	(76)
South	0.9x	0.77	x	0.48	x	46.75	x	0.5	x	0.7	=	5.44	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.5	x	0.7	=	8.91	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.5	x	0.7	=	11.36	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.5	x	0.7	=	12.83	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.5	x	0.7	=	13.37	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.5	x	0.7	=	12.87	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.5	x	0.7	=	12.58	(78)
South	0.9x	0.77	x	0.48	x	104.89	x	0.5	x	0.7	=	12.21	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.5	x	0.7	=	11.86	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.5	x	0.7	=	9.61	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.5	x	0.7	=	6.45	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.5	x	0.7	=	4.7	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	19.05	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	37.28	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	61.39	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	89.53	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	109.72	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	112.32	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	106.93	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	91.85	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	71.4	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	44.23	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	23.76	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	15.67	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	59.74	114.06	186.91	280.34	356.37	371.86	351.04	291.93	219.09	134.55	73.84	49.63	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	423.09	474.82	534.48	607.03	661.91	656.93	623.14	570.33	508.46	445.02	408.47	402.47	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.89	0.72	0.55	0.62	0.87	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.75	19.89	20.13	20.48	20.78	20.95	20.99	20.98	20.85	20.47	20.05	19.73	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.97	19.97	19.98	19.98	20	20	20	19.99	19.98	19.98	19.97	(88)
--------	-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.84	0.63	0.43	0.5	0.81	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	-----	------	------	---	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.3	18.5	18.86	19.36	19.76	19.96	19.99	19.99	19.87	19.35	18.75	18.27	(90)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.37

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.84	19.01	19.33	19.78	20.14	20.33	20.36	20.36	20.24	19.77	19.23	18.82	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.69	18.86	19.18	19.63	19.99	20.18	20.21	20.21	20.09	19.62	19.08	18.67	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.84	0.65	0.46	0.52	0.82	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	421.63	471.69	525.66	574.91	558.9	426	286.9	299.19	414.47	430.84	405.72	401.39	(95)
--------	--------	--------	--------	--------	-------	-----	-------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1193.91	1155.61	1047.02	874.3	674.06	447.5	289.85	304.78	482.66	733.1	979.14	1188.01	(97)
--------	---------	---------	---------	-------	--------	-------	--------	--------	--------	-------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	574.57	459.59	387.89	215.56	85.68	0	0	0	0	224.88	412.86	585.24	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2946.29

Space heating requirement in kWh/m²/year

40.64

(99)

DER WorkSheet: New dwelling design stage

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		90.3	(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)

574.57	459.59	387.89	215.56	85.68	0	0	0	0	224.88	412.86	585.24
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = {[[(98)m x (204)] } x 100 ÷ (206) (211)

636.29	508.96	429.56	238.72	94.88	0	0	0	0	249.04	457.21	648.11
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 3262.78 (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	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0 (215)

Water heating

Output from water heater (calculated above)

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Efficiency of water heater 81 (216)

(217)m=	87.75	87.58	87.16	86.13	84.12	81	81	81	81	86.12	87.31	87.82	(217)
---------	-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.18	194.45	203.29	182.47	180.88	165.45	158.51	176.7	178.65	191.34	201.48	216.78		
Total = Sum(219a) _{1...12} =													2272.18	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3262.78
Water heating fuel used		2272.18

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 149.43 (230a)

central heating pump: 30 (230c)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 179.43 (231)

Electricity for lighting 319.72 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	704.76 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	490.79 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1195.55 (265)

DER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	93.12	(267)
Electricity for lighting	(232) x	0.519	=	165.93	(268)
Total CO2, kg/year		sum of (265)...(271) =		1454.61	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		20.06	(273)
El rating (section 14)				83	(274)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.26

Property Address: Unit 6 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a)	2.55 (2a)	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
---	---	---------	-------

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)	0	(9)
--	---	-----

Additional infiltration	[(9)-1]x0.1 =	0 (10)
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Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0	(11)
--	---	------

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0	(12)
---	---	------

If no draught lobby, enter 0.05, else enter 0	0	(13)
---	---	------

Percentage of windows and doors draught stripped	0	(14)
--	---	------

Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
---------------------	-----------------------------	--------

Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
-------------------	--	--------

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3	(17)
---	---	------

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15	(18)
--	------	------

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	1	(19)
---------------------------	---	------

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
----------------	-----------------------------	-----------

Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14 (21)
--	----------------------	-----------

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x 1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 2			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Windows Type 3			1.57	x 1/[1/(1.3)+ 0.04]	= 1.94		(27)
Windows Type 4			3.62	x 1/[1/(1.3)+ 0.04]	= 4.47		(27)
Windows Type 5			0.81	x 1/[1/(1.3)+ 0.04]	= 1		(27)
Windows Type 6			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Floor			2.74	x 0.2	= 0.548		(28)
Walls Type1	20.34	2.1	18.24	x 0.13	= 2.41		(29)
Walls Type2	78.25	14.42	63.83	x 0.14	= 8.94		(29)
Roof Type1	2.74	0	2.74	x 0.2	= 0.55		(30)
Roof Type2	72.54	0	72.54	x 0.11	= 7.98		(30)
Total area of elements, m²			176.61				(31)
Party floor			72.54				(32a)

* for windows and roof windows, use effective window U-value calculated using formula 1/[1/(U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.18 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 22128.82 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

DER WorkSheet: New dwelling design stage

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

26.4 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

67.58 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
18.22	18.01	17.8	16.74	16.53	15.47	15.47	15.26	15.89	16.53	16.95	17.37

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

85.8	85.59	85.38	84.32	84.11	83.05	83.05	82.84	83.48	84.11	84.53	84.96
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Average = Sum(39)_{1...12} /12=

84.27 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=

1.18	1.18	1.18	1.16	1.16	1.15	1.15	1.14	1.15	1.16	1.17	1.17
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} /12=

1.16 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.31 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

88.95 (43)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84

Total = Sum(44)_{1...12} =

1067.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

Total = Sum(45)_{1...12} =

1399.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(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

$$(47) \times (51) \times (52) \times (53) =$$

0
0

(54)

Enter (50) or (54) in (55)

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(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=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

49.86	43.4	46.23	42.99	42.61	39.48	40.8	42.61	42.99	46.23	46.5	49.86
-------	------	-------	-------	-------	-------	------	-------	-------	-------	------	-------

(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=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual)^{1...12}

1933.08

(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

60.71	53.05	55.1	48.71	47.08	41.3	39.33	44.08	44.57	50.98	54.65	59.19
-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.24	16.2	13.18	9.98	7.46	6.3	6.8	8.84	11.87	15.07	17.59	18.75
-------	------	-------	------	------	-----	-----	------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

81.6	78.94	74.06	67.65	63.28	57.36	52.86	59.24	61.9	68.52	75.9	79.56
------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------

(72)

Total internal gains =

$$(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$$

(73)m=

363.48	360.88	347.67	326.76	305.6	285.11	272.15	278.47	289.46	310.58	334.76	352.98
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.5	x	0.7	=	3.71	(74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.5	x	0.7	=	7.1	(74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.5	x	0.7	=	12.06	(74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.5	x	0.7	=	19.37	(74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.5	x	0.7	=	26.1	(74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.5	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.5	x	0.7	=	26.08	(74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.5	x	0.7	=	20.69	(74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.5	x	0.7	=	14.5	(74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.5	x	0.7	=	8.45	(74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.5	x	0.7	=	4.58	(74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.5	x	0.7	=	3.1	(74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.5	x	0.7	=	22.44	(76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.5	x	0.7	=	43.89	(76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.5	x	0.7	=	72.28	(76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.5	x	0.7	=	105.42	(76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.5	x	0.7	=	129.2	(76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.5	x	0.7	=	132.26	(76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.5	x	0.7	=	125.91	(76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.5	x	0.7	=	108.16	(76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.5	x	0.7	=	84.07	(76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.5	x	0.7	=	52.08	(76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.5	x	0.7	=	27.98	(76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.5	x	0.7	=	18.45	(76)
South	0.9x	0.77	x	0.81	x	46.75	x	0.5	x	0.7	=	9.19	(78)
South	0.9x	0.77	x	0.48	x	46.75	x	0.5	x	0.7	=	16.33	(78)
South	0.9x	0.77	x	0.81	x	76.57	x	0.5	x	0.7	=	15.04	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.5	x	0.7	=	26.74	(78)
South	0.9x	0.77	x	0.81	x	97.53	x	0.5	x	0.7	=	19.16	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.5	x	0.7	=	34.07	(78)
South	0.9x	0.77	x	0.81	x	110.23	x	0.5	x	0.7	=	21.66	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.5	x	0.7	=	38.5	(78)
South	0.9x	0.77	x	0.81	x	114.87	x	0.5	x	0.7	=	22.57	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.5	x	0.7	=	40.12	(78)
South	0.9x	0.77	x	0.81	x	110.55	x	0.5	x	0.7	=	21.72	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.5	x	0.7	=	38.61	(78)
South	0.9x	0.77	x	0.81	x	108.01	x	0.5	x	0.7	=	21.22	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.5	x	0.7	=	37.73	(78)
South	0.9x	0.77	x	0.81	x	104.89	x	0.5	x	0.7	=	20.61	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	0.48	x	104.89	x	0.5	x	0.7	=	36.64	(78)
South	0.9x	0.77	x	0.81	x	101.89	x	0.5	x	0.7	=	20.02	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.5	x	0.7	=	35.59	(78)
South	0.9x	0.77	x	0.81	x	82.59	x	0.5	x	0.7	=	16.23	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.5	x	0.7	=	28.84	(78)
South	0.9x	0.77	x	0.81	x	55.42	x	0.5	x	0.7	=	10.89	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.5	x	0.7	=	19.36	(78)
South	0.9x	0.77	x	0.81	x	40.4	x	0.5	x	0.7	=	7.94	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.5	x	0.7	=	14.11	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	11.43	(80)
West	0.9x	0.77	x	3.62	x	19.64	x	0.5	x	0.7	=	17.24	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	22.37	(80)
West	0.9x	0.77	x	3.62	x	38.42	x	0.5	x	0.7	=	33.73	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	36.83	(80)
West	0.9x	0.77	x	3.62	x	63.27	x	0.5	x	0.7	=	55.56	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	53.72	(80)
West	0.9x	0.77	x	3.62	x	92.28	x	0.5	x	0.7	=	81.02	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	65.83	(80)
West	0.9x	0.77	x	3.62	x	113.09	x	0.5	x	0.7	=	99.3	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	67.39	(80)
West	0.9x	0.77	x	3.62	x	115.77	x	0.5	x	0.7	=	101.65	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	64.16	(80)
West	0.9x	0.77	x	3.62	x	110.22	x	0.5	x	0.7	=	96.78	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	55.11	(80)
West	0.9x	0.77	x	3.62	x	94.68	x	0.5	x	0.7	=	83.13	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	42.84	(80)
West	0.9x	0.77	x	3.62	x	73.59	x	0.5	x	0.7	=	64.61	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	26.54	(80)
West	0.9x	0.77	x	3.62	x	45.59	x	0.5	x	0.7	=	40.03	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	14.26	(80)
West	0.9x	0.77	x	3.62	x	24.49	x	0.5	x	0.7	=	21.5	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	9.4	(80)
West	0.9x	0.77	x	3.62	x	16.15	x	0.5	x	0.7	=	14.18	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 80.34 148.88 229.96 319.7 383.12 389.57 371.88 324.34 261.62 172.17 98.56 67.18 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 443.82 509.76 577.63 646.45 688.71 674.68 644.03 602.8 551.09 482.75 433.32 420.16 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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(86)m=	1	1	0.99	0.96	0.88	0.72	0.55	0.61	0.85	0.98	1	1	(86)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.73	19.88	20.14	20.48	20.77	20.94	20.99	20.98	20.86	20.48	20.04	19.7	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.94	19.94	19.95	19.95	19.96	19.96	19.97	19.96	19.95	19.95	19.94	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.63	0.43	0.48	0.78	0.96	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.24	18.46	18.84	19.34	19.73	19.93	19.96	19.96	19.85	19.34	18.71	18.21	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.37 \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.79	18.99	19.33	19.77	20.12	20.3	20.34	20.34	20.23	19.77	19.2	18.76	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.64	18.84	19.18	19.62	19.97	20.15	20.19	20.19	20.08	19.62	19.05	18.61	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.46	0.51	0.79	0.96	0.99	1	(94)

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	441.93	505.29	565.16	606.34	576.5	437.43	295.02	308.22	435.22	463.02	429.61	418.77	(95)
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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=	1230.61	1193.18	1082.32	903.66	695.4	461.29	298.36	313.9	498.79	758.39	1010.49	1224.51	(97)
--------	---------	---------	---------	--------	-------	--------	--------	-------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	586.78	462.26	384.77	214.06	88.46	0	0	0	0	219.76	418.23	599.47	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 2973.79 \quad (98)$$

Space heating requirement in kWh/m²/year

$$41.02 \quad (99)$$

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 90.3 (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)

(211)m = {[(98)m x (204)]} x 100 ÷ (206)	586.78	462.26	384.77	214.06	88.46	0	0	0	0	219.76	418.23	599.47	(211)
--	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	-------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 3293.23 \quad (211)$$

DER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

= $\{[(98)m \times (201)]\} \times 100 \div (208)$

(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)

	194.96	170.3	177.19	157.16	152.16	134.01	128.39	143.13	144.71	164.78	175.9	190.38	
Efficiency of water heater													81 (216)
(217)m=	87.79	87.59	87.15	86.11	84.19	81	81	81	81	86.07	87.33	87.87	(217)

Fuel for water heating, kWh/month

(219)m = $(64)m \times 100 \div (217)m$

(219)m=	222.09	194.43	203.33	182.5	180.74	165.45	158.51	176.7	178.65	191.46	201.42	216.67	
Total = Sum(219a) _{1...12} =													2271.94 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

3293.23

Water heating fuel used

2271.94

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

149.43

(230a)

central heating pump:

30

(230c)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

179.43

(231)

Electricity for lighting

322.14

(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 711.34 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 490.74 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1202.08 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 93.12 (267)
Electricity for lighting	(232) x	0.519	= 167.19 (268)
Total CO2, kg/year	sum of (265)...(271) =		1462.39 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		20.17 (273)
El rating (section 14)			83 (274)

Appendix B – SAP Energy Assessment Cornwall Road

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Be Green –Domestic

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.7

Property Address: Unit 1 - Block 1

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	50.81 (1a) x	2.55 (2a) =	129.57 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	129.57 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			4.2	x 1/[1/(1.3)+0.04]	= 5.19		(27)
Windows Type 2			0.95	x 1/[1/(1.3)+0.04]	= 1.17		(27)
Windows Type 3			1.07	x 1/[1/(1.3)+0.04]	= 1.32		(27)
Windows Type 4			4.11	x 1/[1/(1.3)+0.04]	= 5.08		(27)
Floor			50.81	x 0.11	= 5.5891		(28)
Walls Type1	71.11	10.33	60.78	x 0.14	= 8.51		(29)
Walls Type2	21.75	2.1	19.65	x 0.13	= 2.59		(29)
Roof	4.67	0	4.67	x 0.11	= 0.51		(30)
Total area of elements, m²			148.34				(31)
Party ceiling			46.13				(32b)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.91 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 25525.83 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.33 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.24 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12.77	12.62	12.47	11.73	11.58	10.84	10.84	10.69	11.14	11.58	11.88	12.18

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

63.01	62.86	62.72	61.98	61.83	61.09	61.09	60.94	61.38	61.83	62.12	62.42
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$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.94

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=

1.24	1.24	1.23	1.22	1.22	1.2	1.2	1.2	1.21	1.22	1.22	1.23
------	------	------	------	------	-----	-----	-----	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

1.22

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

1.71

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

74.91

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

82.4	79.4	76.4	73.41	70.41	67.42	67.42	70.41	73.41	76.4	79.4	82.4
------	------	------	-------	-------	-------	-------	-------	-------	------	------	------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

898.88

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

122.19	106.87	110.28	96.15	92.25	79.61	73.77	84.65	85.66	99.83	108.97	118.34
--------	--------	--------	-------	-------	-------	-------	-------	-------	-------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1178.57

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

18.33	16.03	16.54	14.42	13.84	11.94	11.07	12.7	12.85	14.97	16.35	17.75
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Primary circuit loss (annual) from Table 3	0	(58)
--	---	------

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	(62)
--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	177.47	156.8	165.56	149.64	147.53	133.1	129.05	139.93	139.16	155.11	162.47	173.61	
Output from water heater (annual) ^{1...12}												1829.41	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.85	75.48	80.89	74.76	74.9	69.26	68.75	72.37	71.28	77.42	79.03	83.57	(65)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.39	11.89	9.67	7.32	5.47	4.62	4.99	6.49	8.71	11.06	12.91	13.76	(67)
--------	-------	-------	------	------	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	149.34	150.89	146.98	138.67	128.17	118.31	111.72	110.17	114.08	122.39	132.89	142.75	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	31.57	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	-68.56	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	114.05	112.32	108.72	103.84	100.67	96.2	92.41	97.27	99	104.05	109.76	112.32	(72)
--------	--------	--------	--------	--------	--------	------	-------	-------	----	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.48	323.8	314.08	298.54	283.02	267.84	257.83	262.64	270.49	286.21	304.26	317.54	(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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

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East	0.9x	0.77	x	4.11	x	19.64	x	0.5	x	0.7	=	19.58	(76)
East	0.9x	0.77	x	4.11	x	38.42	x	0.5	x	0.7	=	38.3	(76)
East	0.9x	0.77	x	4.11	x	63.27	x	0.5	x	0.7	=	63.08	(76)
East	0.9x	0.77	x	4.11	x	92.28	x	0.5	x	0.7	=	91.99	(76)
East	0.9x	0.77	x	4.11	x	113.09	x	0.5	x	0.7	=	112.74	(76)
East	0.9x	0.77	x	4.11	x	115.77	x	0.5	x	0.7	=	115.41	(76)
East	0.9x	0.77	x	4.11	x	110.22	x	0.5	x	0.7	=	109.87	(76)
East	0.9x	0.77	x	4.11	x	94.68	x	0.5	x	0.7	=	94.38	(76)
East	0.9x	0.77	x	4.11	x	73.59	x	0.5	x	0.7	=	73.36	(76)
East	0.9x	0.77	x	4.11	x	45.59	x	0.5	x	0.7	=	45.45	(76)
East	0.9x	0.77	x	4.11	x	24.49	x	0.5	x	0.7	=	24.41	(76)
East	0.9x	0.77	x	4.11	x	16.15	x	0.5	x	0.7	=	16.1	(76)
South	0.9x	0.77	x	0.95	x	46.75	x	0.5	x	0.7	=	10.77	(78)
South	0.9x	0.77	x	1.07	x	46.75	x	0.5	x	0.7	=	12.13	(78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.5	x	0.7	=	17.64	(78)
South	0.9x	0.77	x	1.07	x	76.57	x	0.5	x	0.7	=	19.87	(78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.5	x	0.7	=	22.47	(78)
South	0.9x	0.77	x	1.07	x	97.53	x	0.5	x	0.7	=	25.31	(78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.5	x	0.7	=	25.4	(78)
South	0.9x	0.77	x	1.07	x	110.23	x	0.5	x	0.7	=	28.61	(78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.5	x	0.7	=	26.47	(78)
South	0.9x	0.77	x	1.07	x	114.87	x	0.5	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.5	x	0.7	=	25.47	(78)
South	0.9x	0.77	x	1.07	x	110.55	x	0.5	x	0.7	=	28.69	(78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.5	x	0.7	=	24.89	(78)
South	0.9x	0.77	x	1.07	x	108.01	x	0.5	x	0.7	=	28.03	(78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.5	x	0.7	=	24.17	(78)
South	0.9x	0.77	x	1.07	x	104.89	x	0.5	x	0.7	=	27.22	(78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.5	x	0.7	=	23.48	(78)
South	0.9x	0.77	x	1.07	x	101.89	x	0.5	x	0.7	=	26.44	(78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.5	x	0.7	=	19.03	(78)
South	0.9x	0.77	x	1.07	x	82.59	x	0.5	x	0.7	=	21.43	(78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.5	x	0.7	=	12.77	(78)
South	0.9x	0.77	x	1.07	x	55.42	x	0.5	x	0.7	=	14.38	(78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.5	x	0.7	=	9.31	(78)
South	0.9x	0.77	x	1.07	x	40.4	x	0.5	x	0.7	=	10.48	(78)
West	0.9x	0.77	x	4.2	x	19.64	x	0.5	x	0.7	=	20.01	(80)
West	0.9x	0.77	x	4.2	x	38.42	x	0.5	x	0.7	=	39.14	(80)
West	0.9x	0.77	x	4.2	x	63.27	x	0.5	x	0.7	=	64.46	(80)
West	0.9x	0.77	x	4.2	x	92.28	x	0.5	x	0.7	=	94.01	(80)
West	0.9x	0.77	x	4.2	x	113.09	x	0.5	x	0.7	=	115.21	(80)

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West	0.9x	0.77	x	4.2	x	115.77	x	0.5	x	0.7	=	117.94	(80)
West	0.9x	0.77	x	4.2	x	110.22	x	0.5	x	0.7	=	112.28	(80)
West	0.9x	0.77	x	4.2	x	94.68	x	0.5	x	0.7	=	96.45	(80)
West	0.9x	0.77	x	4.2	x	73.59	x	0.5	x	0.7	=	74.97	(80)
West	0.9x	0.77	x	4.2	x	45.59	x	0.5	x	0.7	=	46.44	(80)
West	0.9x	0.77	x	4.2	x	24.49	x	0.5	x	0.7	=	24.95	(80)
West	0.9x	0.77	x	4.2	x	16.15	x	0.5	x	0.7	=	16.45	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	62.49	114.95	175.32	240.01	284.23	287.51	275.08	242.22	198.24	132.35	76.51	52.35	(86)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	387.97	438.76	489.4	538.54	567.25	555.35	532.9	504.86	468.74	418.56	380.77	369.89	(84)
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.83	0.66	0.5	0.54	0.78	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.79	19.95	20.21	20.55	20.81	20.96	20.99	20.99	20.9	20.55	20.11	19.76	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.89	19.89	19.9	19.91	19.92	19.92	19.92	19.91	19.91	19.9	19.9	(88)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.78	0.57	0.38	0.42	0.7	0.93	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.3	18.53	18.91	19.39	19.73	19.89	19.92	19.92	19.84	19.41	18.78	18.26	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.51

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.05	19.25	19.57	19.98	20.28	20.43	20.46	20.46	20.37	19.99	19.45	19.02	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.05	19.25	19.57	19.98	20.28	20.43	20.46	20.46	20.37	19.99	19.45	19.02	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.91	0.8	0.61	0.44	0.48	0.74	0.93	0.98	0.99	(94)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	384.33	431.25	471.47	490.54	453.11	340.11	233.23	243.27	346.13	390.02	373.96	367.07	(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=	929.56	902.02	819.81	686.44	530.39	356.1	235.77	247.25	385.09	580.43	767.43	925.13	(97)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	405.65	316.36	259.17	141.05	57.49	0	0	0	0	141.66	283.3	415.19	
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$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1...5,9...12} = 2019.88 \quad (98)$$

$$\text{Space heating requirement in kWh/m}^2/\text{year} = 39.75 \quad (99)$$

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

$$\text{Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none} = 0 \quad (301)$$

$$\text{Fraction of space heat from community system 1 – (301)} = 1 \quad (302)$$

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

$$\text{Fraction of heat from Community heat pump} = 1 \quad (303a)$$

$$\text{Fraction of heat from Community heat pump (Water)} = 0.8 \quad (303a)$$

$$\text{Fraction of community heat from heat source 2 (Water)} = 0.2 \quad (303b)$$

$$\text{Fraction of total space heat from Community heat pump} = (302) \times (303a) = 1 \quad (304a)$$

$$\text{Factor for control and charging method (Table 4c(3)) for community heating system} = 1 \quad (305)$$

$$\text{Distribution loss factor (Table 12c) for community heating system} = 1.05 \quad (306)$$

$$\text{Distribution loss factor (Table 12c) for community heating system (Water)} = 1.05 \quad (306)$$

Space heating

kWh/year

$$\text{Annual space heating requirement} = 2019.88$$

$$\text{Space heat from Community heat pump} = (98) \times (304a) \times (305) \times (306) = 2120.87 \quad (307a)$$

$$\text{Efficiency of secondary/supplementary heating system in \% (from Table 4a or Appendix E)} = 0 \quad (308)$$

$$\text{Space heating requirement from secondary/supplementary system} = (98) \times (301) \times 100 \div (308) = 0 \quad (309)$$

Water heating

$$\text{Annual water heating requirement} = 1829.41$$

If DHW from community scheme:

$$\text{Water heat from CHP (Water)} = (64) \times (303a) \times (305) \times (306) = 1536.71 \quad (310a)$$

$$\text{Water heat from heat source 2 (Water)} = (64) \times (303a) \times (305) \times (306) = 384.18 \quad (310b)$$

$$\text{Electricity used for heat distribution} = 0.01 \times [(307a)...(307e) + (310a)...(310e)] = 21.21 \quad (313)$$

$$\text{Electricity used for heat distribution (Water)} = 0.01 \times [(307a)...(307e) + (310a)...(310e)] = 19.21 \quad (313)$$

$$\text{Cooling System Energy Efficiency Ratio} = 0 \quad (314)$$

$$\text{Space cooling (if there is a fixed cooling system, if not enter 0)} = (107) + (314) = 0 \quad (315)$$

Electricity for pumps and fans within dwelling (Table 4f):

$$\text{mechanical ventilation - balanced, extract or positive input from outside} = 104.72 \quad (330a)$$

$$\text{warm air heating system fans} = 0 \quad (330b)$$

$$\text{pump for solar water heating} = 0 \quad (330g)$$

$$\text{Total electricity for the above, kWh/year} = (330a) + (330b) + (330g) = 104.72 \quad (331)$$

$$\text{Energy for lighting (calculated in Appendix L)} = 236.39 \quad (332)$$

$$\text{Electricity generated by PVs (Appendix M) (negative quantity)} = -1139.98 \quad (333)$$

$$\text{Electricity generated by wind turbine (Appendix M) (negative quantity)} = 0 \quad (334)$$

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12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		290 (367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	= 379.56 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 11.01 (372)
Water heating from separate community system			
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		290 (367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		100 (367b)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	= 275.02 (367)
CO2 associated with heat source 2	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	= 199.39 (368)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 9.97 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 874.95 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		874.95 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 54.35 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 122.69 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$ -591.65 (380)
Total CO2, kg/year	sum of (376)...(382) =		460.34 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		9.06 (384)
EI rating (section 14)			93.56 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.7

Property Address: Unit 2 - Block 1

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.18 (1a) x	2.55 (2a) =	130.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	130.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
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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) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			1.91	x 1/[1/(1.3)+ 0.04]	= 2.36		(27)
Windows Type 2			4.2	x 1/[1/(1.3)+ 0.04]	= 5.19		(27)
Windows Type 3			0.95	x 1/[1/(1.3)+ 0.04]	= 1.17		(27)
Windows Type 4			1.07	x 1/[1/(1.3)+ 0.04]	= 1.32		(27)
Windows Type 5			2.26	x 1/[1/(1.3)+ 0.04]	= 2.79		(27)
Floor			5.05	x 0.11	= 0.5555		(28)
Walls Type1	25.57	2.1	23.47	x 0.13	= 3.11		(29)
Walls Type2	66.62	10.39	56.23	x 0.14	= 7.87		(29)
Total area of elements, m²			97.24				(31)
Party floor			46.13				(32a)
Party ceiling			51.18				(32b)

* for windows and roof windows, use effective window U-value calculated using formula 1/[1/(U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 27.32 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 24330.15 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.68 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 40 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.86	12.71	12.56	11.82	11.67	10.92	10.92	10.77	11.22	11.67	11.97	12.26	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	52.86	52.71	52.56	51.82	51.67	50.92	50.92	50.77	51.22	51.67	51.97	52.26	
Average = Sum(39) _{1...12} / 12 =												51.78	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m + (4)

(40)m=	1.03	1.03	1.03	1.01	1.01	0.99	0.99	0.99	1	1.01	1.02	1.02	
Average = Sum(40) _{1...12} / 12 =												1.01	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA - 13.9)²)] + 0.0013 × (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 75.17 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.68	79.68	76.67	73.66	70.66	67.65	67.65	70.66	73.66	76.67	79.68	82.68	
Total = Sum(44) _{1...12} =												901.99	(44)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c × (43)

(45)m=	122.62	107.24	110.66	96.48	92.57	79.88	74.02	84.94	85.96	100.18	109.35	118.75	
Total = Sum(45) _{1...12} =												1182.65	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.39	16.09	16.6	14.47	13.89	11.98	11.1	12.74	12.89	15.03	16.4	17.81	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
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 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
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 (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
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 (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
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 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

177.89	157.17	165.94	149.97	147.85	133.38	129.3	140.22	139.45	155.45	162.84	174.02
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 (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
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 (63)

Output from water heater

(64)m=

177.89	157.17	165.94	149.97	147.85	133.38	129.3	140.22	139.45	155.45	162.84	174.02
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Output from water heater (annual) ^{1...12}	1833.49
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 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

84.99	75.6	81.02	74.87	75	69.36	68.83	72.47	71.38	77.53	79.15	83.7
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

13.47	11.97	9.73	7.37	5.51	4.65	5.02	6.53	8.77	11.13	12.99	13.85
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 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

150.3	151.86	147.93	139.56	129	119.07	112.44	110.88	114.81	123.18	133.74	143.67
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 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69
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 (71)

Water heating gains (Table 5)

(72)m=

114.24	112.5	108.89	103.99	100.81	96.33	92.52	97.4	99.13	104.21	109.94	112.51
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 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

326.88	325.2	315.43	299.79	284.19	268.92	258.86	263.68	271.58	287.39	305.54	318.89
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 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.26	x	19.64	x	0.5	x	0.7	=	10.77 (76)
East	0.9x	0.77	x	2.26	x	38.42	x	0.5	x	0.7	=	21.06 (76)
East	0.9x	0.77	x	2.26	x	63.27	x	0.5	x	0.7	=	34.68 (76)
East	0.9x	0.77	x	2.26	x	92.28	x	0.5	x	0.7	=	50.58 (76)
East	0.9x	0.77	x	2.26	x	113.09	x	0.5	x	0.7	=	61.99 (76)
East	0.9x	0.77	x	2.26	x	115.77	x	0.5	x	0.7	=	63.46 (76)
East	0.9x	0.77	x	2.26	x	110.22	x	0.5	x	0.7	=	60.42 (76)
East	0.9x	0.77	x	2.26	x	94.68	x	0.5	x	0.7	=	51.9 (76)
East	0.9x	0.77	x	2.26	x	73.59	x	0.5	x	0.7	=	40.34 (76)
East	0.9x	0.77	x	2.26	x	45.59	x	0.5	x	0.7	=	24.99 (76)
East	0.9x	0.77	x	2.26	x	24.49	x	0.5	x	0.7	=	13.42 (76)
East	0.9x	0.77	x	2.26	x	16.15	x	0.5	x	0.7	=	8.85 (76)
South	0.9x	0.77	x	0.95	x	46.75	x	0.5	x	0.7	=	10.77 (78)
South	0.9x	0.77	x	1.07	x	46.75	x	0.5	x	0.7	=	12.13 (78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.5	x	0.7	=	17.64 (78)
South	0.9x	0.77	x	1.07	x	76.57	x	0.5	x	0.7	=	19.87 (78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.5	x	0.7	=	22.47 (78)
South	0.9x	0.77	x	1.07	x	97.53	x	0.5	x	0.7	=	25.31 (78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.5	x	0.7	=	25.4 (78)
South	0.9x	0.77	x	1.07	x	110.23	x	0.5	x	0.7	=	28.61 (78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.5	x	0.7	=	26.47 (78)
South	0.9x	0.77	x	1.07	x	114.87	x	0.5	x	0.7	=	29.81 (78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.5	x	0.7	=	25.47 (78)
South	0.9x	0.77	x	1.07	x	110.55	x	0.5	x	0.7	=	28.69 (78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.5	x	0.7	=	24.89 (78)
South	0.9x	0.77	x	1.07	x	108.01	x	0.5	x	0.7	=	28.03 (78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.5	x	0.7	=	24.17 (78)
South	0.9x	0.77	x	1.07	x	104.89	x	0.5	x	0.7	=	27.22 (78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.5	x	0.7	=	23.48 (78)
South	0.9x	0.77	x	1.07	x	101.89	x	0.5	x	0.7	=	26.44 (78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.5	x	0.7	=	19.03 (78)
South	0.9x	0.77	x	1.07	x	82.59	x	0.5	x	0.7	=	21.43 (78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.5	x	0.7	=	12.77 (78)
South	0.9x	0.77	x	1.07	x	55.42	x	0.5	x	0.7	=	14.38 (78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.5	x	0.7	=	9.31 (78)
South	0.9x	0.77	x	1.07	x	40.4	x	0.5	x	0.7	=	10.48 (78)
West	0.9x	0.77	x	1.91	x	19.64	x	0.5	x	0.7	=	9.1 (80)
West	0.9x	0.77	x	4.2	x	19.64	x	0.5	x	0.7	=	20.01 (80)
West	0.9x	0.77	x	1.91	x	38.42	x	0.5	x	0.7	=	17.8 (80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	4.2	x	38.42	x	0.5	x	0.7	=	39.14	(80)
West	0.9x	0.77	x	1.91	x	63.27	x	0.5	x	0.7	=	29.31	(80)
West	0.9x	0.77	x	4.2	x	63.27	x	0.5	x	0.7	=	64.46	(80)
West	0.9x	0.77	x	1.91	x	92.28	x	0.5	x	0.7	=	42.75	(80)
West	0.9x	0.77	x	4.2	x	92.28	x	0.5	x	0.7	=	94.01	(80)
West	0.9x	0.77	x	1.91	x	113.09	x	0.5	x	0.7	=	52.39	(80)
West	0.9x	0.77	x	4.2	x	113.09	x	0.5	x	0.7	=	115.21	(80)
West	0.9x	0.77	x	1.91	x	115.77	x	0.5	x	0.7	=	53.63	(80)
West	0.9x	0.77	x	4.2	x	115.77	x	0.5	x	0.7	=	117.94	(80)
West	0.9x	0.77	x	1.91	x	110.22	x	0.5	x	0.7	=	51.06	(80)
West	0.9x	0.77	x	4.2	x	110.22	x	0.5	x	0.7	=	112.28	(80)
West	0.9x	0.77	x	1.91	x	94.68	x	0.5	x	0.7	=	43.86	(80)
West	0.9x	0.77	x	4.2	x	94.68	x	0.5	x	0.7	=	96.45	(80)
West	0.9x	0.77	x	1.91	x	73.59	x	0.5	x	0.7	=	34.09	(80)
West	0.9x	0.77	x	4.2	x	73.59	x	0.5	x	0.7	=	74.97	(80)
West	0.9x	0.77	x	1.91	x	45.59	x	0.5	x	0.7	=	21.12	(80)
West	0.9x	0.77	x	4.2	x	45.59	x	0.5	x	0.7	=	46.44	(80)
West	0.9x	0.77	x	1.91	x	24.49	x	0.5	x	0.7	=	11.35	(80)
West	0.9x	0.77	x	4.2	x	24.49	x	0.5	x	0.7	=	24.95	(80)
West	0.9x	0.77	x	1.91	x	16.15	x	0.5	x	0.7	=	7.48	(80)
West	0.9x	0.77	x	4.2	x	16.15	x	0.5	x	0.7	=	16.45	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

62.78	115.51	176.24	241.35	285.88	289.19	276.68	243.6	199.32	133.02	76.87	52.58
-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

389.66	440.71	491.67	541.14	570.06	558.12	535.54	507.28	470.9	420.4	382.41	371.48
--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.99	0.97	0.9	0.77	0.57	0.42	0.46	0.71	0.93	0.99	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

20.07	20.22	20.46	20.74	20.92	20.99	21	21	20.96	20.73	20.35	20.04
-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

20.06	20.06	20.06	20.07	20.08	20.09	20.09	20.09	20.08	20.08	20.07	20.07
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.98	0.96	0.87	0.71	0.5	0.33	0.37	0.63	0.9	0.98	0.99
------	------	------	------	------	-----	------	------	------	-----	------	------

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

18.83	19.05	19.39	19.78	20	20.08	20.09	20.09	20.05	19.77	19.25	18.8
-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	------

 (90)

fLA = Living area ÷ (4) =

0.51

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=	19.46	19.65	19.94	20.27	20.47	20.54	20.55	20.55	20.52	20.26	19.81	19.43	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.46	19.65	19.94	20.27	20.47	20.54	20.55	20.55	20.52	20.26	19.81	19.43	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=	0.99	0.98	0.95	0.88	0.74	0.53	0.37	0.41	0.67	0.91	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	385.78	432.06	469.23	476.99	420.02	298.16	200.7	209.93	314.19	382.84	374.47	368.54	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	801.5	777.48	706.32	589.15	453.08	302.58	201.2	210.78	328.65	499.04	660.45	796.19	(97)
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	309.3	232.12	176.4	80.75	24.59	0	0	0	0	86.45	205.91	318.17	
--------	-------	--------	-------	-------	-------	---	---	---	---	-------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 1433.7 (98)

Space heating requirement in $kWh/m^2/year$

28.01	(99)
-------	------

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump 1 (303a)

Fraction of heat from Community heat pump (Water) 0.8 (303a)

Fraction of community heat from heat source 2 (Water) 0.2 (303b)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Distribution loss factor (Table 12c) for community heating system (Water) 1.05 (306)

Space heating

Annual space heating requirement 1433.7

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 1505.38 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308)

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 1833.49

If DHW from community scheme:

Water heat from CHP (Water) (64) x (303a) x (305) x (306) = 1540.13 (310a)

DER WorkSheet: New dwelling design stage

Water heat from heat source 2 (Water)	$(64) \times (303a) \times (305) \times (306) =$	385.03	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	15.05	(313)
Electricity used for heat distribution (Water)	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	19.25	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		105.48	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	105.48	(331)
Energy for lighting (calculated in Appendix L)		237.95	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-1139.98	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	290		(367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	$=$	269.41 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	$=$	7.81 (372)
Water heating from separate community system				
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	290		(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	100		(367b)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	$=$	275.63 (367)
CO2 associated with heat source 2	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	$=$	199.83 (368)
Electrical energy for heat distribution	$[(313) \times$	0.52	$=$	9.99 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		$=$	762.68 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	$=$	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	$=$	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			762.68 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	$=$	54.75 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	$=$	123.49 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$	-591.65 (380)
Total CO2, kg/year	sum of (376)...(382) =			349.27 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			6.82 (384)

DER WorkSheet: New dwelling design stage

El rating (section 14)

95.13

(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.7

Property Address: Unit 3 - Block 1

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.18 (1a) x	2.55 (2a) =	130.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.18 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	130.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			1.27	x1/[1/(1.3)+ 0.04]	= 1.57		(27)
Windows Type 2			4.2	x1/[1/(1.3)+ 0.04]	= 5.19		(27)
Windows Type 3			0.95	x1/[1/(1.3)+ 0.04]	= 1.17		(27)
Windows Type 4			1.07	x1/[1/(1.3)+ 0.04]	= 1.32		(27)
Windows Type 5			2.26	x1/[1/(1.3)+ 0.04]	= 2.79		(27)
Walls Type1	25.57	2.1	23.47	x 0.13	= 3.1		(29)
Walls Type2	66.62	9.75	56.87	x 0.14	= 7.96		(29)
Roof	51.18	0	51.18	x 0.11	= 5.63		(30)
Total area of elements, m²			143.37				(31)
Party floor			51.18				(32a)

* for windows and roof windows, use effective window U-value calculated using formula 1/[1/(U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 31.68 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19819.62 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 27.62 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 59.3 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.86	12.71	12.56	11.82	11.67	10.92	10.92	10.77	11.22	11.67	11.97	12.26	(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=	72.16	72.02	71.87	71.12	70.97	70.22	70.22	70.07	70.52	70.97	71.27	71.57	
Average = Sum(39) _{1...12} /12=												71.08	(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=	1.41	1.41	1.4	1.39	1.39	1.37	1.37	1.37	1.38	1.39	1.39	1.4	
Average = Sum(40) _{1...12} /12=												1.39	(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

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

1.72

(42)

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

75.17

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.68	79.68	76.67	73.66	70.66	67.65	67.65	70.66	73.66	76.67	79.68	82.68	
Total = Sum(44) _{1...12} =												901.99	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	122.62	107.24	110.66	96.48	92.57	79.88	74.02	84.94	85.96	100.18	109.35	118.75	
Total = Sum(45) _{1...12} =												1182.65	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.39	16.09	16.6	14.47	13.89	11.98	11.1	12.74	12.89	15.03	16.4	17.81	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

1.03

(54)

Enter (50) or (54) in (55)

1.03

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

DER WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
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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=	177.89	157.17	165.94	149.97	147.85	133.38	129.3	140.22	139.45	155.45	162.84	174.02	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	177.89	157.17	165.94	149.97	147.85	133.38	129.3	140.22	139.45	155.45	162.84	174.02	
Output from water heater (annual) ^{1...12}												1833.49	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.99	75.6	81.02	74.87	75	69.36	68.83	72.47	71.38	77.53	79.15	83.7	(65)
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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=	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	86.24	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.57	12.05	9.8	7.42	5.55	4.68	5.06	6.58	8.83	11.21	13.08	13.95	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	150.3	151.86	147.93	139.56	129	119.07	112.44	110.88	114.81	123.18	133.74	143.67	(68)
--------	-------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	31.62	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	-69	(71)
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Water heating gains (Table 5)

(72)m=	114.24	112.5	108.89	103.99	100.81	96.33	92.52	97.4	99.13	104.21	109.94	112.51	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	326.98	325.28	315.5	299.85	284.23	268.96	258.89	263.73	271.65	287.47	305.63	319	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
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DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.26	x	19.64	x	0.5	x	0.7	=	10.77	(76)
East	0.9x	0.77	x	2.26	x	38.42	x	0.5	x	0.7	=	21.06	(76)
East	0.9x	0.77	x	2.26	x	63.27	x	0.5	x	0.7	=	34.68	(76)
East	0.9x	0.77	x	2.26	x	92.28	x	0.5	x	0.7	=	50.58	(76)
East	0.9x	0.77	x	2.26	x	113.09	x	0.5	x	0.7	=	61.99	(76)
East	0.9x	0.77	x	2.26	x	115.77	x	0.5	x	0.7	=	63.46	(76)
East	0.9x	0.77	x	2.26	x	110.22	x	0.5	x	0.7	=	60.42	(76)
East	0.9x	0.77	x	2.26	x	94.68	x	0.5	x	0.7	=	51.9	(76)
East	0.9x	0.77	x	2.26	x	73.59	x	0.5	x	0.7	=	40.34	(76)
East	0.9x	0.77	x	2.26	x	45.59	x	0.5	x	0.7	=	24.99	(76)
East	0.9x	0.77	x	2.26	x	24.49	x	0.5	x	0.7	=	13.42	(76)
East	0.9x	0.77	x	2.26	x	16.15	x	0.5	x	0.7	=	8.85	(76)
South	0.9x	0.77	x	0.95	x	46.75	x	0.5	x	0.7	=	10.77	(78)
South	0.9x	0.77	x	1.07	x	46.75	x	0.5	x	0.7	=	12.13	(78)
South	0.9x	0.77	x	0.95	x	76.57	x	0.5	x	0.7	=	17.64	(78)
South	0.9x	0.77	x	1.07	x	76.57	x	0.5	x	0.7	=	19.87	(78)
South	0.9x	0.77	x	0.95	x	97.53	x	0.5	x	0.7	=	22.47	(78)
South	0.9x	0.77	x	1.07	x	97.53	x	0.5	x	0.7	=	25.31	(78)
South	0.9x	0.77	x	0.95	x	110.23	x	0.5	x	0.7	=	25.4	(78)
South	0.9x	0.77	x	1.07	x	110.23	x	0.5	x	0.7	=	28.61	(78)
South	0.9x	0.77	x	0.95	x	114.87	x	0.5	x	0.7	=	26.47	(78)
South	0.9x	0.77	x	1.07	x	114.87	x	0.5	x	0.7	=	29.81	(78)
South	0.9x	0.77	x	0.95	x	110.55	x	0.5	x	0.7	=	25.47	(78)
South	0.9x	0.77	x	1.07	x	110.55	x	0.5	x	0.7	=	28.69	(78)
South	0.9x	0.77	x	0.95	x	108.01	x	0.5	x	0.7	=	24.89	(78)
South	0.9x	0.77	x	1.07	x	108.01	x	0.5	x	0.7	=	28.03	(78)
South	0.9x	0.77	x	0.95	x	104.89	x	0.5	x	0.7	=	24.17	(78)
South	0.9x	0.77	x	1.07	x	104.89	x	0.5	x	0.7	=	27.22	(78)
South	0.9x	0.77	x	0.95	x	101.89	x	0.5	x	0.7	=	23.48	(78)
South	0.9x	0.77	x	1.07	x	101.89	x	0.5	x	0.7	=	26.44	(78)
South	0.9x	0.77	x	0.95	x	82.59	x	0.5	x	0.7	=	19.03	(78)
South	0.9x	0.77	x	1.07	x	82.59	x	0.5	x	0.7	=	21.43	(78)
South	0.9x	0.77	x	0.95	x	55.42	x	0.5	x	0.7	=	12.77	(78)
South	0.9x	0.77	x	1.07	x	55.42	x	0.5	x	0.7	=	14.38	(78)
South	0.9x	0.77	x	0.95	x	40.4	x	0.5	x	0.7	=	9.31	(78)
South	0.9x	0.77	x	1.07	x	40.4	x	0.5	x	0.7	=	10.48	(78)
West	0.9x	0.77	x	1.27	x	19.64	x	0.5	x	0.7	=	6.05	(80)
West	0.9x	0.77	x	4.2	x	19.64	x	0.5	x	0.7	=	20.01	(80)
West	0.9x	0.77	x	1.27	x	38.42	x	0.5	x	0.7	=	11.83	(80)
West	0.9x	0.77	x	4.2	x	38.42	x	0.5	x	0.7	=	39.14	(80)
West	0.9x	0.77	x	1.27	x	63.27	x	0.5	x	0.7	=	19.49	(80)

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West	0.9x	0.77	x	4.2	x	63.27	x	0.5	x	0.7	=	64.46	(80)
West	0.9x	0.77	x	1.27	x	92.28	x	0.5	x	0.7	=	28.43	(80)
West	0.9x	0.77	x	4.2	x	92.28	x	0.5	x	0.7	=	94.01	(80)
West	0.9x	0.77	x	1.27	x	113.09	x	0.5	x	0.7	=	34.84	(80)
West	0.9x	0.77	x	4.2	x	113.09	x	0.5	x	0.7	=	115.21	(80)
West	0.9x	0.77	x	1.27	x	115.77	x	0.5	x	0.7	=	35.66	(80)
West	0.9x	0.77	x	4.2	x	115.77	x	0.5	x	0.7	=	117.94	(80)
West	0.9x	0.77	x	1.27	x	110.22	x	0.5	x	0.7	=	33.95	(80)
West	0.9x	0.77	x	4.2	x	110.22	x	0.5	x	0.7	=	112.28	(80)
West	0.9x	0.77	x	1.27	x	94.68	x	0.5	x	0.7	=	29.16	(80)
West	0.9x	0.77	x	4.2	x	94.68	x	0.5	x	0.7	=	96.45	(80)
West	0.9x	0.77	x	1.27	x	73.59	x	0.5	x	0.7	=	22.67	(80)
West	0.9x	0.77	x	4.2	x	73.59	x	0.5	x	0.7	=	74.97	(80)
West	0.9x	0.77	x	1.27	x	45.59	x	0.5	x	0.7	=	14.04	(80)
West	0.9x	0.77	x	4.2	x	45.59	x	0.5	x	0.7	=	46.44	(80)
West	0.9x	0.77	x	1.27	x	24.49	x	0.5	x	0.7	=	7.54	(80)
West	0.9x	0.77	x	4.2	x	24.49	x	0.5	x	0.7	=	24.95	(80)
West	0.9x	0.77	x	1.27	x	16.15	x	0.5	x	0.7	=	4.98	(80)
West	0.9x	0.77	x	4.2	x	16.15	x	0.5	x	0.7	=	16.45	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	59.73	109.55	166.42	227.03	268.32	271.22	259.57	228.9	187.89	125.94	73.07	50.08	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.71	434.83	481.92	526.87	552.55	540.18	518.46	492.63	459.54	413.41	378.7	369.07	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.95	0.88	0.73	0.57	0.62	0.84	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.56	19.72	20	20.37	20.69	20.91	20.98	20.97	20.82	20.4	19.92	19.53	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.76	19.77	19.77	19.78	19.78	19.79	19.78	19.77	19.77	19.76	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.93	0.83	0.63	0.43	0.47	0.75	0.94	0.99	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.88	18.11	18.52	19.04	19.47	19.72	19.78	19.77	19.64	19.1	18.41	17.84	(90)
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fLA = Living area ÷ (4) =

0.51 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.74	18.93	19.27	19.72	20.09	20.33	20.39	20.38	20.24	19.76	19.18	18.71	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.74	18.93	19.27	19.72	20.09	20.33	20.39	20.38	20.24	19.76	19.18	18.71	(93)
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8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=	0.99	0.98	0.97	0.93	0.84	0.68	0.5	0.54	0.79	0.94	0.98	0.99	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	383.2	428.11	467.07	489.72	465.22	366.53	258.78	268.47	362.37	390.26	372.53	366.3	(95)
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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)
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1041.83	1010.61	917.94	769.34	595.78	402.04	265.97	278.98	433.09	650.38	860.69	1038.11	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	490.02	391.44	335.45	201.32	97.13	0	0	0	0	193.53	351.47	499.82	
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Total per year ($kWh/year$) = $Sum(98)_{1...12} =$ 2560.19 (98)

Space heating requirement in $kWh/m^2/year$

50.02 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump

1 (303a)

Fraction of heat from Community heat pump (Water)

0.8 (303a)

Fraction of community heat from heat source 2 (Water)

0.2 (303b)

Fraction of total space heat from Community heat pump

(302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Distribution loss factor (Table 12c) for community heating system (Water)

1.05 (306)

Space heating

$kWh/year$

Annual space heating requirement

2560.19

Space heat from Community heat pump

(98) x (304a) x (305) x (306) = 2688.2 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement

1833.49

If DHW from community scheme:

Water heat from CHP (Water)

(64) x (303a) x (305) x (306) = 1540.13 (310a)

Water heat from heat source 2 (Water)

(64) x (303a) x (305) x (306) = 385.03 (310b)

Electricity used for heat distribution

$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$ 26.88 (313)

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Electricity used for heat distribution (Water)	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	19.25	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) + (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		105.48	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	105.48	(331)
Energy for lighting (calculated in Appendix L)		239.68	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-1139.98	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	290	(367a)	
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	$=$	481.1 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	$=$	13.95 (372)
Water heating from separate community system				
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	290	(367a)	
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	100	(367b)	
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	$=$	275.63 (367)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	$=$	199.83 (368)
Electrical energy for heat distribution	$[(313) \times$	0.52	$=$	9.99 (372)
Total CO2 associated with community systems	$(363) \dots (366) + (368) \dots (372)$		$=$	980.5 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	$=$	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	$=$	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			980.5 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	$=$	54.75 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	$=$	124.4 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$	-591.65 (380)
Total CO2, kg/year	$\text{sum of } (376) \dots (382) =$			568 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			11.1 (384)
EI rating (section 14)				92.09 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.7

Property Address: Unit 1 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	79.98 (1a) x	2.55 (2a) =	203.95 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.98 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	203.95 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
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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) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			1.5	x 1/[1/(1.3)+0.04]	= 1.85		(27)
Windows Type 2			0.8	x 1/[1/(1.3)+0.04]	= 0.99		(27)
Windows Type 3			1.56	x 1/[1/(1.3)+0.04]	= 1.93		(27)
Windows Type 4			4.23	x 1/[1/(1.3)+0.04]	= 5.23		(27)
Windows Type 5			0.81	x 1/[1/(1.3)+0.04]	= 1		(27)
Floor			79.98	x 0.11	= 8.7978		(28)
Walls Type1	20.5	0	20.5	x 0.13	= 2.71		(29)
Walls Type2	71.23	13.37	57.86	x 0.14	= 8.1		(29)
Roof	7.48	0	7.48	x 0.11	= 0.82		(30)
Total area of elements, m²			179.19				(31)
Party ceiling			72.49				(32b)

* for windows and roof windows, use effective window U-value calculated using formula 1/[1/(U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 37.29 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 31002.52 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 18.79 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 56.08 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.1	19.87	19.63	18.47	18.23	17.07	17.07	16.83	17.53	18.23	18.7	19.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.19	75.95	75.72	74.55	74.32	73.15	73.15	72.92	73.62	74.32	74.78	75.25	
Average = Sum(39) _{1...12} / 12 =												74.49	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m + (4)

(40)m=	0.95	0.95	0.95	0.93	0.93	0.91	0.91	0.91	0.92	0.93	0.94	0.94	
Average = Sum(40) _{1...12} / 12 =												0.93	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.46 (42)

if TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA - 13.9)²)] + 0.0013 × (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 92.68 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 × (43)													
(44)m=	101.95	98.24	94.54	90.83	87.12	83.42	83.42	87.12	90.83	94.54	98.24	101.95	
Total = Sum(44) _{1...12} =												1112.21	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.19	132.23	136.45	118.96	114.15	98.5	91.28	104.74	105.99	123.52	134.83	146.42	
Total = Sum(45) _{1...12} =												1458.28	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.68	19.84	20.47	17.84	17.12	14.78	13.69	15.71	15.9	18.53	20.23	21.96	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
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Primary circuit loss (annual) from Table 3	0	(58)
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Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	206.47	182.16	191.73	172.46	169.43	151.99	146.55	160.02	159.49	178.8	188.33	201.7	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	206.47	182.16	191.73	172.46	169.43	151.99	146.55	160.02	159.49	178.8	188.33	201.7	
Output from water heater (annual) _{1...12}												2109.12	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	94.49	83.91	89.59	82.35	82.18	75.55	74.57	79.05	78.04	85.29	87.63	92.91	(65)
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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=	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.95	18.61	15.14	11.46	8.57	7.23	7.81	10.16	13.63	17.31	20.2	21.54	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	219.4	221.68	215.94	203.72	188.31	173.82	164.14	161.86	167.6	179.81	195.23	209.72	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	(71)
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Water heating gains (Table 5)

(72)m=	127.01	124.87	120.42	114.38	110.45	104.93	100.23	106.25	108.38	114.64	121.7	124.87	(72)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

(73)m=	427.3	425.09	411.43	389.5	367.26	345.91	332.12	338.2	349.55	371.7	397.07	416.07	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.81	x	10.63	x	0.5	x	0.7	=	4.18 (74)
North	0.9x	0.77	x	0.81	x	20.32	x	0.5	x	0.7	=	7.98 (74)
North	0.9x	0.77	x	0.81	x	34.53	x	0.5	x	0.7	=	13.57 (74)
North	0.9x	0.77	x	0.81	x	55.46	x	0.5	x	0.7	=	21.79 (74)
North	0.9x	0.77	x	0.81	x	74.72	x	0.5	x	0.7	=	29.36 (74)
North	0.9x	0.77	x	0.81	x	79.99	x	0.5	x	0.7	=	31.43 (74)
North	0.9x	0.77	x	0.81	x	74.68	x	0.5	x	0.7	=	29.34 (74)
North	0.9x	0.77	x	0.81	x	59.25	x	0.5	x	0.7	=	23.28 (74)
North	0.9x	0.77	x	0.81	x	41.52	x	0.5	x	0.7	=	16.31 (74)
North	0.9x	0.77	x	0.81	x	24.19	x	0.5	x	0.7	=	9.5 (74)
North	0.9x	0.77	x	0.81	x	13.12	x	0.5	x	0.7	=	5.15 (74)
North	0.9x	0.77	x	0.81	x	8.86	x	0.5	x	0.7	=	3.48 (74)
East	0.9x	0.77	x	1.56	x	19.64	x	0.5	x	0.7	=	14.86 (76)
East	0.9x	0.77	x	4.23	x	19.64	x	0.5	x	0.7	=	20.15 (76)
East	0.9x	0.77	x	1.56	x	38.42	x	0.5	x	0.7	=	29.07 (76)
East	0.9x	0.77	x	4.23	x	38.42	x	0.5	x	0.7	=	39.42 (76)
East	0.9x	0.77	x	1.56	x	63.27	x	0.5	x	0.7	=	47.88 (76)
East	0.9x	0.77	x	4.23	x	63.27	x	0.5	x	0.7	=	64.92 (76)
East	0.9x	0.77	x	1.56	x	92.28	x	0.5	x	0.7	=	69.83 (76)
East	0.9x	0.77	x	4.23	x	92.28	x	0.5	x	0.7	=	94.68 (76)
East	0.9x	0.77	x	1.56	x	113.09	x	0.5	x	0.7	=	85.58 (76)
East	0.9x	0.77	x	4.23	x	113.09	x	0.5	x	0.7	=	116.03 (76)
East	0.9x	0.77	x	1.56	x	115.77	x	0.5	x	0.7	=	87.61 (76)
East	0.9x	0.77	x	4.23	x	115.77	x	0.5	x	0.7	=	118.78 (76)
East	0.9x	0.77	x	1.56	x	110.22	x	0.5	x	0.7	=	83.41 (76)
East	0.9x	0.77	x	4.23	x	110.22	x	0.5	x	0.7	=	113.08 (76)
East	0.9x	0.77	x	1.56	x	94.68	x	0.5	x	0.7	=	71.65 (76)
East	0.9x	0.77	x	4.23	x	94.68	x	0.5	x	0.7	=	97.14 (76)
East	0.9x	0.77	x	1.56	x	73.59	x	0.5	x	0.7	=	55.69 (76)
East	0.9x	0.77	x	4.23	x	73.59	x	0.5	x	0.7	=	75.5 (76)
East	0.9x	0.77	x	1.56	x	45.59	x	0.5	x	0.7	=	34.5 (76)
East	0.9x	0.77	x	4.23	x	45.59	x	0.5	x	0.7	=	46.77 (76)
East	0.9x	0.77	x	1.56	x	24.49	x	0.5	x	0.7	=	18.53 (76)
East	0.9x	0.77	x	4.23	x	24.49	x	0.5	x	0.7	=	25.13 (76)
East	0.9x	0.77	x	1.56	x	16.15	x	0.5	x	0.7	=	12.22 (76)
East	0.9x	0.77	x	4.23	x	16.15	x	0.5	x	0.7	=	16.57 (76)
West	0.9x	0.77	x	1.5	x	19.64	x	0.5	x	0.7	=	7.15 (80)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	3.81 (80)
West	0.9x	0.77	x	1.5	x	38.42	x	0.5	x	0.7	=	13.98 (80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	7.46	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.5	x	0.7	=	23.02	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	12.28	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.5	x	0.7	=	33.57	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	17.91	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.5	x	0.7	=	41.15	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	21.94	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.5	x	0.7	=	42.12	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	22.46	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.5	x	0.7	=	40.1	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	21.39	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.5	x	0.7	=	34.45	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	18.37	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.5	x	0.7	=	26.77	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	14.28	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.5	x	0.7	=	16.59	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	8.85	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.5	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	4.75	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.5	x	0.7	=	5.88	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	3.13	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

50.15	97.91	161.67	237.79	294.06	302.4	287.32	244.88	188.56	116.21	62.47	41.29
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 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

477.45	523	573.1	627.28	661.32	648.31	619.44	583.08	538.11	487.91	459.55	457.35
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 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.99	0.96	0.87	0.69	0.51	0.57	0.83	0.98	1	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

20.03	20.14	20.35	20.63	20.86	20.98	21	20.99	20.93	20.64	20.29	20.01
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 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

20.12	20.13	20.13	20.14	20.14	20.16	20.16	20.16	20.15	20.14	20.14	20.13
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 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

1	0.99	0.99	0.95	0.83	0.61	0.42	0.47	0.77	0.96	0.99	1
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 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

18.82	18.99	19.29	19.71	20.01	20.14	20.15	20.15	20.09	19.71	19.21	18.81
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 (90)

fLA = Living area ÷ (4) =

0.39

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=

19.3	19.44	19.71	20.07	20.34	20.47	20.49	20.49	20.42	20.08	19.63	19.28
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

19.3	19.44	19.71	20.07	20.34	20.47	20.49	20.49	20.42	20.08	19.63	19.28
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=

1	0.99	0.98	0.95	0.84	0.64	0.46	0.51	0.79	0.96	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (94)

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=

475.77	519.58	563.69	594.15	558.17	416.65	282.86	295.41	424.32	469.85	456.16	456.09
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=

1142.63	1104.7	1000.32	832.83	642.34	429.25	284.23	297.89	465.22	704.37	937.42	1134.9
---------	--------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (97)

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=

496.14	393.2	324.85	171.85	62.63	0	0	0	0	174.49	346.51	505.03
--------	-------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$

2474.71

 (98)

Space heating requirement in $kWh/m^2/year$

30.94

 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0

 (301)

Fraction of space heat from community system 1 – (301) =

1

 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump

1

 (303a)

Fraction of heat from Community heat pump (Water)

0.8

 (303a)

Fraction of community heat from heat source 2 (Water)

0.2

 (303b)

Fraction of total space heat from Community heat pump (302) x (303a) =

1

 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1

 (305)

Distribution loss factor (Table 12c) for community heating system

1.05

 (306)

Distribution loss factor (Table 12c) for community heating system (Water)

1.05

 (306)

Space heating

Annual space heating requirement

2474.71

kWh/year

Space heat from Community heat pump (98) x (304a) x (305) x (306) =

2598.45

 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0

 (308)

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) =

0

 (309)

Water heating

Annual water heating requirement

2109.12

If DHW from community scheme:

Water heat from CHP (Water) (64) x (303a) x (305) x (306) =

1771.66

 (310a)

DER WorkSheet: New dwelling design stage

Water heat from heat source 2 (Water)	$(64) \times (303a) \times (305) \times (306) =$	442.92	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	25.98	(313)
Electricity used for heat distribution (Water)	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	22.15	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		164.84	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	164.84	(331)
Energy for lighting (calculated in Appendix L)		370.06	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-1139.98	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	290	(367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	= 465.03 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 13.49 (372)
Water heating from separate community system			
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	290	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel	100	(367b)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	= 317.07 (367)
CO2 associated with heat source 2	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	= 229.87 (368)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 11.49 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		= 1036.95 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	= 0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	= 0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$		1036.95 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	= 85.55 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	= 192.06 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$ -591.65 (380)
Total CO2, kg/year	sum of (376)...(382) =		722.92 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$		9.04 (384)

DER WorkSheet: New dwelling design stage

El rating (section 14)

92.25

(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.7

Property Address: Unit 2 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	79.98 (1a) x	2.55 (2a) =	203.95 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.98 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	203.95 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>		0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 2			1.5	x1/[1/(1.3)+ 0.04]	= 1.85		(27)
Windows Type 3			0.81	x1/[1/(1.3)+ 0.04]	= 1		(27)
Windows Type 4			4.23	x1/[1/(1.3)+ 0.04]	= 5.23		(27)
Windows Type 5			1.56	x1/[1/(1.3)+ 0.04]	= 1.93		(27)
Floor			79.98	x 0.11	= 8.7978		(28)
Walls Type1	20.5	0	20.5	x 0.13	= 2.71		(29)
Walls Type2	71.23	12.56	58.67	x 0.14	= 8.21		(29)
Roof	7.44	0	7.44	x 0.11	= 0.82		(30)
Total area of elements, m²			179.15				(31)
Party ceiling			72.54				(32b)

* for windows and roof windows, use effective window U-value calculated using formula 1/[1/(U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 31161.06 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 17.54 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 53.94 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.1	19.87	19.63	18.47	18.23	17.07	17.07	16.83	17.53	18.23	18.7	19.17	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.04	73.81	73.58	72.41	72.18	71.01	71.01	70.77	71.47	72.18	72.64	73.11	
Average = Sum(39) _{1...12} / 12 =												72.35	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m + (4)

(40)m=	0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.88	0.89	0.9	0.91	0.91	
Average = Sum(40) _{1...12} / 12 =												0.9	(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 2.46 (42)

if TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA - 13.9)²)] + 0.0013 × (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 × N) + 36 92.68 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 × (43)													
(44)m=	101.95	98.24	94.54	90.83	87.12	83.42	83.42	87.12	90.83	94.54	98.24	101.95	
Total = Sum(44) _{1...12} =												1112.21	(44)

Energy content of hot water used - calculated monthly = 4.190 × Vd,m × nm × DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.19	132.23	136.45	118.96	114.15	98.5	91.28	104.74	105.99	123.52	134.83	146.42	
Total = Sum(45) _{1...12} =												1458.28	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.68	19.84	20.47	17.84	17.12	14.78	13.69	15.71	15.9	18.53	20.23	21.96	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Primary circuit loss (annual) from Table 3	0	(58)
--	---	------

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	206.47	182.16	191.73	172.46	169.43	151.99	146.55	160.02	159.49	178.8	188.33	201.7	(62)
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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)
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Output from water heater

(64)m=	206.47	182.16	191.73	172.46	169.43	151.99	146.55	160.02	159.49	178.8	188.33	201.7	
Output from water heater (annual) _{1...12}												2109.12	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	94.49	83.91	89.59	82.35	82.18	75.55	74.57	79.05	78.04	85.29	87.63	92.91	(65)
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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=	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	123.12	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.3	18.92	15.39	11.65	8.71	7.35	7.94	10.32	13.86	17.6	20.54	21.89	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	219.4	221.68	215.94	203.72	188.31	173.82	164.14	161.86	167.6	179.81	195.23	209.72	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	-98.5	(71)
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Water heating gains (Table 5)

(72)m=	127.01	124.87	120.42	114.38	110.45	104.93	100.23	106.25	108.38	114.64	121.7	124.87	(72)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$

(73)m=	427.64	425.4	411.68	389.69	367.4	346.03	332.25	338.37	349.78	371.98	397.41	416.42	(73)
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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	4.23	x	19.64	x	0.5	x	0.7	=	20.15 (76)
East	0.9x	0.77	x	1.56	x	19.64	x	0.5	x	0.7	=	14.86 (76)
East	0.9x	0.77	x	4.23	x	38.42	x	0.5	x	0.7	=	39.42 (76)
East	0.9x	0.77	x	1.56	x	38.42	x	0.5	x	0.7	=	29.07 (76)
East	0.9x	0.77	x	4.23	x	63.27	x	0.5	x	0.7	=	64.92 (76)
East	0.9x	0.77	x	1.56	x	63.27	x	0.5	x	0.7	=	47.88 (76)
East	0.9x	0.77	x	4.23	x	92.28	x	0.5	x	0.7	=	94.68 (76)
East	0.9x	0.77	x	1.56	x	92.28	x	0.5	x	0.7	=	69.83 (76)
East	0.9x	0.77	x	4.23	x	113.09	x	0.5	x	0.7	=	116.03 (76)
East	0.9x	0.77	x	1.56	x	113.09	x	0.5	x	0.7	=	85.58 (76)
East	0.9x	0.77	x	4.23	x	115.77	x	0.5	x	0.7	=	118.78 (76)
East	0.9x	0.77	x	1.56	x	115.77	x	0.5	x	0.7	=	87.61 (76)
East	0.9x	0.77	x	4.23	x	110.22	x	0.5	x	0.7	=	113.08 (76)
East	0.9x	0.77	x	1.56	x	110.22	x	0.5	x	0.7	=	83.41 (76)
East	0.9x	0.77	x	4.23	x	94.68	x	0.5	x	0.7	=	97.14 (76)
East	0.9x	0.77	x	1.56	x	94.68	x	0.5	x	0.7	=	71.65 (76)
East	0.9x	0.77	x	4.23	x	73.59	x	0.5	x	0.7	=	75.5 (76)
East	0.9x	0.77	x	1.56	x	73.59	x	0.5	x	0.7	=	55.69 (76)
East	0.9x	0.77	x	4.23	x	45.59	x	0.5	x	0.7	=	46.77 (76)
East	0.9x	0.77	x	1.56	x	45.59	x	0.5	x	0.7	=	34.5 (76)
East	0.9x	0.77	x	4.23	x	24.49	x	0.5	x	0.7	=	25.13 (76)
East	0.9x	0.77	x	1.56	x	24.49	x	0.5	x	0.7	=	18.53 (76)
East	0.9x	0.77	x	4.23	x	16.15	x	0.5	x	0.7	=	16.57 (76)
East	0.9x	0.77	x	1.56	x	16.15	x	0.5	x	0.7	=	12.22 (76)
South	0.9x	0.77	x	0.81	x	46.75	x	0.5	x	0.7	=	9.19 (78)
South	0.9x	0.77	x	0.81	x	76.57	x	0.5	x	0.7	=	15.04 (78)
South	0.9x	0.77	x	0.81	x	97.53	x	0.5	x	0.7	=	19.16 (78)
South	0.9x	0.77	x	0.81	x	110.23	x	0.5	x	0.7	=	21.66 (78)
South	0.9x	0.77	x	0.81	x	114.87	x	0.5	x	0.7	=	22.57 (78)
South	0.9x	0.77	x	0.81	x	110.55	x	0.5	x	0.7	=	21.72 (78)
South	0.9x	0.77	x	0.81	x	108.01	x	0.5	x	0.7	=	21.22 (78)
South	0.9x	0.77	x	0.81	x	104.89	x	0.5	x	0.7	=	20.61 (78)
South	0.9x	0.77	x	0.81	x	101.89	x	0.5	x	0.7	=	20.02 (78)
South	0.9x	0.77	x	0.81	x	82.59	x	0.5	x	0.7	=	16.23 (78)
South	0.9x	0.77	x	0.81	x	55.42	x	0.5	x	0.7	=	10.89 (78)
South	0.9x	0.77	x	0.81	x	40.4	x	0.5	x	0.7	=	7.94 (78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	3.81 (80)
West	0.9x	0.77	x	1.5	x	19.64	x	0.5	x	0.7	=	7.15 (80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	7.46 (80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.5	x	38.42	x	0.5	x	0.7	=	13.98	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	12.28	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.5	x	0.7	=	23.02	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	17.91	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.5	x	0.7	=	33.57	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	21.94	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.5	x	0.7	=	41.15	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	22.46	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.5	x	0.7	=	42.12	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	21.39	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.5	x	0.7	=	40.1	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	18.37	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.5	x	0.7	=	34.45	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	14.28	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.5	x	0.7	=	26.77	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	8.85	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.5	x	0.7	=	16.59	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	4.75	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.5	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	3.13	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.5	x	0.7	=	5.88	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 55.16 104.97 167.26 237.65 287.27 292.69 279.2 242.21 192.26 122.93 68.21 45.74 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 482.8 530.37 578.94 627.33 654.68 638.72 611.44 580.58 542.04 494.91 465.61 462.16 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	1	0.99	0.96	0.87	0.68	0.51	0.55	0.82	0.97	1	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m= 20.08 20.19 20.39 20.66 20.88 20.98 21 21 20.94 20.67 20.33 20.06 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m= 20.15 20.15 20.15 20.16 20.17 20.18 20.18 20.18 20.17 20.17 20.16 20.16 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m= 1 0.99 0.98 0.95 0.83 0.61 0.41 0.46 0.75 0.96 0.99 1 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m= 18.91 19.08 19.37 19.76 20.04 20.16 20.18 20.18 20.12 19.78 19.29 18.89 (90)

fLA = Living area ÷ (4) =

0.39

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

DER WorkSheet: New dwelling design stage

(92)m=	19.37	19.51	19.77	20.12	20.37	20.48	20.5	20.5	20.44	20.13	19.7	19.35	(92)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.37	19.51	19.77	20.12	20.37	20.48	20.5	20.5	20.44	20.13	19.7	19.35	(93)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------	-------	------

8. Space heating requirement

Set T_i to the mean internal temperature obtained at step 11 of Table 9b, so that $T_{i,m}=(76)m$ 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, h_m :

(94)m=	1	0.99	0.98	0.94	0.84	0.64	0.45	0.5	0.77	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	-----	------	------	------	---	------

Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	480.99	526.58	568.62	592.32	549.67	407	275.81	288.23	419.4	474.49	461.86	460.82	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1115.55	1078.7	976.62	812.2	625.76	417.85	276.92	290.17	453.45	687.7	915.04	1107.54	(97)
--------	---------	--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	---------	------

Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	472.11	371.02	303.55	158.32	56.61	0	0	0	0	158.63	326.29	481.17	
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 2327.69 (98)

Space heating requirement in $kWh/m^2/year$

29.1 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump

1 (303a)

Fraction of heat from Community heat pump (Water)

0.8 (303a)

Fraction of community heat from heat source 2 (Water)

0.2 (303b)

Fraction of total space heat from Community heat pump

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Distribution loss factor (Table 12c) for community heating system (Water)

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2327.69

Space heat from Community heat pump

(98) x (304a) x (305) x (306) =

2444.08 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2109.12

If DHW from community scheme:

Water heat from CHP (Water)

(64) x (303a) x (305) x (306) =

1771.66 (310a)

DER WorkSheet: New dwelling design stage

Water heat from heat source 2 (Water)	$(64) \times (303a) \times (305) \times (306) =$	442.92	(310b)
Electricity used for heat distribution	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	24.44	(313)
Electricity used for heat distribution (Water)	$0.01 \times [(307a)...(307e) + (310a)...(310e)] =$	22.15	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		164.84	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$=(330a) + (330b) + (330g) =$	164.84	(331)
Energy for lighting (calculated in Appendix L)		376.17	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-1139.98	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		290	(367a)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	437.41 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	12.68 (372)
Water heating from separate community system				
CO2 from other sources of space and water heating (not CHP)				
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		290	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		100	(367b)
CO2 associated with heat source 1	$[(307b)+(310b)] \times 100 \div (367b) \times$	0	=	317.07 (367)
CO2 associated with heat source 2	$[(307b)+(310b)] \times 100 \div (367b) \times$	0.52	=	229.87 (368)
Electrical energy for heat distribution	$[(313) \times$	0.52	=	11.49 (372)
Total CO2 associated with community systems	$(363)...(366) + (368)...(372)$		=	1008.52 (373)
CO2 associated with space heating (secondary)	$(309) \times$	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	$(312) \times$	0.52	=	0 (375)
Total CO2 associated with space and water heating	$(373) + (374) + (375) =$			1008.52 (376)
CO2 associated with electricity for pumps and fans within dwelling	$(331) \times$	0.52	=	85.55 (378)
CO2 associated with electricity for lighting	$(332) \times$	0.52	=	195.23 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	$\times 0.01 =$	-591.65 (380)
Total CO2, kg/year	sum of (376)...(382) =			697.66 (383)
Dwelling CO2 Emission Rate	$(383) \div (4) =$			8.72 (384)

DER WorkSheet: New dwelling design stage

El rating (section 14)

92.52

(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.7

Property Address: Unit 3 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a) x	2.55 (2a) =	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>		0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x 1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 2			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Windows Type 3			1.57	x 1/[1/(1.3)+ 0.04]	= 1.94		(27)
Windows Type 4			0.81	x 1/[1/(1.3)+ 0.04]	= 1		(27)
Windows Type 5			1.56	x 1/[1/(1.3)+ 0.04]	= 1.93		(27)
Windows Type 6			7.23	x 1/[1/(1.3)+ 0.04]	= 8.93		(27)
Windows Type 7			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Floor			0.91	x 0.2	= 0.182		(28)
Walls Type1	73.79	16.13	57.66	x 0.13	= 7.64		(29)
Walls Type2	20.5	2.1	18.4	x 0.14	= 2.58		(29)
Roof	0.91	0	0.91	x 0.2	= 0.18		(30)
Total area of elements, m²			96.11				(31)
Party floor			72.5				(32a)
Party ceiling			72.5				(32b)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.46 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 27527.79 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

16.17 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

49.62 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	18.22	18.01	17.8	16.74	16.53	15.47	15.47	15.26	15.89	16.53	16.95	17.37

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	67.84	67.63	67.42	66.36	66.15	65.09	65.09	64.88	65.52	66.15	66.57	67
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----

Average = Sum(39)_{1...12} /12=

66.31 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	0.94	0.93	0.93	0.92	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.92
--------	------	------	------	------	------	-----	-----	------	-----	------	------	------

Average = Sum(40)_{1...12} /12=

0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.31

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.95

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Total = Sum(44)_{1...12} =

1067.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
--------	-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

Total = Sum(45)_{1...12} =

1399.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

1.03
1.03

(54)
 Enter (50) or (54) in (55) (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

200.38	176.83	186.23	167.66	164.83	148.03	142.88	155.8	155.21	173.82	182.9	195.8
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

200.38	176.83	186.23	167.66	164.83	148.03	142.88	155.8	155.21	173.82	182.9	195.8
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------

(64)
Output from water heater (annual)_{1...12}

2050.37

Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

92.47	82.14	87.76	80.76	80.65	74.23	73.35	77.64	76.62	83.64	85.82	90.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.1	16.08	13.08	9.9	7.4	6.25	6.75	8.78	11.78	14.95	17.45	18.61
------	-------	-------	-----	-----	------	------	------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

124.28	122.23	117.96	112.16	108.4	103.09	98.59	104.36	106.41	112.42	119.2	122.24
--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	-------	--------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

403.03	401.06	388.48	368.19	347.66	327.79	314.83	320.52	330.89	351.37	374.92	392.52
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.5	x	0.7	=	1.24 (74)
North	0.9x	0.77	x	1.56	x	10.63	x	0.5	x	0.7	=	4.02 (74)
North	0.9x	0.77	x	7.23	x	10.63	x	0.5	x	0.7	=	18.65 (74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.5	x	0.7	=	2.37 (74)
North	0.9x	0.77	x	1.56	x	20.32	x	0.5	x	0.7	=	7.69 (74)
North	0.9x	0.77	x	7.23	x	20.32	x	0.5	x	0.7	=	35.64 (74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.5	x	0.7	=	4.02 (74)
North	0.9x	0.77	x	1.56	x	34.53	x	0.5	x	0.7	=	13.07 (74)
North	0.9x	0.77	x	7.23	x	34.53	x	0.5	x	0.7	=	60.55 (74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.5	x	0.7	=	6.46 (74)
North	0.9x	0.77	x	1.56	x	55.46	x	0.5	x	0.7	=	20.99 (74)
North	0.9x	0.77	x	7.23	x	55.46	x	0.5	x	0.7	=	97.26 (74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.5	x	0.7	=	8.7 (74)
North	0.9x	0.77	x	1.56	x	74.72	x	0.5	x	0.7	=	28.27 (74)
North	0.9x	0.77	x	7.23	x	74.72	x	0.5	x	0.7	=	131.02 (74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.5	x	0.7	=	9.31 (74)
North	0.9x	0.77	x	1.56	x	79.99	x	0.5	x	0.7	=	30.26 (74)
North	0.9x	0.77	x	7.23	x	79.99	x	0.5	x	0.7	=	140.27 (74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.5	x	0.7	=	8.69 (74)
North	0.9x	0.77	x	1.56	x	74.68	x	0.5	x	0.7	=	28.26 (74)
North	0.9x	0.77	x	7.23	x	74.68	x	0.5	x	0.7	=	130.96 (74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.5	x	0.7	=	6.9 (74)
North	0.9x	0.77	x	1.56	x	59.25	x	0.5	x	0.7	=	22.42 (74)
North	0.9x	0.77	x	7.23	x	59.25	x	0.5	x	0.7	=	103.9 (74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.5	x	0.7	=	4.83 (74)
North	0.9x	0.77	x	1.56	x	41.52	x	0.5	x	0.7	=	15.71 (74)
North	0.9x	0.77	x	7.23	x	41.52	x	0.5	x	0.7	=	72.8 (74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.5	x	0.7	=	2.82 (74)
North	0.9x	0.77	x	1.56	x	24.19	x	0.5	x	0.7	=	9.15 (74)
North	0.9x	0.77	x	7.23	x	24.19	x	0.5	x	0.7	=	42.42 (74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.5	x	0.7	=	1.53 (74)
North	0.9x	0.77	x	1.56	x	13.12	x	0.5	x	0.7	=	4.96 (74)
North	0.9x	0.77	x	7.23	x	13.12	x	0.5	x	0.7	=	23 (74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.5	x	0.7	=	1.03 (74)
North	0.9x	0.77	x	1.56	x	8.86	x	0.5	x	0.7	=	3.35 (74)
North	0.9x	0.77	x	7.23	x	8.86	x	0.5	x	0.7	=	15.55 (74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.5	x	0.7	=	7.48 (76)
East	0.9x	0.77	x	0.81	x	19.64	x	0.5	x	0.7	=	3.86 (76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.5	x	0.7	=	14.63 (76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	0.81	x	38.42	x	0.5	x	0.7	=	7.55	(76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.5	x	0.7	=	24.09	(76)
East	0.9x	0.77	x	0.81	x	63.27	x	0.5	x	0.7	=	12.43	(76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.5	x	0.7	=	35.14	(76)
East	0.9x	0.77	x	0.81	x	92.28	x	0.5	x	0.7	=	18.13	(76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.5	x	0.7	=	43.07	(76)
East	0.9x	0.77	x	0.81	x	113.09	x	0.5	x	0.7	=	22.22	(76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.5	x	0.7	=	44.09	(76)
East	0.9x	0.77	x	0.81	x	115.77	x	0.5	x	0.7	=	22.74	(76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.5	x	0.7	=	41.97	(76)
East	0.9x	0.77	x	0.81	x	110.22	x	0.5	x	0.7	=	21.65	(76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.5	x	0.7	=	36.05	(76)
East	0.9x	0.77	x	0.81	x	94.68	x	0.5	x	0.7	=	18.6	(76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.5	x	0.7	=	28.02	(76)
East	0.9x	0.77	x	0.81	x	73.59	x	0.5	x	0.7	=	14.46	(76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.5	x	0.7	=	17.36	(76)
East	0.9x	0.77	x	0.81	x	45.59	x	0.5	x	0.7	=	8.96	(76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.5	x	0.7	=	9.33	(76)
East	0.9x	0.77	x	0.81	x	24.49	x	0.5	x	0.7	=	4.81	(76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.5	x	0.7	=	6.15	(76)
East	0.9x	0.77	x	0.81	x	16.15	x	0.5	x	0.7	=	3.17	(76)
South	0.9x	0.77	x	0.48	x	46.75	x	0.5	x	0.7	=	5.44	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.5	x	0.7	=	8.91	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.5	x	0.7	=	11.36	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.5	x	0.7	=	12.83	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.5	x	0.7	=	13.37	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.5	x	0.7	=	12.87	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.5	x	0.7	=	12.58	(78)
South	0.9x	0.77	x	0.48	x	104.89	x	0.5	x	0.7	=	12.21	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.5	x	0.7	=	11.86	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.5	x	0.7	=	9.61	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.5	x	0.7	=	6.45	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.5	x	0.7	=	4.7	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	19.05	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	37.28	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	61.39	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	89.53	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	109.72	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	112.32	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	106.93	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	91.85	(80)

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West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	71.4	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	44.23	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	23.76	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	15.67	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	59.74	114.06	186.91	280.34	356.37	371.86	351.04	291.93	219.09	134.55	73.84	49.63	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	462.77	515.11	575.38	648.54	704.03	699.66	665.87	612.45	549.97	485.92	448.76	442.15	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.79	0.59	0.43	0.48	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.22	20.44	20.73	20.92	20.99	21	21	20.96	20.7	20.35	20.08	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.14	20.15	20.16	20.17	20.17	20.17	20.16	20.16	20.15	20.15	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.91	0.74	0.51	0.35	0.4	0.69	0.94	0.99	1	(89)
--------	---	------	------	------	------	------	------	-----	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.93	19.11	19.43	19.85	20.09	20.16	20.17	20.17	20.13	19.81	19.31	18.91	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.37

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.53	19.81	20.18	20.4	20.47	20.48	20.48	20.44	20.14	19.7	19.34	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.53	19.81	20.18	20.4	20.47	20.48	20.48	20.44	20.14	19.7	19.34	(93)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.91	0.76	0.54	0.38	0.43	0.72	0.94	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	460.48	510.02	560.22	591.37	534.82	377.94	252.04	263.79	394.22	458.85	443.93	440.45	(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=	1021.84	989.21	897.41	748.28	575.45	382.19	252.44	264.64	415.28	631.35	838.78	1014.43	(97)
--------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	417.65	322.01	250.87	112.98	30.23	0	0	0	0	128.34	284.29	427.04	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

1973.41

Space heating requirement in kWh/m²/year

27.22

(99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump

1 (303a)

Fraction of heat from Community heat pump (Water)

0.8 (303a)

Fraction of community heat from heat source 2 (Water)

0.2 (303b)

Fraction of total space heat from Community heat pump

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Distribution loss factor (Table 12c) for community heating system (Water)

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

1973.41

Space heat from Community heat pump

(98) x (304a) x (305) x (306) =

2072.08 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2050.37

If DHW from community scheme:

Water heat from CHP (Water)

(64) x (303a) x (305) x (306) =

1722.31 (310a)

Water heat from heat source 2 (Water)

(64) x (303a) x (305) x (306) =

430.58 (310b)

Electricity used for heat distribution

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

20.72 (313)

Electricity used for heat distribution (Water)

$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$

21.53 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

$= (107) \div (314) =$

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

149.43 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

$= (330a) + (330b) + (330g) =$

149.43 (331)

Energy for lighting (calculated in Appendix L)

319.72 (332)

Electricity generated by PVs (Appendix M) (negative quantity)

-1139.98 (333)

Electricity generated by wind turbine (Appendix M) (negative quantity)

0 (334)

12b. CO2 Emissions – Community heating scheme

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
--------------------	-------------------------------	--------------------------

DER WorkSheet: New dwelling design stage

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 290 (367a)

CO2 associated with heat source 1 $[(307b)+(310b)] \times 100 \div (367b) \times$ 0.52 = 370.83 (367)

Electrical energy for heat distribution $[(313) \times$ 0.52 = 10.75 (372)

Water heating from separate community system

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 290 (367a)

Efficiency of heat source 2 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 100 (367b)

CO2 associated with heat source 1 $[(307b)+(310b)] \times 100 \div (367b) \times$ 0 = 308.23 (367)

CO2 associated with heat source 2 $[(307b)+(310b)] \times 100 \div (367b) \times$ 0.52 = 223.47 (368)

Electrical energy for heat distribution $[(313) \times$ 0.52 = 11.17 (372)

Total CO2 associated with community systems $(363)...(366) + (368)...(372)$ = 924.46 (373)

CO2 associated with space heating (secondary) $(309) \times$ 0 = 0 (374)

CO2 associated with water from immersion heater or instantaneous heater $(312) \times$ 0.52 = 0 (375)

Total CO2 associated with space and water heating $(373) + (374) + (375) =$ 924.46 (376)

CO2 associated with electricity for pumps and fans within dwelling $(331) \times$ 0.52 = 77.55 (378)

CO2 associated with electricity for lighting $(332)) \times$ 0.52 = 165.93 (379)

Energy saving/generation technologies (333) to (334) as applicable
Item 1

0.52 $\times 0.01 =$ -591.65 (380)

Total CO2, kg/year $\text{sum of (376)...(382) =}$ 576.3 (383)

Dwelling CO2 Emission Rate $(383) \div (4) =$ 7.95 (384)

EI rating (section 14) 93.43 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.7

Property Address: Unit 4 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a) x	2.55 (2a) =	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 2			0.48	x1/[1/(1.3)+ 0.04]	= 0.59		(27)
Windows Type 3			1.57	x1/[1/(1.3)+ 0.04]	= 1.94		(27)
Windows Type 4			3.62	x1/[1/(1.3)+ 0.04]	= 4.47		(27)
Windows Type 5			0.81	x1/[1/(1.3)+ 0.04]	= 1		(27)
Windows Type 6			0.48	x1/[1/(1.3)+ 0.04]	= 0.59		(27)
Floor			2.74	x 0.2	= 0.548		(28)
Walls Type1	20.34	2.1	18.24	x 0.13	= 2.42		(29)
Walls Type2	78.25	14.42	63.83	x 0.14	= 8.94		(29)
Roof	2.74	0	2.74	x 0.2	= 0.55		(30)
Total area of elements, m²			104.07				(31)
Party floor			72.54				(32a)
Party ceiling			72.54				(32b)

* for windows and roof windows, use effective window U-value calculated using formula 1/[1/(U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 33.21 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 28729.96 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

19.54 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

52.75 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	18.22	18.01	17.8	16.74	16.53	15.47	15.47	15.26	15.89	16.53	16.95	17.37

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	70.97	70.76	70.55	69.49	69.28	68.22	68.22	68.01	68.64	69.28	69.7	70.12
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Average = Sum(39)_{1...12} /12=

69.44 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	0.98	0.98	0.97	0.96	0.96	0.94	0.94	0.94	0.95	0.96	0.96	0.97
--------	------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} /12=

0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.31

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.95

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Total = Sum(44)_{1...12} =

1067.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
--------	-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

Total = Sum(45)_{1...12} =

1399.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

1.03
1.03

(54)
 Enter (50) or (54) in (55) (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

200.38	176.83	186.23	167.66	164.83	148.03	142.88	155.8	155.21	173.82	182.9	195.8
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

200.38	176.83	186.23	167.66	164.83	148.03	142.88	155.8	155.21	173.82	182.9	195.8
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------

(64)

Output from water heater (annual)_{1...12}

2050.37

Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

92.47	82.14	87.76	80.76	80.65	74.23	73.35	77.64	76.62	83.64	85.82	90.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.24	16.2	13.18	9.98	7.46	6.3	6.8	8.84	11.87	15.07	17.59	18.75
-------	------	-------	------	------	-----	-----	------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

124.28	122.23	117.96	112.16	108.4	103.09	98.59	104.36	106.41	112.42	119.2	122.24
--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	-------	--------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

403.16	401.18	388.58	368.27	347.72	327.84	314.88	320.59	330.97	351.48	375.05	392.67
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(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.5	x	0.7	=	3.71 (74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.5	x	0.7	=	7.1 (74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.5	x	0.7	=	12.06 (74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.5	x	0.7	=	19.37 (74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.5	x	0.7	=	26.1 (74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.5	x	0.7	=	27.94 (74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.5	x	0.7	=	26.08 (74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.5	x	0.7	=	20.69 (74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.5	x	0.7	=	14.5 (74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.5	x	0.7	=	8.45 (74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.5	x	0.7	=	4.58 (74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.5	x	0.7	=	3.1 (74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.5	x	0.7	=	22.44 (76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.5	x	0.7	=	43.89 (76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.5	x	0.7	=	72.28 (76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.5	x	0.7	=	105.42 (76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.5	x	0.7	=	129.2 (76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.5	x	0.7	=	132.26 (76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.5	x	0.7	=	125.91 (76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.5	x	0.7	=	108.16 (76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.5	x	0.7	=	84.07 (76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.5	x	0.7	=	52.08 (76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.5	x	0.7	=	27.98 (76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.5	x	0.7	=	18.45 (76)
South	0.9x	0.77	x	0.81	x	46.75	x	0.5	x	0.7	=	9.19 (78)
South	0.9x	0.77	x	0.48	x	46.75	x	0.5	x	0.7	=	16.33 (78)
South	0.9x	0.77	x	0.81	x	76.57	x	0.5	x	0.7	=	15.04 (78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.5	x	0.7	=	26.74 (78)
South	0.9x	0.77	x	0.81	x	97.53	x	0.5	x	0.7	=	19.16 (78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.5	x	0.7	=	34.07 (78)
South	0.9x	0.77	x	0.81	x	110.23	x	0.5	x	0.7	=	21.66 (78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.5	x	0.7	=	38.5 (78)
South	0.9x	0.77	x	0.81	x	114.87	x	0.5	x	0.7	=	22.57 (78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.5	x	0.7	=	40.12 (78)
South	0.9x	0.77	x	0.81	x	110.55	x	0.5	x	0.7	=	21.72 (78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.5	x	0.7	=	38.61 (78)
South	0.9x	0.77	x	0.81	x	108.01	x	0.5	x	0.7	=	21.22 (78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.5	x	0.7	=	37.73 (78)
South	0.9x	0.77	x	0.81	x	104.89	x	0.5	x	0.7	=	20.61 (78)

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South	0.9x	0.77	x	0.48	x	104.89	x	0.5	x	0.7	=	36.64	(78)
South	0.9x	0.77	x	0.81	x	101.89	x	0.5	x	0.7	=	20.02	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.5	x	0.7	=	35.59	(78)
South	0.9x	0.77	x	0.81	x	82.59	x	0.5	x	0.7	=	16.23	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.5	x	0.7	=	28.84	(78)
South	0.9x	0.77	x	0.81	x	55.42	x	0.5	x	0.7	=	10.89	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.5	x	0.7	=	19.36	(78)
South	0.9x	0.77	x	0.81	x	40.4	x	0.5	x	0.7	=	7.94	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.5	x	0.7	=	14.11	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	11.43	(80)
West	0.9x	0.77	x	3.62	x	19.64	x	0.5	x	0.7	=	17.24	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	22.37	(80)
West	0.9x	0.77	x	3.62	x	38.42	x	0.5	x	0.7	=	33.73	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	36.83	(80)
West	0.9x	0.77	x	3.62	x	63.27	x	0.5	x	0.7	=	55.56	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	53.72	(80)
West	0.9x	0.77	x	3.62	x	92.28	x	0.5	x	0.7	=	81.02	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	65.83	(80)
West	0.9x	0.77	x	3.62	x	113.09	x	0.5	x	0.7	=	99.3	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	67.39	(80)
West	0.9x	0.77	x	3.62	x	115.77	x	0.5	x	0.7	=	101.65	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	64.16	(80)
West	0.9x	0.77	x	3.62	x	110.22	x	0.5	x	0.7	=	96.78	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	55.11	(80)
West	0.9x	0.77	x	3.62	x	94.68	x	0.5	x	0.7	=	83.13	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	42.84	(80)
West	0.9x	0.77	x	3.62	x	73.59	x	0.5	x	0.7	=	64.61	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	26.54	(80)
West	0.9x	0.77	x	3.62	x	45.59	x	0.5	x	0.7	=	40.03	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	14.26	(80)
West	0.9x	0.77	x	3.62	x	24.49	x	0.5	x	0.7	=	21.5	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	9.4	(80)
West	0.9x	0.77	x	3.62	x	16.15	x	0.5	x	0.7	=	14.18	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 80.34 148.88 229.96 319.7 383.12 389.57 371.88 324.34 261.62 172.17 98.56 67.18 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 483.51 550.05 618.54 687.97 730.83 717.41 686.76 644.92 592.6 523.65 473.61 459.84 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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DER WorkSheet: New dwelling design stage

(86)m=	1	0.99	0.98	0.92	0.8	0.6	0.44	0.48	0.74	0.95	0.99	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.21	20.44	20.72	20.92	20.99	21	21	20.96	20.7	20.33	20.04	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.11	20.12	20.12	20.13	20.13	20.14	20.13	20.12	20.12	20.11	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.52	0.35	0.39	0.67	0.93	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.85	19.06	19.4	19.8	20.04	20.12	20.13	20.13	20.1	19.78	19.25	18.82	(90)
--------	-------	-------	------	------	-------	-------	-------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.37	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.3	19.49	19.79	20.15	20.37	20.45	20.45	20.46	20.42	20.13	19.65	19.27	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.3	19.49	19.79	20.15	20.37	20.45	20.45	20.46	20.42	20.13	19.65	19.27	(93)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.9	0.76	0.55	0.38	0.43	0.7	0.93	0.99	1	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	480.62	543.04	598.1	620.62	554.5	393.25	262.42	274.78	412.66	488.45	467.4	457.73	(95)
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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)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1064.47	1032.23	937.41	781.57	600.43	398.82	262.97	275.81	433.56	659.93	875.06	1056.98	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	434.38	328.74	252.44	115.88	34.17	0	0	0	0	127.58	293.52	445.84	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2032.55	(98)
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Space heating requirement in kWh/m²/year

28.04	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
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Fraction of space heat from community system 1 – (301) =

1	(302)
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The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump

1	(303a)
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Fraction of heat from Community heat pump (Water)

0.8	(303a)
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Fraction of community heat from heat source 2 (Water)

0.2	(303b)
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Fraction of total space heat from Community heat pump

(302) x (303a) =	1	(304a)
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Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
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DER WorkSheet: New dwelling design stage

Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Distribution loss factor (Table 12c) for community heating system (Water)		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		2032.55	
Space heat from Community heat pump	$(98) \times (304a) \times (305) \times (306) =$	2134.18	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2050.37	
If DHW from community scheme:			
Water heat from CHP (Water)	$(64) \times (303a) \times (305) \times (306) =$	1722.31	(310a)
Water heat from heat source 2 (Water)	$(64) \times (303a) \times (305) \times (306) =$	430.58	(310b)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	21.34	(313)
Electricity used for heat distribution (Water)	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	21.53	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		149.43	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	149.43	(331)
Energy for lighting (calculated in Appendix L)		322.14	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-1139.98	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	$\text{If there is CHP using two fuels repeat (363) to (366) for the second fuel}$		290 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 381.94 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 11.08 (372)
Water heating from separate community system			
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	$\text{If there is CHP using two fuels repeat (363) to (366) for the second fuel}$		290 (367a)
Efficiency of heat source 2 (%)	$\text{If there is CHP using two fuels repeat (363) to (366) for the second fuel}$		100 (367b)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	= 308.23 (367)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 223.47 (368)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 11.17 (372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)...(366) + (368)...(372)	=	935.9	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		935.9	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	77.55 (378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	167.19 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-591.65 (380)
Total CO2, kg/year	sum of (376)...(382) =		588.99	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =		8.12	(384)
EI rating (section 14)			93.28	(385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.7

Property Address: Unit 5 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a) x	2.55 (2a) =	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>		0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 2			0.48	x1/[1/(1.3)+ 0.04]	= 0.59		(27)
Windows Type 3			1.57	x1/[1/(1.3)+ 0.04]	= 1.94		(27)
Windows Type 4			0.81	x1/[1/(1.3)+ 0.04]	= 1		(27)
Windows Type 5			1.56	x1/[1/(1.3)+ 0.04]	= 1.93		(27)
Windows Type 6			7.23	x1/[1/(1.3)+ 0.04]	= 8.93		(27)
Windows Type 7			0.48	x1/[1/(1.3)+ 0.04]	= 0.59		(27)
Floor			0.91	x 0.2	= 0.182		(28)
Walls Type1	73.79	16.13	57.66	x 0.13	= 7.61		(29)
Walls Type2	20.5	2.1	18.4	x 0.14	= 2.58		(29)
Roof Type1	0.91	0	0.91	x 0.2	= 0.18		(30)
Roof Type2	72.5	0	72.5	x 0.11	= 7.97		(30)
Total area of elements, m²			168.61				(31)
Party floor			72.5				(32a)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 20930.29 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

23.35 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

64.75 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	18.22	18.01	17.8	16.74	16.53	15.47	15.47	15.26	15.89	16.53	16.95	17.37

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	82.97	82.76	82.55	81.49	81.28	80.22	80.22	80.01	80.64	81.28	81.7	82.13
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

Average = Sum(39)_{1...12} /12=

81.44 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	1.14	1.14	1.14	1.12	1.12	1.11	1.11	1.1	1.11	1.12	1.13	1.13
--------	------	------	------	------	------	------	------	-----	------	------	------	------

Average = Sum(40)_{1...12} /12=

1.12 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.31

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.95

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Total = Sum(44)_{1...12} =

1067.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
--------	-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

Total = Sum(45)_{1...12} =

1399.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

1.03
1.03

(54)
 Enter (50) or (54) in (55) (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

200.38	176.83	186.23	167.66	164.83	148.03	142.88	155.8	155.21	173.82	182.9	195.8
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

200.38	176.83	186.23	167.66	164.83	148.03	142.88	155.8	155.21	173.82	182.9	195.8
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------

(64)
Output from water heater (annual)_{1...12}

2050.37

Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

92.47	82.14	87.76	80.76	80.65	74.23	73.35	77.64	76.62	83.64	85.82	90.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.1	16.08	13.08	9.9	7.4	6.25	6.75	8.78	11.78	14.95	17.45	18.61
------	-------	-------	-----	-----	------	------	------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

124.28	122.23	117.96	112.16	108.4	103.09	98.59	104.36	106.41	112.42	119.2	122.24
--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	-------	--------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

403.03	401.06	388.48	368.19	347.66	327.79	314.83	320.52	330.89	351.37	374.92	392.52
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.5	x	0.7	=	1.24 (74)
North	0.9x	0.77	x	1.56	x	10.63	x	0.5	x	0.7	=	4.02 (74)
North	0.9x	0.77	x	7.23	x	10.63	x	0.5	x	0.7	=	18.65 (74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.5	x	0.7	=	2.37 (74)
North	0.9x	0.77	x	1.56	x	20.32	x	0.5	x	0.7	=	7.69 (74)
North	0.9x	0.77	x	7.23	x	20.32	x	0.5	x	0.7	=	35.64 (74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.5	x	0.7	=	4.02 (74)
North	0.9x	0.77	x	1.56	x	34.53	x	0.5	x	0.7	=	13.07 (74)
North	0.9x	0.77	x	7.23	x	34.53	x	0.5	x	0.7	=	60.55 (74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.5	x	0.7	=	6.46 (74)
North	0.9x	0.77	x	1.56	x	55.46	x	0.5	x	0.7	=	20.99 (74)
North	0.9x	0.77	x	7.23	x	55.46	x	0.5	x	0.7	=	97.26 (74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.5	x	0.7	=	8.7 (74)
North	0.9x	0.77	x	1.56	x	74.72	x	0.5	x	0.7	=	28.27 (74)
North	0.9x	0.77	x	7.23	x	74.72	x	0.5	x	0.7	=	131.02 (74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.5	x	0.7	=	9.31 (74)
North	0.9x	0.77	x	1.56	x	79.99	x	0.5	x	0.7	=	30.26 (74)
North	0.9x	0.77	x	7.23	x	79.99	x	0.5	x	0.7	=	140.27 (74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.5	x	0.7	=	8.69 (74)
North	0.9x	0.77	x	1.56	x	74.68	x	0.5	x	0.7	=	28.26 (74)
North	0.9x	0.77	x	7.23	x	74.68	x	0.5	x	0.7	=	130.96 (74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.5	x	0.7	=	6.9 (74)
North	0.9x	0.77	x	1.56	x	59.25	x	0.5	x	0.7	=	22.42 (74)
North	0.9x	0.77	x	7.23	x	59.25	x	0.5	x	0.7	=	103.9 (74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.5	x	0.7	=	4.83 (74)
North	0.9x	0.77	x	1.56	x	41.52	x	0.5	x	0.7	=	15.71 (74)
North	0.9x	0.77	x	7.23	x	41.52	x	0.5	x	0.7	=	72.8 (74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.5	x	0.7	=	2.82 (74)
North	0.9x	0.77	x	1.56	x	24.19	x	0.5	x	0.7	=	9.15 (74)
North	0.9x	0.77	x	7.23	x	24.19	x	0.5	x	0.7	=	42.42 (74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.5	x	0.7	=	1.53 (74)
North	0.9x	0.77	x	1.56	x	13.12	x	0.5	x	0.7	=	4.96 (74)
North	0.9x	0.77	x	7.23	x	13.12	x	0.5	x	0.7	=	23 (74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.5	x	0.7	=	1.03 (74)
North	0.9x	0.77	x	1.56	x	8.86	x	0.5	x	0.7	=	3.35 (74)
North	0.9x	0.77	x	7.23	x	8.86	x	0.5	x	0.7	=	15.55 (74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.5	x	0.7	=	7.48 (76)
East	0.9x	0.77	x	0.81	x	19.64	x	0.5	x	0.7	=	3.86 (76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.5	x	0.7	=	14.63 (76)

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East	0.9x	0.77	x	0.81	x	38.42	x	0.5	x	0.7	=	7.55	(76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.5	x	0.7	=	24.09	(76)
East	0.9x	0.77	x	0.81	x	63.27	x	0.5	x	0.7	=	12.43	(76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.5	x	0.7	=	35.14	(76)
East	0.9x	0.77	x	0.81	x	92.28	x	0.5	x	0.7	=	18.13	(76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.5	x	0.7	=	43.07	(76)
East	0.9x	0.77	x	0.81	x	113.09	x	0.5	x	0.7	=	22.22	(76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.5	x	0.7	=	44.09	(76)
East	0.9x	0.77	x	0.81	x	115.77	x	0.5	x	0.7	=	22.74	(76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.5	x	0.7	=	41.97	(76)
East	0.9x	0.77	x	0.81	x	110.22	x	0.5	x	0.7	=	21.65	(76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.5	x	0.7	=	36.05	(76)
East	0.9x	0.77	x	0.81	x	94.68	x	0.5	x	0.7	=	18.6	(76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.5	x	0.7	=	28.02	(76)
East	0.9x	0.77	x	0.81	x	73.59	x	0.5	x	0.7	=	14.46	(76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.5	x	0.7	=	17.36	(76)
East	0.9x	0.77	x	0.81	x	45.59	x	0.5	x	0.7	=	8.96	(76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.5	x	0.7	=	9.33	(76)
East	0.9x	0.77	x	0.81	x	24.49	x	0.5	x	0.7	=	4.81	(76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.5	x	0.7	=	6.15	(76)
East	0.9x	0.77	x	0.81	x	16.15	x	0.5	x	0.7	=	3.17	(76)
South	0.9x	0.77	x	0.48	x	46.75	x	0.5	x	0.7	=	5.44	(78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.5	x	0.7	=	8.91	(78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.5	x	0.7	=	11.36	(78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.5	x	0.7	=	12.83	(78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.5	x	0.7	=	13.37	(78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.5	x	0.7	=	12.87	(78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.5	x	0.7	=	12.58	(78)
South	0.9x	0.77	x	0.48	x	104.89	x	0.5	x	0.7	=	12.21	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.5	x	0.7	=	11.86	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.5	x	0.7	=	9.61	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.5	x	0.7	=	6.45	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.5	x	0.7	=	4.7	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	19.05	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	37.28	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	61.39	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	89.53	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	109.72	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	112.32	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	106.93	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	91.85	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	71.4	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	44.23	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	23.76	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	15.67	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	59.74	114.06	186.91	280.34	356.37	371.86	351.04	291.93	219.09	134.55	73.84	49.63	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	462.77	515.11	575.38	648.54	704.03	699.66	665.87	612.45	549.97	485.92	448.76	442.15	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.87	0.69	0.52	0.58	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.8	19.94	20.18	20.52	20.81	20.96	20.99	20.99	20.88	20.52	20.1	19.78	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.97	19.97	19.98	19.98	20	20	20	19.99	19.98	19.98	19.97	(88)
--------	-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.82	0.6	0.41	0.47	0.77	0.96	0.99	1	(89)
--------	---	------	------	------	------	-----	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.37	18.57	18.93	19.42	19.8	19.97	19.99	19.99	19.89	19.42	18.82	18.35	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.37

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.08	19.4	19.83	20.17	20.34	20.36	20.36	20.26	19.83	19.3	18.88	(92)
--------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.08	19.4	19.83	20.17	20.34	20.36	20.36	20.26	19.83	19.3	18.88	(93)
--------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.83	0.63	0.45	0.51	0.79	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	460.54	510.58	563.39	608	582.62	440.8	299.26	311.94	435.76	466.08	444.54	440.45	(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=	1211.78	1173.45	1064.65	890.93	688.77	460.21	302.02	317.02	496.79	750.07	996.76	1205.73	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	558.92	445.45	372.94	203.71	78.98	0	0	0	0	211.29	397.6	569.37	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2838.25

Space heating requirement in kWh/m²/year

39.15

(99)

DER WorkSheet: New dwelling design stage

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0 (301)

Fraction of space heat from community system 1 – (301) =

1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump

1 (303a)

Fraction of heat from Community heat pump (Water)

0.8 (303a)

Fraction of community heat from heat source 2 (Water)

0.2 (303b)

Fraction of total space heat from Community heat pump

(302) x (303a) =

1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system

1 (305)

Distribution loss factor (Table 12c) for community heating system

1.05 (306)

Distribution loss factor (Table 12c) for community heating system (Water)

1.05 (306)

Space heating

Annual space heating requirement

kWh/year

2838.25

Space heat from Community heat pump

(98) x (304a) x (305) x (306) =

2980.16 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)

0 (308)

Space heating requirement from secondary/supplementary system

(98) x (301) x 100 ÷ (308) =

0 (309)

Water heating

Annual water heating requirement

2050.37

If DHW from community scheme:

Water heat from CHP (Water)

(64) x (303a) x (305) x (306) =

1722.31 (310a)

Water heat from heat source 2 (Water)

(64) x (303a) x (305) x (306) =

430.58 (310b)

Electricity used for heat distribution

0.01 x [(307a)...(307e) + (310a)...(310e)] =

29.8 (313)

Electricity used for heat distribution (Water)

0.01 x [(307a)...(307e) + (310a)...(310e)] =

21.53 (313)

Cooling System Energy Efficiency Ratio

0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0)

= (107) ÷ (314) =

0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside

149.43 (330a)

warm air heating system fans

0 (330b)

pump for solar water heating

0 (330g)

Total electricity for the above, kWh/year

=(330a) + (330b) + (330g) =

149.43 (331)

Energy for lighting (calculated in Appendix L)

319.72 (332)

Electricity generated by PVs (Appendix M) (negative quantity)

-1139.98 (333)

Electricity generated by wind turbine (Appendix M) (negative quantity)

0 (334)

12b. CO2 Emissions – Community heating scheme

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
--------------------	-------------------------------	--------------------------

DER WorkSheet: New dwelling design stage

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 290 (367a)

CO2 associated with heat source 1 $[(307b)+(310b)] \times 100 \div (367b) \times$ 0.52 = 533.35 (367)

Electrical energy for heat distribution $[(313) \times$ 0.52 = 15.47 (372)

Water heating from separate community system

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 290 (367a)

Efficiency of heat source 2 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel 100 (367b)

CO2 associated with heat source 1 $[(307b)+(310b)] \times 100 \div (367b) \times$ 0 = 308.23 (367)

CO2 associated with heat source 2 $[(307b)+(310b)] \times 100 \div (367b) \times$ 0.52 = 223.47 (368)

Electrical energy for heat distribution $[(313) \times$ 0.52 = 11.17 (372)

Total CO2 associated with community systems $(363)...(366) + (368)...(372)$ = 1091.69 (373)

CO2 associated with space heating (secondary) $(309) \times$ 0 = 0 (374)

CO2 associated with water from immersion heater or instantaneous heater $(312) \times$ 0.52 = 0 (375)

Total CO2 associated with space and water heating $(373) + (374) + (375) =$ 1091.69 (376)

CO2 associated with electricity for pumps and fans within dwelling $(331) \times$ 0.52 = 77.55 (378)

CO2 associated with electricity for lighting $(332)) \times$ 0.52 = 165.93 (379)

Energy saving/generation technologies (333) to (334) as applicable
Item 1

0.52 $\times 0.01 =$ -591.65 (380)

Total CO2, kg/year $\text{sum of } (376)...(382) =$ 743.53 (383)

Dwelling CO2 Emission Rate $(383) \div (4) =$ 10.26 (384)

EI rating (section 14) 91.52 (385)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Chris Hocknell **Stroma Number:** STRO016363
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.7

Property Address: Unit 6 - Block 2

Address : , London, N15 5AR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.5 (1a) x	2.55 (2a) =	184.87 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.87 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>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</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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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DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [1 - (23c) ÷ 100]

(24a)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.3 0.3 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.28 0.28 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.1	x 1.4	= 2.94		(26)
Windows Type 1			0.8	x 1/[1/(1.3)+ 0.04]	= 0.99		(27)
Windows Type 2			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Windows Type 3			1.57	x 1/[1/(1.3)+ 0.04]	= 1.94		(27)
Windows Type 4			3.62	x 1/[1/(1.3)+ 0.04]	= 4.47		(27)
Windows Type 5			0.81	x 1/[1/(1.3)+ 0.04]	= 1		(27)
Windows Type 6			0.48	x 1/[1/(1.3)+ 0.04]	= 0.59		(27)
Floor			2.74	x 0.2	= 0.548		(28)
Walls Type1	20.34	2.1	18.24	x 0.13	= 2.41		(29)
Walls Type2	78.25	14.42	63.83	x 0.14	= 8.94		(29)
Roof Type1	2.74	0	2.74	x 0.2	= 0.55		(30)
Roof Type2	72.54	0	72.54	x 0.11	= 7.98		(30)
Total area of elements, m²			176.61				(31)
Party floor			72.54				(32a)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 41.18 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 22128.82 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

26.4 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss

(33) + (36) =

67.58 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	18.22	18.01	17.8	16.74	16.53	15.47	15.47	15.26	15.89	16.53	16.95	17.37

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	85.8	85.59	85.38	84.32	84.11	83.05	83.05	82.84	83.48	84.11	84.53	84.96
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Average = Sum(39)_{1...12} / 12 =

84.27 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=	1.18	1.18	1.18	1.16	1.16	1.15	1.15	1.14	1.15	1.16	1.17	1.17
--------	------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} / 12 =

1.16 (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

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

2.31

(42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

88.95

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.84	94.29	90.73	87.17	83.61	80.05	80.05	83.61	87.17	90.73	94.29	97.84
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Total = Sum(44)_{1...12} =

1067.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	145.1	126.91	130.96	114.17	109.55	94.53	87.6	100.52	101.72	118.55	129.4	140.52
--------	-------	--------	--------	--------	--------	-------	------	--------	--------	--------	-------	--------

Total = Sum(45)_{1...12} =

1399.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.77	19.04	19.64	17.13	16.43	14.18	13.14	15.08	15.26	17.78	19.41	21.08
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(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

110

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0.02

(51)

If community heating see section 4.3

Volume factor from Table 2a

1.03

(52)

Temperature factor from Table 2b

0.6

(53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

1.03
1.03

(54)
 Enter (50) or (54) in (55) (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(57)

Primary circuit loss (annual) from Table 3

0

(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (41)m

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0
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(61)

Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

200.38	176.83	186.23	167.66	164.83	148.03	142.88	155.8	155.21	173.82	182.9	195.8
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(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=

200.38	176.83	186.23	167.66	164.83	148.03	142.88	155.8	155.21	173.82	182.9	195.8
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	-------

(64)
Output from water heater (annual)_{1...12}

2050.37

Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

92.47	82.14	87.76	80.76	80.65	74.23	73.35	77.64	76.62	83.64	85.82	90.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26	115.26

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

18.24	16.2	13.18	9.98	7.46	6.3	6.8	8.84	11.87	15.07	17.59	18.75
-------	------	-------	------	------	-----	-----	------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

203.06	205.17	199.86	188.55	174.28	160.87	151.91	149.81	155.12	166.42	180.69	194.1
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21	-92.21
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

124.28	122.23	117.96	112.16	108.4	103.09	98.59	104.36	106.41	112.42	119.2	122.24
--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	-------	--------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

403.16	401.18	388.58	368.27	347.72	327.84	314.88	320.59	330.97	351.48	375.05	392.67
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.48	x	10.63	x	0.5	x	0.7	=	3.71 (74)
North	0.9x	0.77	x	0.48	x	20.32	x	0.5	x	0.7	=	7.1 (74)
North	0.9x	0.77	x	0.48	x	34.53	x	0.5	x	0.7	=	12.06 (74)
North	0.9x	0.77	x	0.48	x	55.46	x	0.5	x	0.7	=	19.37 (74)
North	0.9x	0.77	x	0.48	x	74.72	x	0.5	x	0.7	=	26.1 (74)
North	0.9x	0.77	x	0.48	x	79.99	x	0.5	x	0.7	=	27.94 (74)
North	0.9x	0.77	x	0.48	x	74.68	x	0.5	x	0.7	=	26.08 (74)
North	0.9x	0.77	x	0.48	x	59.25	x	0.5	x	0.7	=	20.69 (74)
North	0.9x	0.77	x	0.48	x	41.52	x	0.5	x	0.7	=	14.5 (74)
North	0.9x	0.77	x	0.48	x	24.19	x	0.5	x	0.7	=	8.45 (74)
North	0.9x	0.77	x	0.48	x	13.12	x	0.5	x	0.7	=	4.58 (74)
North	0.9x	0.77	x	0.48	x	8.86	x	0.5	x	0.7	=	3.1 (74)
East	0.9x	0.77	x	1.57	x	19.64	x	0.5	x	0.7	=	22.44 (76)
East	0.9x	0.77	x	1.57	x	38.42	x	0.5	x	0.7	=	43.89 (76)
East	0.9x	0.77	x	1.57	x	63.27	x	0.5	x	0.7	=	72.28 (76)
East	0.9x	0.77	x	1.57	x	92.28	x	0.5	x	0.7	=	105.42 (76)
East	0.9x	0.77	x	1.57	x	113.09	x	0.5	x	0.7	=	129.2 (76)
East	0.9x	0.77	x	1.57	x	115.77	x	0.5	x	0.7	=	132.26 (76)
East	0.9x	0.77	x	1.57	x	110.22	x	0.5	x	0.7	=	125.91 (76)
East	0.9x	0.77	x	1.57	x	94.68	x	0.5	x	0.7	=	108.16 (76)
East	0.9x	0.77	x	1.57	x	73.59	x	0.5	x	0.7	=	84.07 (76)
East	0.9x	0.77	x	1.57	x	45.59	x	0.5	x	0.7	=	52.08 (76)
East	0.9x	0.77	x	1.57	x	24.49	x	0.5	x	0.7	=	27.98 (76)
East	0.9x	0.77	x	1.57	x	16.15	x	0.5	x	0.7	=	18.45 (76)
South	0.9x	0.77	x	0.81	x	46.75	x	0.5	x	0.7	=	9.19 (78)
South	0.9x	0.77	x	0.48	x	46.75	x	0.5	x	0.7	=	16.33 (78)
South	0.9x	0.77	x	0.81	x	76.57	x	0.5	x	0.7	=	15.04 (78)
South	0.9x	0.77	x	0.48	x	76.57	x	0.5	x	0.7	=	26.74 (78)
South	0.9x	0.77	x	0.81	x	97.53	x	0.5	x	0.7	=	19.16 (78)
South	0.9x	0.77	x	0.48	x	97.53	x	0.5	x	0.7	=	34.07 (78)
South	0.9x	0.77	x	0.81	x	110.23	x	0.5	x	0.7	=	21.66 (78)
South	0.9x	0.77	x	0.48	x	110.23	x	0.5	x	0.7	=	38.5 (78)
South	0.9x	0.77	x	0.81	x	114.87	x	0.5	x	0.7	=	22.57 (78)
South	0.9x	0.77	x	0.48	x	114.87	x	0.5	x	0.7	=	40.12 (78)
South	0.9x	0.77	x	0.81	x	110.55	x	0.5	x	0.7	=	21.72 (78)
South	0.9x	0.77	x	0.48	x	110.55	x	0.5	x	0.7	=	38.61 (78)
South	0.9x	0.77	x	0.81	x	108.01	x	0.5	x	0.7	=	21.22 (78)
South	0.9x	0.77	x	0.48	x	108.01	x	0.5	x	0.7	=	37.73 (78)
South	0.9x	0.77	x	0.81	x	104.89	x	0.5	x	0.7	=	20.61 (78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	0.48	x	104.89	x	0.5	x	0.7	=	36.64	(78)
South	0.9x	0.77	x	0.81	x	101.89	x	0.5	x	0.7	=	20.02	(78)
South	0.9x	0.77	x	0.48	x	101.89	x	0.5	x	0.7	=	35.59	(78)
South	0.9x	0.77	x	0.81	x	82.59	x	0.5	x	0.7	=	16.23	(78)
South	0.9x	0.77	x	0.48	x	82.59	x	0.5	x	0.7	=	28.84	(78)
South	0.9x	0.77	x	0.81	x	55.42	x	0.5	x	0.7	=	10.89	(78)
South	0.9x	0.77	x	0.48	x	55.42	x	0.5	x	0.7	=	19.36	(78)
South	0.9x	0.77	x	0.81	x	40.4	x	0.5	x	0.7	=	7.94	(78)
South	0.9x	0.77	x	0.48	x	40.4	x	0.5	x	0.7	=	14.11	(78)
West	0.9x	0.77	x	0.8	x	19.64	x	0.5	x	0.7	=	11.43	(80)
West	0.9x	0.77	x	3.62	x	19.64	x	0.5	x	0.7	=	17.24	(80)
West	0.9x	0.77	x	0.8	x	38.42	x	0.5	x	0.7	=	22.37	(80)
West	0.9x	0.77	x	3.62	x	38.42	x	0.5	x	0.7	=	33.73	(80)
West	0.9x	0.77	x	0.8	x	63.27	x	0.5	x	0.7	=	36.83	(80)
West	0.9x	0.77	x	3.62	x	63.27	x	0.5	x	0.7	=	55.56	(80)
West	0.9x	0.77	x	0.8	x	92.28	x	0.5	x	0.7	=	53.72	(80)
West	0.9x	0.77	x	3.62	x	92.28	x	0.5	x	0.7	=	81.02	(80)
West	0.9x	0.77	x	0.8	x	113.09	x	0.5	x	0.7	=	65.83	(80)
West	0.9x	0.77	x	3.62	x	113.09	x	0.5	x	0.7	=	99.3	(80)
West	0.9x	0.77	x	0.8	x	115.77	x	0.5	x	0.7	=	67.39	(80)
West	0.9x	0.77	x	3.62	x	115.77	x	0.5	x	0.7	=	101.65	(80)
West	0.9x	0.77	x	0.8	x	110.22	x	0.5	x	0.7	=	64.16	(80)
West	0.9x	0.77	x	3.62	x	110.22	x	0.5	x	0.7	=	96.78	(80)
West	0.9x	0.77	x	0.8	x	94.68	x	0.5	x	0.7	=	55.11	(80)
West	0.9x	0.77	x	3.62	x	94.68	x	0.5	x	0.7	=	83.13	(80)
West	0.9x	0.77	x	0.8	x	73.59	x	0.5	x	0.7	=	42.84	(80)
West	0.9x	0.77	x	3.62	x	73.59	x	0.5	x	0.7	=	64.61	(80)
West	0.9x	0.77	x	0.8	x	45.59	x	0.5	x	0.7	=	26.54	(80)
West	0.9x	0.77	x	3.62	x	45.59	x	0.5	x	0.7	=	40.03	(80)
West	0.9x	0.77	x	0.8	x	24.49	x	0.5	x	0.7	=	14.26	(80)
West	0.9x	0.77	x	3.62	x	24.49	x	0.5	x	0.7	=	21.5	(80)
West	0.9x	0.77	x	0.8	x	16.15	x	0.5	x	0.7	=	9.4	(80)
West	0.9x	0.77	x	3.62	x	16.15	x	0.5	x	0.7	=	14.18	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 80.34 148.88 229.96 319.7 383.12 389.57 371.88 324.34 261.62 172.17 98.56 67.18 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m= 483.51 550.05 618.54 687.97 730.83 717.41 686.76 644.92 592.6 523.65 473.61 459.84 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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DER WorkSheet: New dwelling design stage

(86)m=	1	0.99	0.98	0.95	0.86	0.69	0.52	0.57	0.82	0.97	0.99	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.93	20.19	20.53	20.8	20.95	20.99	20.99	20.88	20.52	20.09	19.75	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.94	19.94	19.95	19.95	19.96	19.97	19.96	19.95	19.95	19.94	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.81	0.6	0.4	0.45	0.75	0.95	0.99	1	(89)
--------	---	------	------	------	------	-----	-----	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.31	18.54	18.91	19.4	19.76	19.93	19.96	19.96	19.87	19.41	18.78	18.28	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.37	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.86	19.05	19.39	19.82	20.15	20.31	20.34	20.34	20.25	19.82	19.27	18.83	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.86	19.05	19.39	19.82	20.15	20.31	20.34	20.34	20.25	19.82	19.27	18.83	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.93	0.82	0.63	0.45	0.5	0.77	0.95	0.99	1	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	480.7	543.83	602.19	638.57	600.11	452.7	307.8	321.3	455.54	497.2	468.15	457.73	(95)
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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=	1249.04	1211.55	1100.41	920.66	710.55	474.48	310.96	326.56	513.15	775.73	1028.64	1242.79	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	571.65	448.7	370.68	203.1	82.17	0	0	0	0	207.23	403.55	584.09	(98)
--------	--------	-------	--------	-------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2871.17	(98)
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Space heating requirement in kWh/m²/year

39.6	(99)
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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none

0	(301)
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Fraction of space heat from community system 1 – (301) =

1	(302)
---	-------

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump

1	(303a)
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Fraction of heat from Community heat pump (Water)

0.8	(303a)
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Fraction of community heat from heat source 2 (Water)

0.2	(303b)
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Fraction of total space heat from Community heat pump

(302) x (303a) =	1	(304a)
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Factor for control and charging method (Table 4c(3)) for community heating system

1	(305)
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DER WorkSheet: New dwelling design stage

Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Distribution loss factor (Table 12c) for community heating system (Water)		1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		2871.17	
Space heat from Community heat pump	$(98) \times (304a) \times (305) \times (306) =$	3014.73	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308)
Space heating requirement from secondary/supplementary system	$(98) \times (301) \times 100 \div (308) =$	0	(309)
Water heating			
Annual water heating requirement		2050.37	
If DHW from community scheme:			
Water heat from CHP (Water)	$(64) \times (303a) \times (305) \times (306) =$	1722.31	(310a)
Water heat from heat source 2 (Water)	$(64) \times (303a) \times (305) \times (306) =$	430.58	(310b)
Electricity used for heat distribution	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	30.15	(313)
Electricity used for heat distribution (Water)	$0.01 \times [(307a) \dots (307e) + (310a) \dots (310e)] =$	21.53	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	$= (107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		149.43	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	$= (330a) + (330b) + (330g) =$	149.43	(331)
Energy for lighting (calculated in Appendix L)		322.14	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-1139.98	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		290 (367a)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 539.53 (367)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 15.65 (372)
Water heating from separate community system			
CO2 from other sources of space and water heating (not CHP)			
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		290 (367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel		100 (367b)
CO2 associated with heat source 1	$[(307b) + (310b)] \times 100 \div (367b) \times$	0	= 308.23 (367)
CO2 associated with heat source 2	$[(307b) + (310b)] \times 100 \div (367b) \times$	0.52	= 223.47 (368)
Electrical energy for heat distribution	$[(313) \times$	0.52	= 11.17 (372)

DER WorkSheet: New dwelling design stage

Total CO2 associated with community systems	(363)...(366) + (368)...(372)	=	1098.06	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0 (374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		1098.06	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	77.55 (378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	167.19 (379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-591.65 (380)
Total CO2, kg/year	sum of (376)...(382) =		751.15	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =		10.36	(384)
EI rating (section 14)			91.43	(385)