Sustainability & Energy Strategy Report

For the site of:
138-140 Highgate Road, Highgate, London NW5 1PB

For:
Design Ventures Highgate Limited

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Revision	-	*Rev A*	*Rev B*	
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Forecast cost estimates do not include such costs associated with any negotiations, appeals or other non-technical actions associated with the agreement on measures to meet the requirements of the authorities, nor are potential business loss and interruption costs considered that may be incurred as part of any technical measures.

Contents

1. Executive Summary

This Energy Statement demonstrates the predicted energy performance and carbon dioxide emissions of the proposed development at **138-140 Highgate Road, Highgate, London, NW5 1PB** based on the information provided by the design team. The development will comprise of 6 x 4 bedrooms residential units **within the London Borough of Camden.**

1.1. Policy Requirements

The Council requires new developments to incorporate sustainable design and construction measures. The table below summarises the local policy requirements for the proposed development.

Policies	Requirements	Compliance Check
London Plan 5.2 **Policy CC1**	An overall 19% reduction of carbon emissions over the Building Regulation levels (Part L 2013).	The development achieved an overall carbon reduction of 23.56% over Part L 2013 baseline via energy efficient measures and PV panels on the site.
London Policy 5.2 **Policy DP22**	Code for Sustainable Home (CSH) Level 4 Encourage CSH Level 6 (zero carbon) by 2016	As CSH was withdrawn by the government as of April 2015, a pre-assessment has not been provided as part of this report.

Table 1 Policy Requirements

1.2. Methodology and Strategies

The methodology used to determine the CO_2 emissions is in accordance with the London Plan's three-step Energy Hierarchy (Policy 5.2). The below table shows the Energy Hierarchy and suggested strategies for the proposed development.

Stages	Strategies
BE LEAN Energy efficient design	• U-values and air permeability better than Building Regulations Part L. • Accredited Construction Details for all junctions • Natural ventilation with extract fans in wet rooms • Low energy lights
BE CLEAN District heat networks or communal heating systems	N/A
BE GREEN On-site renewable technologies	• Individual Air Source Heat Pump for heating and hot water and PV panels of 5.67 kWp on the roof (approximate 18 panels with 315 w/p are required).

Table 2 Energy Hierarchy and suggested strategies

1.3. Assessment Results

After the application of all strategies based on the Energy Hierarchy, the regulated carbon dioxide emissions have been reduced as follows;

Energy Hierarchy		Carbon Emissions (tonnesCO_2/year)
		Regulated
BASELINE	TER set by Building Regulations 2013 Part L	17.27
BE LEAN	After energy demand reduction	13.41
BE CLEAN	After CHP/ Communal Heating	13.41
BE GREEN	After renewable energy	13.20

Table 3 Carbon Emissions after each stage of the proposed strategy

This carbon savings from each stage can be calculated based on the results above. The chart below summarises the total cumulative savings:

Energy Hierarchy		Regulated Carbon Savings	
		Tonnes CO_2/yr	%
BE LEAN	After energy demand reduction	3.86	22.35 %
BE CLEAN	After heat network/ CHP	0	0%
BE GREEN	After renewable energy	0.21	1.56%
Total Cumulative Savings		**4.07**	**23.56%**
Total Target Savings		3.28	19 %

Table 4 Carbon dioxide Emissions after each stage of the Energy Hierarchy

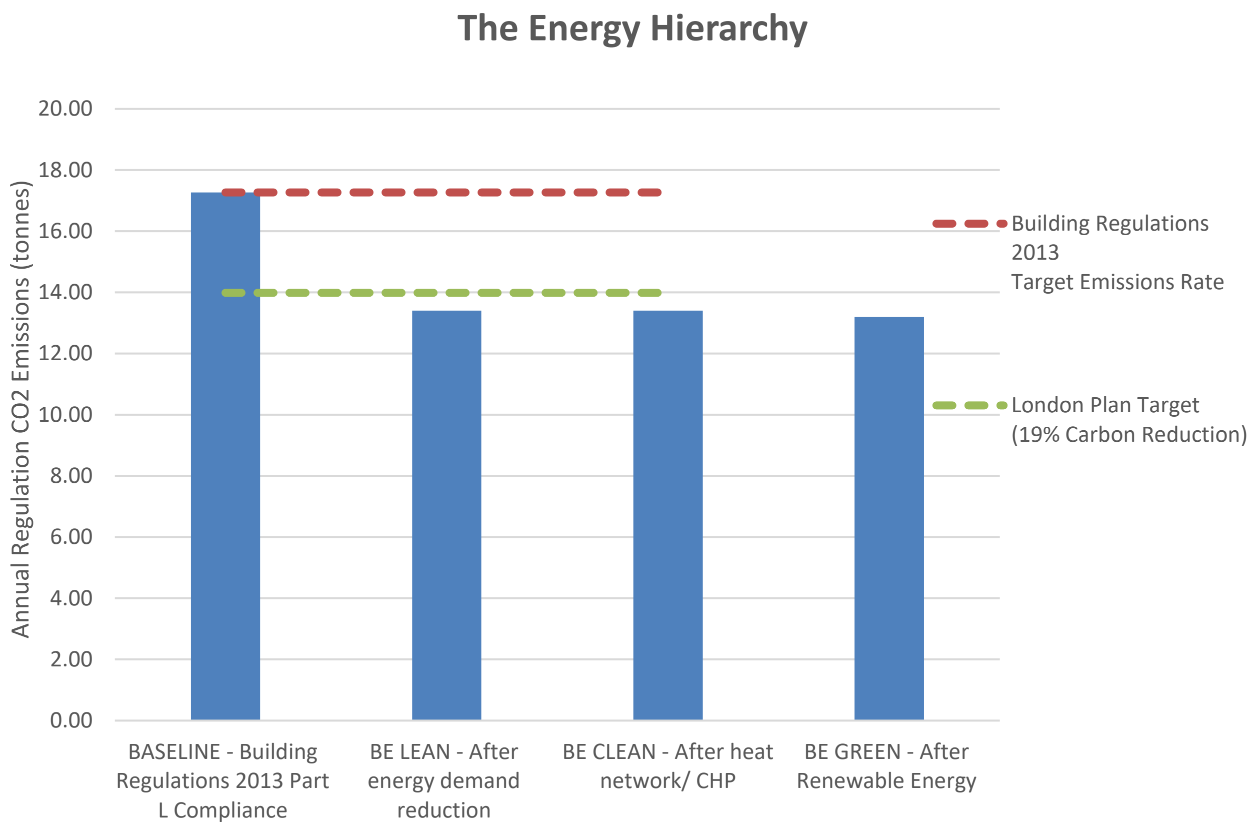


Figure 1 The Energy Hierarchy

2. Introduction

This Energy Statement will be included as part of the planning application that addresses the environmental impact of the development. This report focuses on the energy strategy for the proposed scheme and how energy consumption and carbon emissions will be minimised and to meet the targeted carbon emissions in accordance with the London Plan and Local planning policy.

The development is to be located in the **London Borough of Camden** and it is in close proximity to Gospel Oak train station (approximately 0.2 miles to the South west) and Tufnell Park underground station (approximately 0.4 miles to the East). The proposal is 6 x 4 bedrooms residential units **at 138-140 Highgate Road, Highgate, London, NW5 1PB.**

Figure 2 Site Location

The following table presents the type, area and number of units to be assessed within this report.

EW CONSTRUCTION				
Type	**Name of unit**	**Floor**	**No. of Bedrooms**	**Floor Area** (m^2)
Residential	Unit 01	Basement, GF,FF	4	113.72
Residential	Unit 02	Basement, GF,FF	4	107.40
Residential	Unit 03	Basement, GF,FF	4	108.17
Residential	Unit 04	Basement, GF,FF	4	109.12
Residential	Unit 05	Basement, GF,FF	4	109.21
Residential	Unit 06	Basement, GF,FF	4	104.81
Total	**-**	**-**	-	**652.43**

Table 5 Proposed units to be assessed for the development

3. Planning Policy

3.1. National Planning Policy Framework (March 2012)

The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

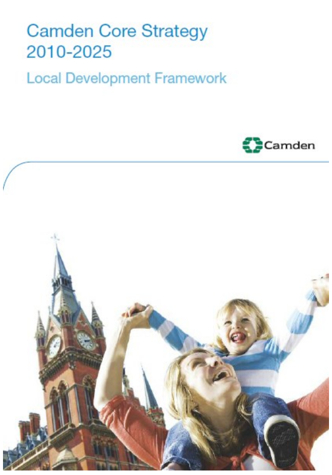
3.2. The London Plan (March 2016)

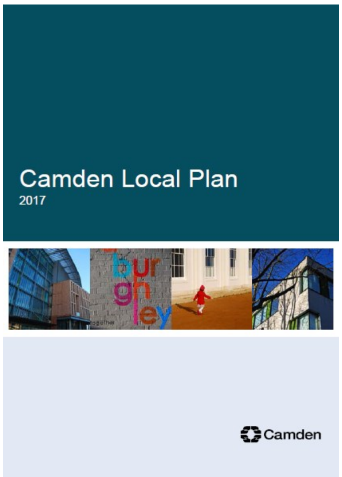
Policy 5.2, 5.4, 5.5, 5.6, & 5.7
According to Policy 5.2 all major new developments should show carbon emissions reduction through the Mayor's energy hierarchy (Be Lean, Be Clean and Be Green), unless it can be demonstrated that such provision is not feasible. From October 2016 Zero Carbon Standard apply to all new major residential development (10 or more units). This means that at least 35% of carbon reductions against a Building Regulations Part L 2013 must be achieved on-site, with the remaining emissions, up to 100%, to be offset through a contribution to the Council's Carbon Offset Fund. For the non-residential development, must achieve a 35% reduction in CO_2 emissions against a Building Regulations Part L 2013 baseline.

For retrofitting developments, it will be a challenge to meet these targets. However, available reductions in carbon emissions should be demonstrated along with water saving measures as per Policy 5.4.

Furthermore, intent must be shown for connecting to a Decentralised Energy Network and utilising a Combined Heat & Power according to Policy 5.5 and 5.6. The Mayor and boroughs should in their DPDs adopt a presumption that developments will achieve a reduction in carbon dioxide emissions of 20% from onsite renewable energy generation according to paragraph 5.42 of Policy 5.7

3.3. London Borough of Camden





<u>**Core Strategy** (Adopted in 2010)</u>

Policy CS13 – Tackling climate change through promoting higher environmental standards
Reducing the effects of and adapting to climate change

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

a) Ensuring patterns of land use that minimize the need to travel by car and hep support local energy networks;
b) Promoting the efficient use of land and buildings;
c) Minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
   - Ensuring developments use less energy,
   - Making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;
   - Generating renewable energy on-site; and
d) Ensuring buildings and spaces are designed to cope with, and minimize the effects of, climate change.

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

Local energy generation

The Council will promote local energy generation and networks by:

e) Working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the vicinity of:
  - Housing estates with community heating or the potential for community heating and other uses with large heating loads;
  - The growth areas of King's Cross, Euston, Tottenham Court Road; West Hampstead Interchange and Holborn;
  - Schools to be redeveloped as part of Building Schools for the Future programme;
  - Existing or approved combined heat and power/local energy networks and other locations where land ownership would facilitate their implementation.

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

Water and surface water flooding

We will make Camden a water efficient borough and minimise the potential for surface water flooding by:

g) Protecting our existing drinking water and foul water infrastructure, including Barrow Hill Reservoir, Hampstead Heath Reservoir, Highgate Reservoir and Kidderpore Reservoir;
h) Making sure development incorporates efficient water and foul water infrastructure;
i) Requiring development to avoid harm to the water environment, water quality or drainage systems and prevents or mitigates local surface water and down-stream flooding, especially in areas up-hill from, and in, areas known to be at risk from surface water flooding such as South and West Hampstead, Gospel Oak and King's Cross.

Camden's carbon reduction measures

The Council will take a lead in tackling climate change by:
j) Taking measures to reduce its own carbon emissions;
k) Trialing new energy efficient technologies, where feasible; and
l) Raising awareness on mitigation and adaptation measures.

<u>**Local Development Framework** (Adopted in 2010)</u>

Policy DP22 – Promoting sustainable design and construction

The Council will require development to incorporate sustainable design and construction measures. Scheme must:

a) Demonstrate how sustainable development principles, have been incorporated into the design and proposed implementation; and
b) Incorporate green or brown roofs and green walls whenever suitable.

The Council will promote and measure sustainable design and construction by:

c) Expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016;
d) Expecting developments (except new build) of 500 sq. m of residential floorspace or above or 5 or more dwellings to achieve “very good” in Eco Homes assessments prior to 2013 and encouraging “excellent” from 2013;
e) Expecting non-domestic developments of 500sqm of floorspace or above to achieve “very good” in BREEAM assessments and 2excellent” from 2016 and encouraging zero carbon from 2019.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:
f) Summer shading and planting;
g) Limiting run-off;
h) Reducing water consumption;
i) Reducing air pollution; and
j) Not locating vulnerable uses in basements in flood-prone areas.

Camden Local Plan (Adopted in 2017)

Policy CC1 – Climate change mitigation

The energy hierarchy

The Council’s Sustainability Plan ‘Green Action for Change’ commits the Council to seek low and where possible zero carbon buildings. New developments in Camden will be expected to be designed to minimise energy use and CO2 emissions in operation through the application of the energy hierarchy. It is understood that some sustainable design measures may be challenging for listed buildings and some conservation areas and we would advise developers to engage early with the Council to develop innovative solutions.

The energy hierarchy is a sequence of steps that minimise the energy consumption of a building. Buildings designed in line with the energy hierarchy prioritise lower cost passive design measures, such as improved fabric performance over higher cost active systems such as renewable energy technologies.

All developments involving five or more dwellings and/or more than 500 sqm of (gross internal) any floorspace will be required to submit an energy statement demonstrating how the energy hierarchy has been applied to make the fullest contribution to CO2 reduction. All new residential development will also be required to demonstrate a 19% CO2 reduction below Part L 2013 Building Regulations (in addition to any requirements for renewable energy). This can be demonstrated through an energy statement or sustainability statement.

4. Sustainability Statement

4.1. Water Efficiency

In accordance with London Plan SPG Sustainable Design and Construction 2.6, London Plan policy 5.3/ 5.4/ 5.13/ 5.15 (see below summary table), 8.44/ CC3 8.55 of local plan, policy CC2 and in accordance with Camden Planning Guidance CPG3 the development will be based upon the specification of **water efficient fittings** including low volume dual flush WCs, and low flow taps/ showers/ bath. These measures will result in a water consumption rate of **105 litres/person/day or less and 5 l/p/day external use.** To manage the impacts of inefficiencies and leakage, water meters and leak detection systems on the mains water supply will be installed where feasible.

Water Efficiency	
Mayor's Priority	**London Plan Policy**
Developers should maximise the opportunities for water saving measures and appliances in all developments, including the reuse and using alternative sources of water.	5.3, 5.13, 5.15
Mayor's Priority	**London Plan Policy**
Developers should design residential schemes to meet a water consumption rate of 105 litres or less per person per day.	5.3, 5.15
Mayor's Priority	**London Plan Policy**
Where a building is to be retained, water efficiency measures should be retrofitted.	5.3, 5.4, 5.15
Mayor's Priority	**London Plan Policy**
All developments should be designed to incorporate rainwater harvesting.	5.3, 5.13, 5.15
Mayor's Priority	**London Plan Policy**
All residential units, including individual flats / apartments and commercial units, and where practical, individual leases in large commercial properties should be metered.	5.15

Table 6 Summary of the Mayor's priorities and best practice set by SPG

The proposed water calculations table is provided below which provides the guidance as how each unit can achieve the internal/ external water use.

The water calculator for new dwellings					
Installation Type	**Unit of Measure**	**Capacity/ flow rate (1)**	**Use factor (2)**	**Fixed use (litres/person/day) (3)**	**Litres/person/day = [(1) x (2)] +(3) (4)**
WC (single flush)	Flush Volume (litres)	-	4.42	0.00	-
WC (dual flush)	Full Flush Volume (litres)	**4**	1.46	0.00	**5.84**
	Part flush Volume (litres)	**2.6**	2.96	0.00	**7.70**

WCs (multiple fittings)	Average effective flushing volume (litres)	-	4.42	0.00	-
Taps (excluding kitchen/ utility room taps)	Flow rate (litres/minute)	**5**	1.58	1.58	**9.48**
Bath (where shower also present)	Capacity to overflow (litres)	**180**	0.11	0.00	**19.80**
Shower (where bath also present)	Flow rate (litres/minute)	**8**	4.37	0.00	**34.96**
Bath only	Capacity to overflow (litres)	-	0.5	0.00	-
Shower only	Flow rate (litres/minute)	-	5.6	0.00	-
Kitchen / utility room sink taps	Flow rate (litres/minute)	**8**	0.44	10.36	**13.88**
Washing machine	Flow rate (litres/minute)	**8.17**	2.1	0.00	**17.16**
Dishwasher	Litres/place setting	**1.25**	3.6	0.00	**4.50**
Waste disposal unit	Litres/use	**If present = 1** **If absent = 0**	3.08	0.00	**0**
Water Softener	Litres/person/day	-	1.00	0.00	-
	(5)	**Total calculated use (litres/ person/day) = (Sum column 4)**			**113.3**
	(6)	Contribution from greywater (litres/person/day)			**0**
	(7)	Contribution from rainwater (litres/person/day)			**0**
	(8)	Normalisation Factor			**0.91**
	(9)	Total water consumption (litres/ person/day) = [(5)-(6)-(7)]*(8)			**103.1**
	(10)	**External water use**			5
	(11)	**Total water consumption (litres/ person/day) = (9)+(10)**			**108.1**

4.2. Materials

The development will utilise **low embodied materials** - at least three of the key elements of the building envelope are to achieve a rating of A+ to D in the BRE's The Green Guide of specification. At least 50% of timber and timber products will be sourced from accredited Forest Stewardship Council **(FSC)** or Programme for the Endorsement of forestry certification **(PEFC)** where feasible. All material used will be durable to cater for their level of use and exposure and will not release toxins into the internal and external environment where feasible. This is in line with SPG Sustainable Design and Construction 2.7 and London Plan policy 5.3, 5.20, 7.6, and 7.14 as specified below table.

Materials – Design phase	
Mayor's Priority	**London Plan Policy**
The design of development should prioritise materials that: ○ have a low embodied energy, including those that can be re-used intact or recycled; ○ at least three of the key elements of the building envelope (external walls, windows roof, upper floor slabs, internal walls, floor finishes / coverings) are to achieve a rating of A+ to D in the BRE's *The Green Guide* of specification; ○ can be sustainably sourced; ○ at least 50% of timber and timber products should be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of forestry Certification (PEFC) source; ○ are durable to cater for their level of use and exposure; and will not release toxins into the internal and external environment, including those that deplete stratospheric ozone	5.3, 5.20, 7.6, 7.14
Mayor's Priority	**London Plan Policy**
The design of developments should maximise the potential to use pre-fabrication elements.	5.3, 7.6

Table 7 Summary of the Mayor's priorities set by SPG

4.3. Waste

The construction waste will be considered to **minimise, recycle and reuse** on site where possible, this will reduce the overall construction cost and at the same time minimise the amount of waste diverting to landfill. **Site Waste Management Plan (SWMP)** will be formalised before the construction works start and updated as the works continue on the site.

The proposed development will adopt the best waste management procedures to reduce the amount of waste going to landfill. This will be established by creating provisions for recycling and also waste segregation from general to recyclable waste. This development has **separated bin storages on the upper ground floor level for each unit,** and the storages include refuse, recycling, composting bins with enough sizes in accordance with borough requirements. This is in line with SPG Sustainable Design and Construction 2.7 and London Plan policy 5.3 and 5.17 as below table.

Waste	
Construction phase	
Mayor's Priority	**London Plan Policy**
Developers should maximise the use of existing resources and materials and minimise waste generated during the demolition and construction process through the implementation of the waste hierarchy.	5.3, 5.20
Occupation phase	
Mayor's Priority	**London Plan Policy**
Developers should provide sufficient internal space for the storage of recyclable and compostable materials and waste in their schemes.	5.3, 5.17
Mayor's Priority	**London Plan Policy**
The design of development should meet borough requirements for the size and location of recycling, composting and refuse storage and its removal.	5.3, 5.17

Table 8 Summary of the Mayor's priorities set by SPG

4.4. Nature conservation and biodiversity

There will be **no loss in the quality and quantity of biodiversity** by this development as all the units have the back gardens which contributes towards the enhancement of biodiversity. And, the development will make a positive contribution to biodiversity on the site in the course of design development. This is related with SPG Sustainable Design and Construction 2.8 / 3.3 and London Plan policy 5.3, 5.10, and 7.19.

Nature conservation and biodiversity	
Mayor's Priority	**London Plan Policy**
There is no net loss in the quality and quantity of biodiversity.	5.3, 7.19
Mayor's Priority	**London Plan Policy**
Developers make a contribution to biodiversity on their development site.	5.3, 7.19

Table 9 Summary of the Mayor's priorities set by SPG

4.5. Flood Risk

The Environmental Agency map shows that the site surrounding area is within zone 1 of the flood risk (see below image). **If feasible, the SuDs would be developed in the course of design development** in order to consider attenuation for surface water runoff as well as habitat, water quality and amenity benefits in accordance with SPG Sustainable Design and Construction 3.4 and London Plan policy 5.3, 5.13, and 5.14 below. Therefore, there would be a net decrease in both the volume and rate of run-off leaving the site. As part of this, **permeable paving materials** will be used on the ground floor to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses. And also, rainwater collection and recycling systems would be considered at detailed design stage where feasible.

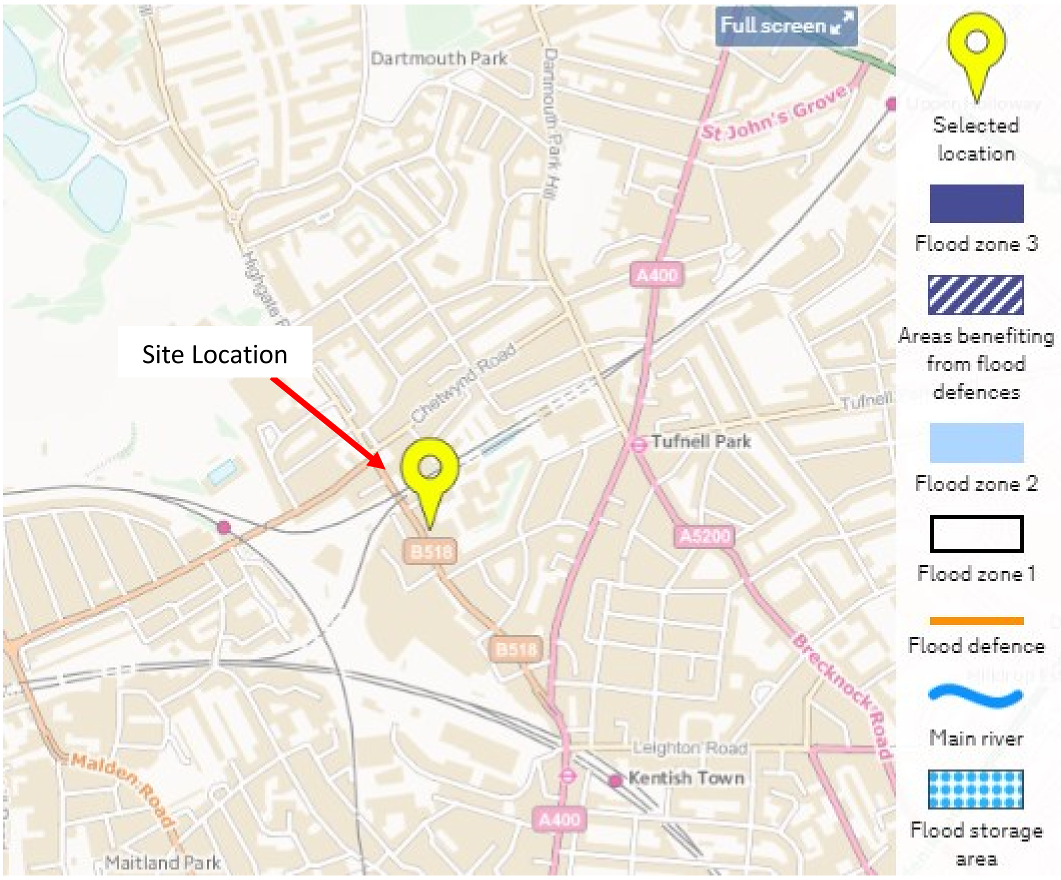


Figure 3 The Environmental Agency Map

Flooding	
Surface water flooding and Sustainable drainage	
Mayor's Priority	**London Plan Policy**
Through their Local Flood Risk Management Strategies boroughs should identify areas where there are particular surface water management issues and develop policies and actions to address these risks	5.3, 5.12
Mayor's Priority	**London Plan Policy**
Developers should maximise all opportunities to achieve greenfield runoff rates in their developments	5.12, 5.13
Mayor's Priority	**London Plan Policy**

When designing their schemes developers should follow the drainage hierarchy set out in London Plan policy 5.13	5.13
Mayor's Priority	**London Plan Policy**
Developers should design Sustainable Drainage Systems (SuDS) into their schemes that incorporate attenuation for surface water runoff as well as habitat, water quality and amenity benefits.	5.3, 5.13, 5.14
Flood resilience and resistance of buildings in flood risk areas	
Mayor's Priority	**London Plan Policy**
Development in areas at risk from any form of flooding should include flood resistance and resilience measures in line with industry best practice.	5.3, 5.12, 5,13
Flood Risk Management	
Mayor's Priority	**London Plan Policy**
Developments are designed to be flexible and capable of being adapted to and mitigating the potential increase in flood risk as a result of climate change.	5.3, 5.12
Mayor's Priority	**London Plan Policy**
Developments incorporate the recommendation of the TE2100 plan for the future tidal flood risk management in the Thames estuary.	5.3, 5.12
Mayor's Priority	**London Plan Policy**
Where development is permitted in a flood risk zone, appropriate residual risk management measures are to be incorporated into the design to ensure resilience and the safety of occupiers.	5.3, 5.12
Other sources of flooding	
Mayor's Priority	**London Plan Policy**
All sources of flooding need to be considered when designing and constructing developments.	5.3, 5.12, 5.13

Table 10 Summary of the Mayor's priorities set by SPG

4.6. Pollution

- Air

The proposed scheme has been designed to minimise the generation of air pollution and mitigate against increased exposure to poor air quality. This will include **low/No NOx heating systems and non-toxic building materials** where feasible. The proposal is to install NOx neutral Air Source Heat Pump system on site for each unit. Contractor will follow the guidance set out in the emerging Minimising dust and emissions from construction and demolition SPG when constructing their development.

Air quality	
Mayor's Priority	**London Plan Policy**
Developers are to design their schemes so that they are at least 'air quality neutral'.	7.14
Mayor's Priority	**London Plan Policy**
Developments should be designed to minimise the generation of air pollution.	5.3, 7.14
Mayor's Priority	**London Plan Policy**

Developments should be designed to minimise and mitigate against increased exposure to poor air quality.	3.2, 5.3, 7.14
Mayor's Priority	**London Plan Policy**
Developers should select plant that meets the standards for emissions from combined heat and power and biomass plants set out in Appendix 7.	7.14
Mayor's Priority	**London Plan Policy**
Developers and contractors should follow the guidance set out in the emerging *The Control of Dust and Emissions during Construction and Demolition SPG* when constructing their development.	5.3, 7.14

Table 11 Summary of the Mayor's priorities set by SPG

- Noise

The mitigation measures will be incorporated to the proposed building at construction stage to reduce sources of noise – insulate and soundproofing doors, walls, windows, floors and ceilings, and seal air gaps around windows etc.

Noise	
Mayor's Priority	**London Plan Policy**
Areas identified as having positive sound features or as being tranquil should be protected from noise.	3.2, 7.15
Mayor's Priority	**London Plan Policy**
Noise should be reduced at source, and then designed out of a scheme to reduce the need for mitigation measures.	3.2, 5.3, 7.6,.7 .15

Table 12 Summary of the Mayor's priorities set by SPG

- Light

Lighting scheme will be designed to minimise light pollution where feasible. Guidance Notes for the Reduction of Obtrusive Light (2005) will be utilised to reduce obtrusive light in accordance with SPG Sustainable Design and Construction 4.5 and London Plan policy 5.2, 5.3, and 6.7.

Light pollution	
Mayor's Priority	**London Plan Policy**
Developments and lighting schemes should be designed to minimise light pollution.	5.2, 5.3, 6.7

Table 13 Summary of the Mayor's priorities set by SPG

4.7. Health and Wellbeing

The health and wellbeing of the building occupant has been considered in this development. The proposed scheme is designed to **maximise the opportunity for daylighting potential in habitable areas** – e.g. roof lights. The proposed development will ensure to introduce the **occupant controlled and zoned space heating systems** in accordance with space requirements and window orientation. This will provide occupant thermal comfort but at the same time it will reduce the overall energy cost and the carbon footprint.

5.5	**Daylight and sunlight**		
5.5.1	Glazing to all habitable rooms should be not less than 20% of the internal floor area of the room.	Good Practice	Code for Sustainable Homes
5.5.2	All homes should provide for direct sunlight to enter at least one habitable room for part of the day. Living areas and kitchen dining spaces should preferably receive direct sunlight.	Good Practice	Code for Sustainable Homes

Table 14 GLA Sustainable Design and Construction SPG Appendix 4 – Housing SPG Design Standards

4.8. Bicycle Storage

To promote exercise and help reduce congestion and carbon emissions, **cycle storages are provided on the lower ground floor at the rear gardens.** The site contains a cycle storage spaces for each unit at the rear garden spaces as shown on the lower ground floor drawings and the provided space is sufficient to store number of cycles.

3.4	**Cycle storage**		
3.4.1	All developments should provide dedicated storage space for cycles at the following levels: i. 1 per 1 or 2 bedroom dwelling; or ii. 2 per 3 or more bedroom dwelling	Baseline	LP Policy 6.9
3.4.2	Individual or communal cycle storage outside the home should be secure, sheltered and adequately lit, with convenient access to the street. Where cycle storage is provided within the home, it should be in addition to the minimum GIA and minimum storage and circulation space requirements. Cycle storage identified in habitable rooms or on balconies will not be considered acceptable.	Baseline	Design for London

Table 15 GLA Sustainable Design and Construction SPG Appendix 4 – Housing SPG Design Standards

5. Energy Statement

5.1. Methodology - Mayor's Energy Hierarchy

The energy hierarchy is a classification of different methods to improve energy performance in a parallel sequence. This includes primarily a focus on reducing energy use by avoiding unnecessary use, to then improving the efficiency of energy systems to minimise loss, this is followed by exploiting renewable energy sources and then low carbon energy solutions for energy needs and finally, any remaining demand can be catered for by conventional fuel sources.

The Mayor's Energy Strategy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. These guiding principles have been reordered since the publication of the Mayor's Energy Strategy in Feb 2004 and the adopted replacement London Plan 2011 with further alterations in 2015 stating that the following hierarchy should be used to assess applications:

- **BE LEAN** – By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.
- **BE CLEAN** – By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.
- **BE GREEN** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.

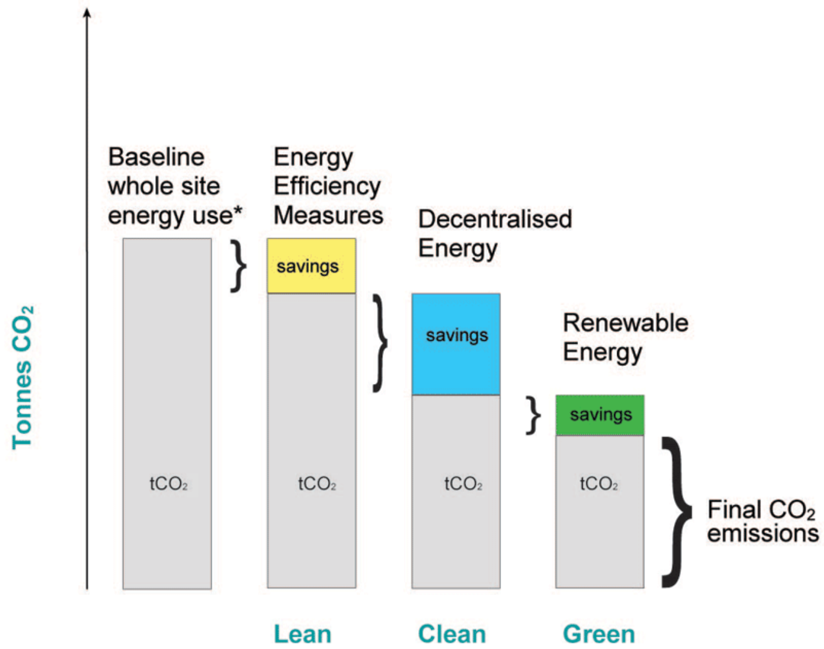


Figure 4 The Energy Hierarchy

5.2. Software and Input data

The Government approved software, i.e. **FSAP 2012**, have been utilised to carry out **Standard Assessment Procedure (SAP)** calculations.
Turner Jomas received the architectural drawings and relevant documents, and they were used to undertake the energy assessments. The document references are listed in the table below.

No.	Document Name	Format	Received Date
1	Proposed Plans - Lower Ground Floor Plan	pdf	01-02-2018
2	Proposed Plans - Ground Floor Plan	pdf	01-02-2018
3	Proposed Plans – Upper Ground Floor Plan	pdf	01-02-2018
4	Proposed Plans – Roof Plan	pdf	01-02-2018
5	Proposed Elevations	pdf	01-02-2018
6	Proposed Sections	pdf	01-02-2018
7	Site Plan	pdf	17-01-2018

Table 16 The document list

6. Energy Statement - Baseline Stage

The baseline (known as Target Emission Rate), as calculated in line with the Building Regulation 2013, is the maximum amount of carbon dioxide a dwelling or non-residential unit is allowed to emit. The Target Emission Rate (TER) includes carbon dioxide emissions which are covered by Part L of the Building Regulations, known as regulated emissions (space and water heating, ventilation, lighting, pumps, fans & controls). The baseline energy uses and resulting CO_2 emissions rates of the development have been assessed using the Government approved software.

The unregulated emissions provided in this report include energy uses that are not covered by Building Regulations; typically, energy from appliances, small power and cooking. The unregulated emissions for the domestic dwellings have been calculated following the SAP 2009 technical guidance, based on the BREDEM methodology.

The baseline regulated CO_2 emissions for the development as a whole are presented in the tables below:

BASELINE

BASELINE: TER	Regulated CO_2 Emissions (kg CO_2/yr)
Unit 01	3329.72
Unit 02	2736.55
Unit 03	2748.60
Unit 04	2764.01
Unit 05	2764.11
Unit 06	2925.25
TOTAL	**17268.24**

Table 17 Regulated Energy Use and Carbon Emissions at Baseline

7. Energy Statement - BE LEAN Stage

This section outlines the energy efficient measures taken in order to minimise the building's energy demand and therefore reduce energy use and CO_2 emissions further than the Baseline requirements (Building Regulations 2013 Part L compliance).

7.1. Passive Design Measures

- **Enhanced Building Elements**

At the 'BE LEAN' stage of the energy hierarchy, energy efficient building elements have been incorporated into the build. The heat loss of different building element is dependent upon their U-value, air tightness, and thermal bridging y-values. Therefore, better U-values and air permeability than the minimum values set in the Part L 2013 have been suggested in this development. And, Accredited Construction Detail for Part L was also applied for all thermal bridging junctions to reduce the heat loss from the thermal bridging. Please see below more specifically:

		Part L 2013 min. required values L1A	Proposed building values
U-value (W/m² K)	Wall	0.30	0.15
	Window	2.00	1.4
	Floor	0.25	0.13
	Roof	0.20	0.13
	Door	1.0	1.4
Air Permeability (m³/h.m² at 50 Pa)		10	4
Use of Accredited Construction Details		YES (thermal bridging calculations have been carried out for residential units based on ACD for Part L) http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partl/bcassociateddocuments9/acd	

Table 18 Proposed Building Elements

- **Orientation & Natural Daylighting**

Passive solar gain reduces the amount of energy required for space heating during the winter months. The building is typically positioned to have south and south west aspects, so they align with the roads and also maximise the passive solar gains into the building throughout the day. Moreover, the internal layout of the development has been designed to improve daylighting in all habitable spaces, as a way of improving the health and wellbeing of occupants.

- **Cooling and Overheating Hierarchy**

Based on the GLA guidance on preparing energy assessment (March 2016), various strategies have been considered for this development to reduce the cooling demand and the overheating risks. This follows below cooling hierarchy set by London Plan Policy 5.9, Camden Local Plan Policy CC1and CC2, planning guidance CPG3 and CP2.

- ✓ Firstly, **internal heat generation will be minimised through energy efficient design** in the course of design development. It will include minimizing pipe lengths (particularly lateral pipework in corridors of flats) and adopting pipe configurations which minimise heat loss, e.g. twin pipes. Due to the type of scheme this is not impacted as there aren't any communal corridors etc. for this scheme.

- ✓ Moreover, the amount of heat entering building in summer will be reduced through use of shading measures including **internal blinds or curtains in the habitable rooms. Passive design: shading and orientation to reduce excessive solar gain in summer**. Passive buildings aim to maintain interior thermal comfort throughout the sun's daily and annual cycles whilst reducing the requirement for active heating and cooling systems.

- ✓ Next, the internal layout provides the dwellings the **passive ventilation via openable windows and dual aspect features for each unit**.

- ✓ Lastly, this natural ventilation will be adopted with **extract fans in wet rooms** (toilets, bathroom, and kitchen) to remove the hot humid air.

- ✓ SAP Appendix P report has been included within the Appendix of this report which confirms that as per all the above measures the development can achieve "Medium" risk of overheating for each unit.

Given the all strategies above, the cooling demand and overheating risks have been reduced, and therefore higher energy consumption and CO_2 emissions due to active cooling systems can be avoided. Hence, the energy strategy report does not anticipate a need of any active cooling within each unit and the proposed Air Source Heat Pump system is only for space heating and hot water.

7.2. Active Design Measures

- **Heating and Hot Water System**

The space heating and hot water are provided by energy efficient systems as summarised in the table below. At the **'BE LEAN' stage A high efficiency individual combi boiler (89.5% efficiency) have been examined for space heating and hot water demand in the residential unit.** Detailed specifications used at BE LEAN stage are in the table below. All suggested specifications below are provisional at this early design stage, and therefore have to be reviewed with mechanical engineers and contractors in the course of design development.

Systems	General Specification
Heating system	Gas condensing combi boiler for radiator heating (efficiency of 89.5% for residential)
Cooling – Active Cooling Provided by electricity	None proposed for this scheme
Hot water system	Same as space heating

Table 19 Heating and Hot water systems

Please note that above systems have been used only for carbon emissions calculation at BE LEAN stage as per GLA Guidance on energy assessment. Suggested systems will be mentioned at BE GREEN stage as renewable technology (ASHPs) has been suggested – Section 9.2.

- **High Efficiency Lighting**

The proposed light fittings will be low energy efficient fittings. These can be **T5 fluorescent fittings with high frequency ballasts, or LED fittings for residential units.**

8. Energy Statement - BE CLEAN Stage

The Energy Hierarchy encourages the use of a CHP system and the connection to District Heating system to reduce CO_2 emissions further.

8.1. Decentralised Energy Network

The Mayor's Energy Strategy favours community heating systems because they offer:

- Potential economies of scale in respect of efficiency and therefore reduced carbon emissions; and
- Greater potential for future replacement with Low or Zero Carbon (LZC) technologies.

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed alongside the **London Heat Map Study** as part of this assessment. The study identifies that the site is not located near the existing district heating networks. This is demonstrated clearly from the London Heat Map (http://www.londonheatmap.org.uk) snapshot below.

1.

2.

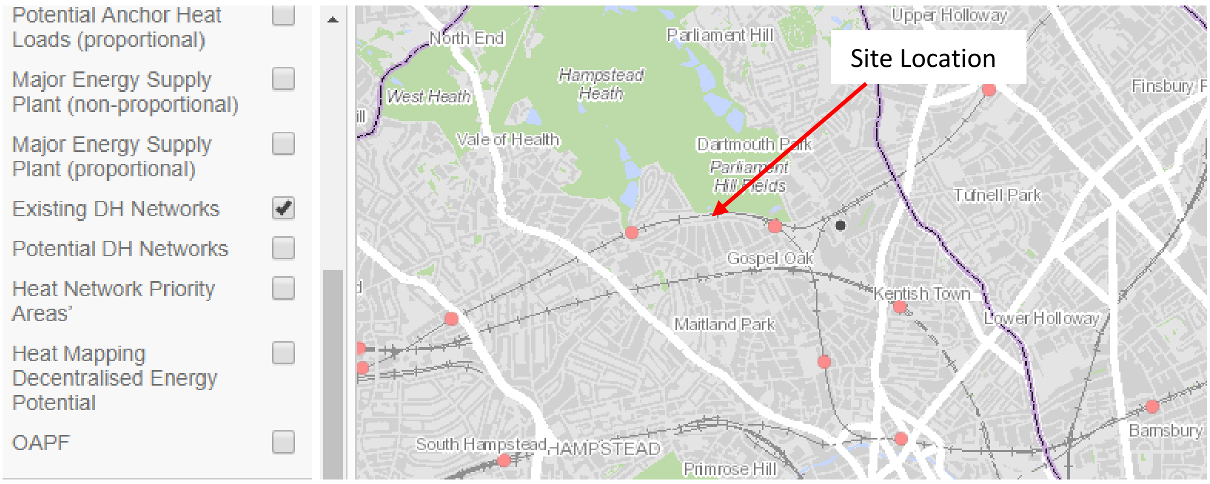


Figure 5 London Heat Map near the site

Moreover, the London heat map below identifies existing DH networks in more broaden area, and it could not find any existing DH networks (in yellow) within 1km radius from the property. The costs involved in extending the existing DH network would outweigh the advantages in this development. **Therefore, utilisation of the DH network has not been a feasible option for this development.**

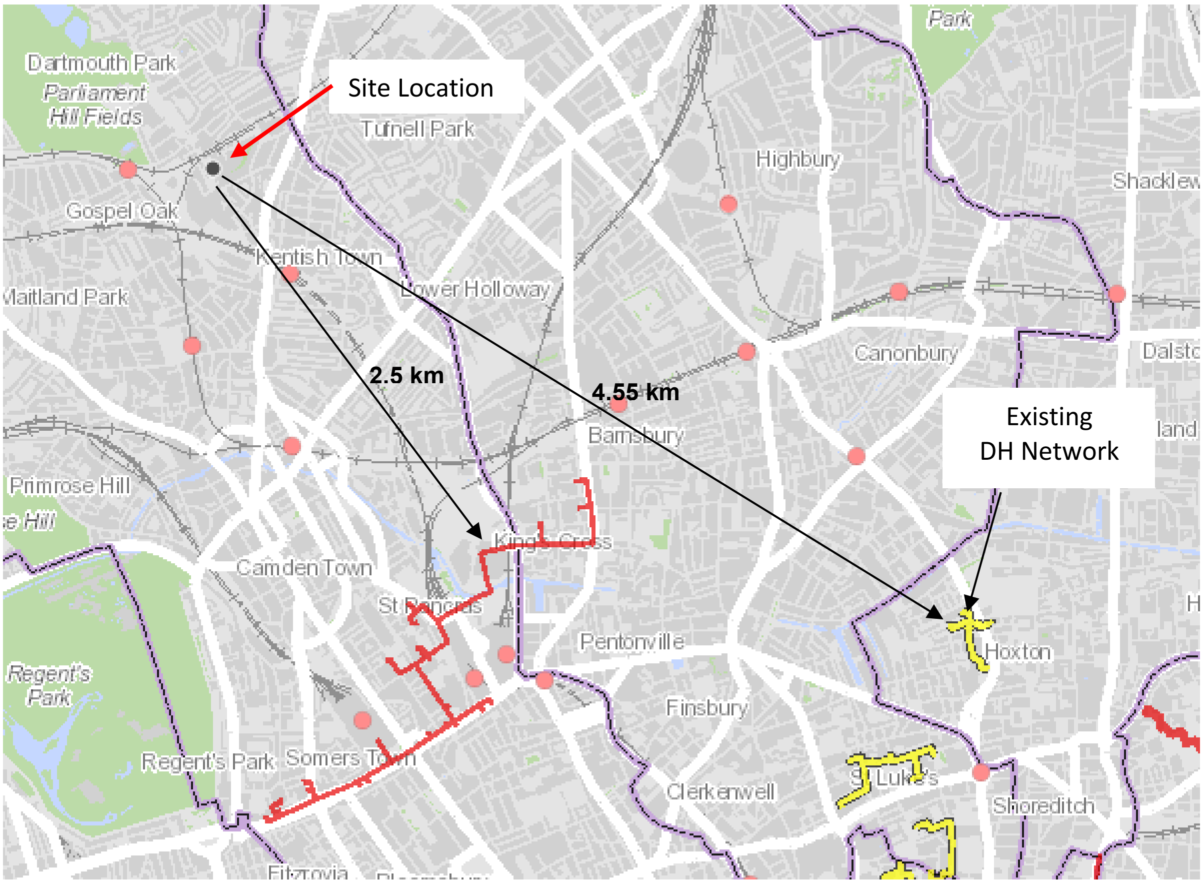


Figure 6 Existing and potential DH Network near the site

8.2. CHP

The Energy Hierarchy identifies the combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP. The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

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

To ensure that CHP is financially viable it is essential that the unit is selected to meet the base heat load and that this load is maintained over a large proportion of the day (a figure of 14 – 17 hours per day is often quoted subject to the load profiles and gas and electricity prices) to ensure that the additional costs (maintenance) associated with running a CHP unit can be recovered. This need to run the CHP plant, as far as possible continuously makes the building load profile of prime importance when reviewing the viability of such solutions and in particular the summer time heat load profile. To enable the CHP plant to run continuously when it is operating, a thermal store is often used so that excess CHP capacity can be used to generate hot water for use at a later time.

The feasibility of installing CHP has been assessed for this development. **Since this development has only 6 residential unit that would not require high heating loads, installing the CHP system would not be beneficial given the cost. Moreover, the development does not have enough plant space for the CHP system. Hence a CHP system has not been considered for this development.** Hence, no CO_2 reduction can be achieved at Be Clean stage.

9. Energy Statement - BE GREEN Stage

In this section the viable renewable energy technologies that could reduce the development's CO_2 emissions are examined. In determining the appropriate renewable technology for the site, the following factors were considered;

- Renewable energy resource or fuel availability of the LZC technology on the site.
- Space limitations due to building design and urban location of the site.
- Capital, operating and maintenance cost.
- Planning Permission
- Implementation with regards the overall M&E design strategy for building type
- Available Grants

The table below summarises the various low zero carbon technologies considered for the projects, and we have identified that **Photovoltaic (PV)** would be the most appropriate option in this development.

Technology	Local Planning Requirements	Carbon Payback	Grants/ Funding	Feasibility
Air Source Heat Pumps (ASHP)	Noise Issues from External units	High	Renewable Heat Incentive (RHI)	**HIGH**
Photovoltaic (PV)	Spatial and Shadowing	High	Feed-in Tariff (FIT)	**HIGH**
Solar Thermal	Spatial and Shadowing	Low	Renewable Heat Incentive (RHI)	**LOW**
Ground Source Heat Pumps (GSHP)	Spatial issues for Bore Holes and noise	Medium	Renewable Heat Incentive (RHI)	**LOW**
Biomass	Spatial requirement for fuel storage and biomass odour	High	Renewable Heat Incentive (RHI)	**LOW**
Wind Power	Extensive planning requirements for noise and local biodiversity	Low	Feed-in Tariff (FIT)	**LOW**
Hydro Power	Extensive planning requirements for noise and water quality	None	Feed-in Tariff (FIT)	**ZERO**

Table 20 Feasibility Study of LZC Technologies

9.1. Non-feasible Technology

- **Ground Source Heat Pumps (GSHP)**

Ground source heat pump would be a feasible option to meet the space heating requirements, however, it requires ground space for bore holes to extract the ground heat to be utilised for space heating requirements. In this case there is no available ground space for a borehole or trench system, the ground source loop would have to be incorporated within the foundation piles of the structure, which would result in additional cost. Hence, this option is not suitable for this development.

- **Solar Thermal**

The use of solar thermal for this development would be limited to domestic hot water only. The use of solar thermal for space heating would not be practical as it is not required when solar thermal is at its most effective during the summer months. Therefore, this system would require additional plumbing and space for hot water storage, incurring additional financial cost. Moreover, the amount of carbon offset from the system is generally lower than other technologies. Therefore, this technology is deemed to be unsuitable for this development.

- **Hydro power**

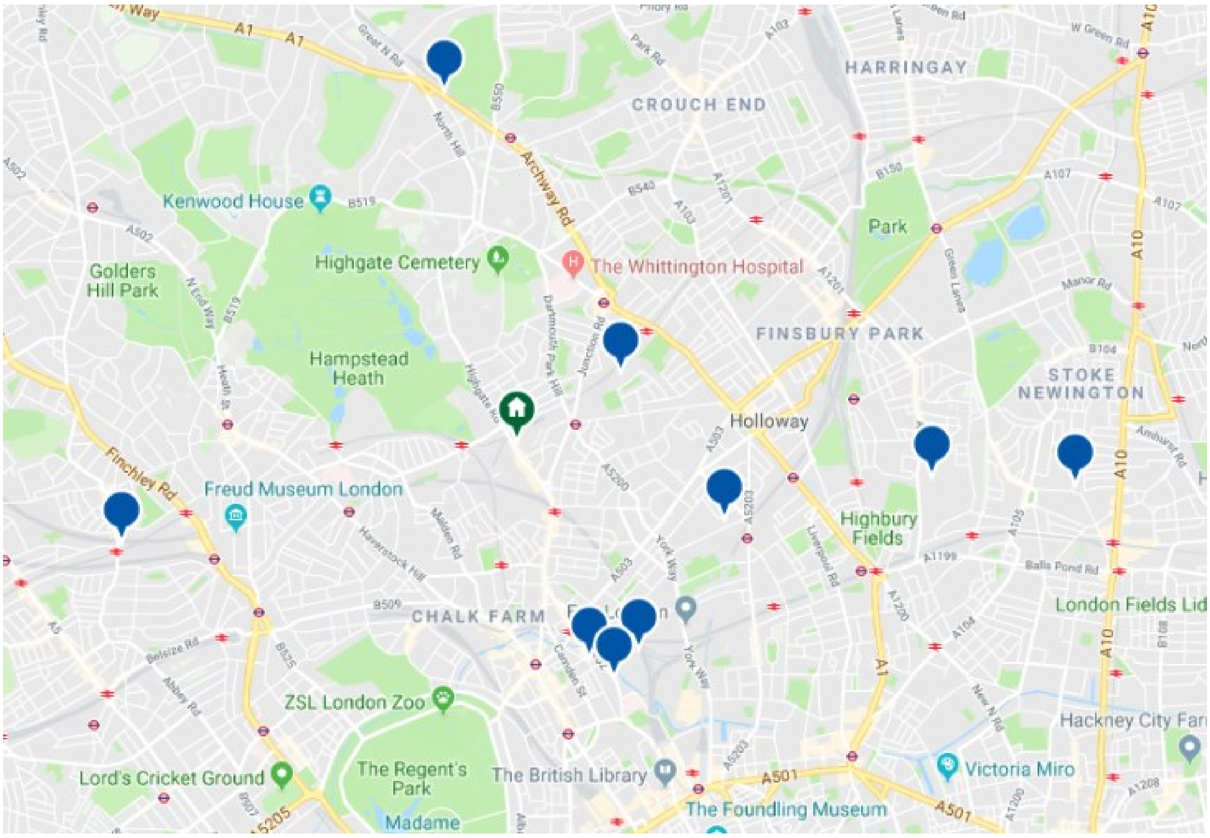
There is a river (river Thames) within the development site boundaries. However, small scale hydro-electric will not be studied any further because of the location and the spatial limitations of the development.

- **Biomass**

A biomass system designed for this development would be fueled by wood pellets which have a high energy content. However, a biomass system would not be an appropriate technology for the site for the following reasons:

i. The burning of wood pellets releases substantially more NOx emissions when compared to similar gas boilers. As the development is situated within an urban area, the installation of a biomass boiler would further impact on the air quality in this area.
ii. the lack of spaces for pellet boiler and storage on the site.
iii. Pellets would need to be transported from local pellet suppliers, which causes carbon emissions to the air.

However, if the biomass system is considered at detailed design stage, local suppliers can be found near the site as shown in the map below (http://biomass-suppliers-list.service.gov.uk).



Company name	Postcode	Contact	Fuel Supplied	Telephone
Travis Perkins Trading Co. Ltd	N19 5UN	www.travisperkins.co.uk toby.duncan@travisperkins.co.uk	Pellets	0207 561 0516
City Plumbing Suppliers (CPS) part of the Travis Perkins Group	N7 9HD	www.cityplumbing.co.uk shaun.jackson@cityplumbing.co.uk	Pellets	0207 6973480
Wolseley UK Ltd	NW1 0BY	www.plumbcenter.co.uk FFP.Camden@wolseley.co.uk	Pellets	0207 4240957
Wolseley UK Ltd	N1C 4PD	www.pipecenter.co.uk k94.kingscross@wolseley.co.uk	Pellets	0207 3804230
Travis Perkins Trading Co. Ltd	NW1 0PT	www.travisperkins.co.uk sean.mahon@travisperkins.co.uk	Pellets	0207 380 6480
Wolseley UK Ltd	N6 4JD	www.draincenter.co.uk qdn.Highgate@wolseley.co.uk	Pellets	0208 3400793
Travis Perkins Trading Co. Ltd	NW6 1SD	www.travisperkins.co.uk johnny.farmer@travisperkins.co.uk	Pellets	020 7794 8151
Wolseley UK Ltd	N5 2PW	www.plumbcenter.co.uk YM.Highbury@wolseley.co.uk	Pellets	0207 7041830
Travis Perkins Trading Co. Ltd	N16 8NU	www.travisperkins.co.uk kelly.thomson@travisperkins.co.uk	Pellets	020 7254 1200
Travis Perkins Trading Co. Ltd	W2 6NA	www.travisperkins.co.uk liam.clancy@travisperkins.co.uk	Pellets	020 7262 6602

- **Wind Power**

Wind turbines need extensive planning requirements and they are only feasible at consistent wind speed. Moreover, since the development is located in an urban area, the site does not have sufficient wind speed to operate wind turbine at the height of 10 meters as shown below (http://www.renew-reuse-recycle.com/noabl.pl?n=503). Hence this option has been discounted.

Estimated average windspeeds around NW5 1..

Wind speed at 10m above ground level (m/s)		
5.5	5.2	5.1
5.1	**4.9**	5
5	4.9	4.8

Wind speed at 25m above ground level (m/s)		
6.3	6	5.8
6	**5.7**	5.7
5.8	5.6	5.6

Wind speed at 45m above ground level (m/s)		
6.7	6.5	6.3
6.4	**6.2**	6.2
6.3	6.1	6.1

Squares surrounding the central square correspond to wind speeds for surrounding grid squares. Power generated is related to windspeed by a cubic ratio. That means if you halve the windspeed, the power goes down by a factor of 8 (which is 2 x 2 x 2). A quarter of the windspeed gives you a 64^{th} of the power (4 x 4 x 4). As a rough guide, if your turbine is rated at producing 1KW at 12m/s then it will produce 125W at 6m/s and 15W at 3m/s.

Please note! Bear in mind that the NOABL windspeed dataset used here is a model of windspeeds across the country, assuming completely flat terrain. It isn't a database of measured windspeeds. Other factors such as hills, houses, trees and other obstructions in your vicinity need to be considered as well as they can have a significant effect. If you're thinking about installing a wind turbine, you should perform your own windspeed measurements using an anemometer to determine what the actual figures are.

9.2. Proposed Technology

- **Air Source Heat Pumps**

Air-source heat pumps (ASHPs) utilise thermal energy absorbed from surrounding air, boosting it into useable heat via an electrically-driven heat pump. The system comprises of an outdoor condenser unit and an indoor compressor unit, which then feeds the heating manifolds. ASHP efficiencies are measured by seasonal coefficients of performance (SCoPs), which are highly dependent on environmental temperature. The generated heat is typically used for space heating, serving radiators and underfloor heating at high SCoPs of up to 4.52, and for domestic hot water at SCoP 3.23. Because of the high SCoPs achievable, ASHPs result in lower carbon emissions than high-efficiency gas-fired condensing boilers. Although ASHPs have lower SCoPs than ground-source heat pumps (GSHPs), the installation costs are much lower as there is no need for ground loops or boreholes. Noise pollution from the external units is commonly cited as a planning issue, though this can be alleviated through thoughtful siting and attenuators.

For minimised installation costs and increased cost-effectiveness, a site-wide ASHP system has been considered to produce heating and hot water for individual dwelling.

- **Photovoltaic (PV)**

Based on the feasibility study above, PV would be the most suitable renewable Technology for the following reasons:

i. The installation of PV is much simpler when compared to other renewable technologies
ii. There is sufficient roof space available to install enough PV modules to have a significant impact on carbon emissions of the development
iii. PV panels sited on the roof within an urban area are less visually intrusive when compared to wind turbines

The PV system capacity for the whole development depends upon the heating system selected. Therefore, the amount of PV relating to the proposed heating system option is outlined below:

Air Source Heat Pump
+
5.67 kWp PV

The tables below illustrate the indicative PV panel's detail, should it be feasible to implement:

Orientation	South West	**Number of Panels**	18
Panel Tilt	30º	**Power Output**	315 W/p
Overshading	None or very little	**Type**	Monocrystalline
Proportion Exported	50%	**PV Area**	Approximate 29.7 m^2 (18 panels * 1.65 m^2)
Annual Output	Approximate 4668.42 kWh		

Table 21 Suggested PV details

For the 5.67 kWp system,18 high efficiency 315W monocrystalline PV panels would to be installed at 30°. The area on the roof could be utilised for the PV panels and condenser units. For flat roofs as a rule of thumb, 400mm between rows of panels has been considered. The proposed PV panels are subject to further consideration at detailed design stage. In order to qualify both the installer and the equipment, the system must be certified under the Microgeneration Certification Scheme (MCS).

The Feed - In – Tariffs (FIT) were introduced in order to give an incentive for PV generated electricity. The FIT scheme is based on the principle that the energy supplier pays generation tariff for every kWh the PV system generates and an export tariff for every kWh of electricity supplied back to the national grid. The table below shows FIT payment rate from 1 April 2016 – 31 March 2019 (https://www.ofgem.gov.uk/publications-and-updates/feed-tariff-fit-generation-export-payment-rate-table-01-april-30-june-2016).

		2016/17				2017/18				2018/19			
		1 Apr–30	1 Jul–30 Sep	1 Oct–31	1 Jan–31Mar	1 Apr–30	1 Jul–30 Sep	1 Oct–31	1 Jan–31Mar	1 Apr–30	1 Jul–30 Sep	1 Oct–31	1 Jan–31Mar
Solar photovoltaic (≤10kW)	Higher	4.32	4.25	4.18	4.11	4.04	3.97	3.90	3.83	3.76	3.69	3.62	3.55
	Middle	3.89	3.83	3.76	3.70	3.64	3.57	3.51	3.45	3.38	3.32	3.26	3.20
	Lower	0.74	0.68	0.63	0.58	0.52	0.47	0.41	0.37	0.32	0.26	0.21	0.15
Solar photovoltaic (>10kW & ≤50kW)	Higher	4.53	4.46	4.39	4.32	4.25	4.19	4.12	4.05	3.98	3.91	3.85	3.78
	Middle	4.08	4.01	3.95	3.89	3.83	3.77	3.71	3.65	3.58	3.52	3.47	3.40
	Lower	0.74	0.68	0.63	0.58	0.52	0.47	0.41	0.37	0.32	0.26	0.21	0.15
Solar photovoltaic (>50kW & ≤250kW)	Higher	2.38	2.32	2.26	2.21	2.15	2.10	2.04	1.98	1.93	1.87	1.82	1.76
	Middle	2.14	2.09	2.03	1.99	1.94	1.89	1.84	1.78	1.74	1.68	1.64	1.58
	Lower	0.74	0.68	0.63	0.58	0.52	0.47	0.41	0.37	0.32	0.26	0.21	0.15

Table 22 FIT Generation & Export Payment Rate Table (pence/kWh)

Given the proposed LZC technologies on the site (**PVs and Air Source Heat Pump**), the overall CO2 reduction at BE GREEN stage can be calculated as shown below. And, it can be seen that the overall CO_2 reduction via on-site renewables is ***1.56%*** for the total emissions.

BE GREEN stage

	Regulated CO_2 Emissions (kg CO_2/yr.)	
	BE LEAN	**BE GREEN**
Unit 01	2579.17	2426.78
Unit 02	2131.89	2127.59
Unit 03	2140.68	2135.28
Unit 04	2152.94	2144.21
Unit 05	2152.53	2143.79
Unit 06	2252.37	2223.02
TOTAL	**13409.58**	**13200.68**
Carbon Reduction	**-**	**1.56%**

Table 23 Regulated Energy Use and Carbon Reduction at Be Green Stage

10. Conclusion

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at **138-140 Highgate Road, Highgate, London, NW5 1PB,** based on the information provided by the design team.

In line with the London Plan's three step energy hierarchy the regulated CO2 emissions for this development have been reduced by **23.56%** over Building Regulation 2013, once all measures in the table below are taken into account.

Stages	Strategies
BE LEAN Energy efficient design	• U-values and air permeability better than Building Regulations Part L. • Accredited Construction Details for all junctions • Natural ventilation with extract fans in wet rooms • Low energy lights
BE CLEAN District heat networks or communal heating systems	N/A
BE GREEN On-site renewable technologies	• Individual Air Source Heat Pump for heating and hot water and PV panels of 5.67 kWp on the roof (approximate 18 panels with 315 w/p are required).

Table 24 Energy Hierarchy and suggested strategies

The carbon savings from each stage can be calculated as shown below.

Energy Hierarchy		Regulated Carbon Savings	
		Tonnes CO_2/yr	%
BE LEAN	After energy demand reduction	3.86	22.35%
BE CLEAN	After heat network/ CHP	0	0%
BE GREEN	After renewable energy	0.21	1.56%
Total Cumulative Savings		**4.07**	**23.56%**
Total Target Savings		3.28	19 %

Table 25 Carbon dioxide Emissions after each stage of the Energy Hierarchy

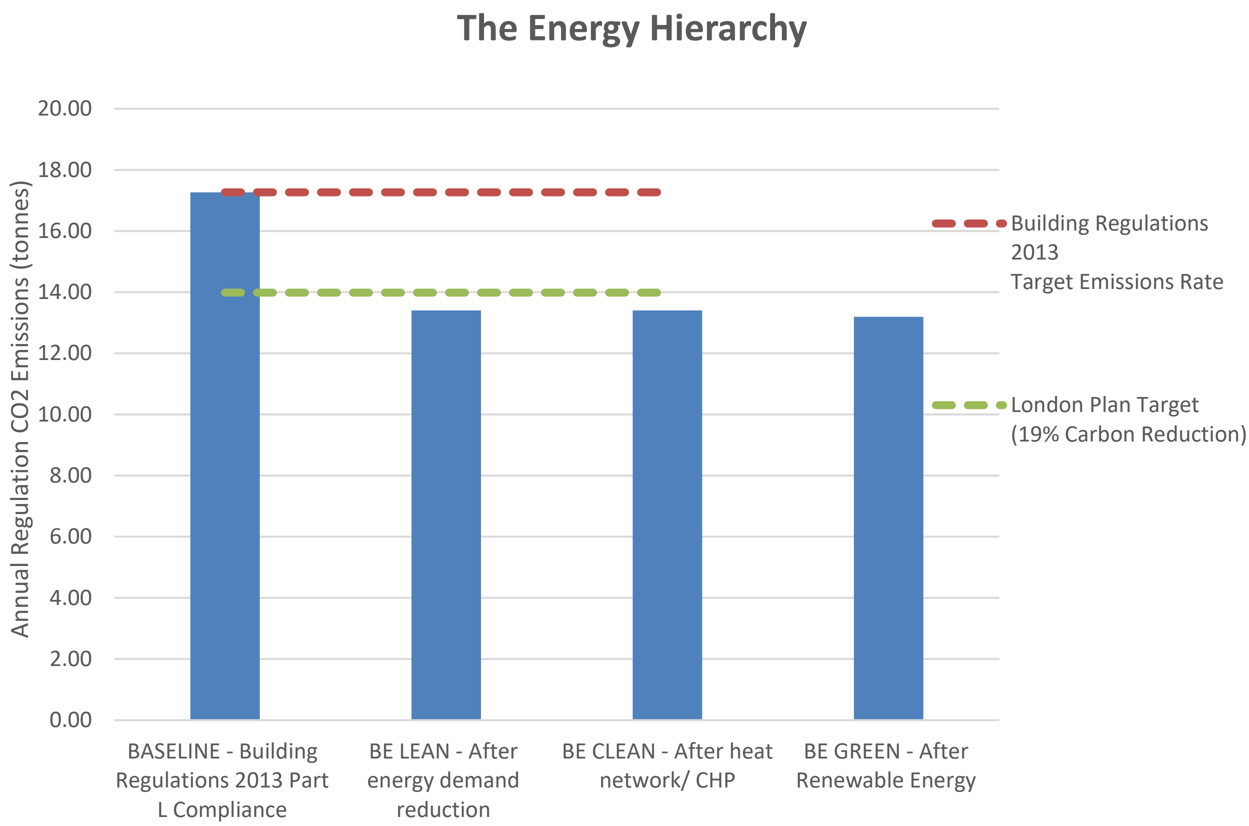


Figure 7 The Energy Hierarchy

11. Appendix A – SAP repots

11.1. Block Compliance

Block Compliance WorkSheet: Highgate Road 2

User Details

Assessor Name: Su Lee
Stroma Number: STRO031315
Software Name: Stroma FSAP
Software Version: Version: 1.0.4.16

Calculation Details

Dwelling	**DER**	**TER**	**DFEE**	**TFEE**	**TFA**
Unit 01	21.34	29.28	61	70.6	113.72
Unit 02	19.81	25.48	49.8	56.6	107.4
Unit 03	19.74	25.41	49.8	56.5	108.17
Unit 04	19.65	25.33	49.6	56.5	109.12
Unit 05	19.63	25.31	49.6	56.5	109.21
Unit 06	21.21	27.91	54.9	64.1	104.81

Calculation Summary

Total Floor Area	652.43
Average TER	26.47
Average DER	20.23
Average DFEE	52.50
Average TFEE	60.20
Compliance % Improvement DER|TER % Improvement DFEE|TFEE	Pass 23.57 12.79

11.2. Baseline

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 01

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	42.14	(1a)	x	2.7	(2a)	=	113.78	(3a)
Ground floor	36.79	(1b)	x	3.2	(2b)	=	117.73	(3b)
First floor	34.79	(1c)	x	4.65	(2c)	=	161.77	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	113.72	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	393.28	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.1	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(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) =	0.33	(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

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

0.41	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1	=	2.46			(26)
Windows Type 1			2.78	x1/[1/(1.4)+ 0.04]		=	3.69			(27)
Windows Type 2			2.97	x1/[1/(1.4)+ 0.04]		=	3.94			(27)
Windows Type 3			0.8	x1/[1/(1.4)+ 0.04]		=	1.06			(27)
Windows Type 4			2.78	x1/[1/(1.4)+ 0.04]		=	3.69			(27)
Windows Type 5			4.22	x1/[1/(1.4)+ 0.04]		=	5.59			(27)
Windows Type 6			3.33	x1/[1/(1.4)+ 0.04]		=	4.41			(27)
Windows Type 7			1.92	x1/[1/(1.4)+ 0.04]		=	2.55			(27)
Windows Type 8			3.83	x1/[1/(1.4)+ 0.04]		=	5.08			(27)
Rooflights Type 1			1.914602	x1/[1/(1.7) + 0.04]		=	3.254823			(27b)
Rooflights Type 2			0.6458209	x1/[1/(1.7) + 0.04]		=	1.097896			(27b)
Rooflights Type 3			0.7829865	x1/[1/(1.7) + 0.04]		=	1.331077			(27b)
Floor			42.14	x	0.13	=	5.478199			(28)
Walls Type1	12.61	0	12.61	x	0.18	=	2.27			(29)
Walls Type2	5.08	2.78	2.3	x	0.18	=	0.41			(29)
Walls Type3	1.35	0.8	0.55	x	0.18	=	0.1			(29)
Walls Type4	5.18	2.97	2.21	x	0.18	=	0.4			(29)

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Walls Type5	14.63	0	14.63	x	0.18	=	2.63			(29)
Walls Type6	1.7	0	1.7	x	0.18	=	0.31			(29)
Walls Type7	13.5	0	13.5	x	0.18	=	2.43			(29)
Walls Type8	5.22	0	5.22	x	0.18	=	0.94			(29)
Walls Type9	5.76	2.78	2.98	x	0.18	=	0.54			(29)
Walls Type10	0.42	0	0.42	x	0.18	=	0.08			(29)
Walls Type11	6.18	0	6.18	x	0.18	=	1.11			(29)
Walls Type12	15.33	0	15.33	x	0.18	=	2.76			(29)
Walls Type13	2.02	0	2.02	x	0.18	=	0.36			(29)
Walls Type14	16	0	16	x	0.18	=	2.88			(29)
Walls Type15	11.53	3.83	7.7	x	0.18	=	1.39			(29)
Walls Type16	2	0	2	x	0.18	=	0.36			(29)
Walls Type17	9.63	2.46	7.17	x	0.18	=	1.29			(29)
Walls Type18	9.3	0	9.3	x	0.18	=	1.67			(29)
Walls Type19	0.6	0	0.6	x	0.18	=	0.11			(29)
Walls Type20	10.04	3.33	6.71	x	0.18	=	1.21			(29)
Walls Type21	5.77	0	5.77	x	0.18	=	1.04			(29)
Walls Type22	1.91	0	1.91	x	0.18	=	0.34			(29)
Walls Type23	17.21	0	17.21	x	0.18	=	3.1			(29)
Walls Type24	2.65	0	2.65	x	0.18	=	0.48			(29)
Walls Type25	16.14	0	16.14	x	0.18	=	2.91			(29)
Walls Type26	3.94	0	3.94	x	0.18	=	0.71			(29)
Walls Type27	9.7	4.22	5.48	x	0.18	=	0.99			(29)
Walls Type28	5.81	1.92	3.89	x	0.18	=	0.7			(29)
Roof Type1	33.58	2.56	31.02	x	0.13	=	4.03			(30)
Roof Type2	4.01	0.78	3.23	x	0.13	=	0.42			(30)
Total area of elements, m²			290.94							(31)
Party wall			27.41	x	0	=	0			(32)
Party wall			27.94	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	81.22	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		11.39	(36)

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

Total fabric heat loss	(33) + (36) =	92.6	(37)

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

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

(38)m=	76.06	75.62	75.2	73.2	72.83	71.09	71.09	70.77	71.76	72.83	73.58	74.37	(38)

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

(39)m=	168.66	168.23	167.8	165.81	165.43	163.69	163.69	163.37	164.36	165.43	166.19	166.98	

Average = Sum(39)1…12 /12= 165.8 (39)

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

(40)m=	1.48	1.48	1.48	1.46	1.45	1.44	1.44	1.44	1.45	1.45	1.46	1.47	

Average = Sum(40)1…12 /12= 1.46 (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 2.84 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.54 (43)

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	111.69	107.63	103.57	99.51	95.45	91.39	91.39	95.45	99.51	103.57	107.63	111.69	
(45)m=	165.64	144.87	149.49	130.33	125.06	107.91	100	114.75	116.12	135.33	147.72	160.41	

Total = Sum(44)1…12 = 1218.49 (44)

Total = Sum(45)1…12 = 1597.63 (45)

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

(46)m=	24.85	21.73	22.42	19.55	18.76	16.19	15	17.21	17.42	20.3	22.16	24.06	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.7 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.92 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.92 (55)

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

(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(56)

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

(57)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(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=	217.39	191.61	201.24	180.41	176.8	157.99	151.74	166.5	166.2	187.07	197.8	212.16	(62)

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

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

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

Output from water heater

(64)m=	217.39	191.61	201.24	180.41	176.8	157.99	151.74	166.5	166.2	187.07	197.8	212.16

Output from water heater (annual)$_{1...12}$ | 2206.91 | (64)

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

(65)m=	96.47	85.56	91.1	83.4	82.98	75.94	74.65	79.55	78.67	86.39	89.18	94.73	(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=	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	24.68	21.92	17.82	13.49	10.09	8.52	9.2	11.96	16.05	20.38	23.79	25.36	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	276.8	279.67	272.43	257.02	237.57	219.29	207.08	204.2	211.44	226.85	246.3	264.58	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	(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=	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	(71)
Water heating gains (Table 5)													
(72)m=	129.67	127.32	122.45	115.83	111.53	105.48	100.33	106.92	109.27	116.12	123.86	127.33	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	499.67	497.44	481.24	454.88	427.72	401.81	385.14	391.62	405.29	431.89	462.48	485.81	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.22	x	11.28	x	0.63	x	0.7	=	14.55	(75)
Northeast 0.9x	0.77	x	3.83	x	11.28	x	0.63	x	0.7	=	13.21	(75)

Northeast	0.9x	0.77	x	4.22	x	22.97	x	0.63	x	0.7	=	29.62	(75)
Northeast	0.9x	0.77	x	3.83	x	22.97	x	0.63	x	0.7	=	26.88	(75)
Northeast	0.9x	0.77	x	4.22	x	41.38	x	0.63	x	0.7	=	53.37	(75)
Northeast	0.9x	0.77	x	3.83	x	41.38	x	0.63	x	0.7	=	48.43	(75)
Northeast	0.9x	0.77	x	4.22	x	67.96	x	0.63	x	0.7	=	87.64	(75)
Northeast	0.9x	0.77	x	3.83	x	67.96	x	0.63	x	0.7	=	79.54	(75)
Northeast	0.9x	0.77	x	4.22	x	91.35	x	0.63	x	0.7	=	117.81	(75)
Northeast	0.9x	0.77	x	3.83	x	91.35	x	0.63	x	0.7	=	106.92	(75)
Northeast	0.9x	0.77	x	4.22	x	97.38	x	0.63	x	0.7	=	125.6	(75)
Northeast	0.9x	0.77	x	3.83	x	97.38	x	0.63	x	0.7	=	113.99	(75)
Northeast	0.9x	0.77	x	4.22	x	91.1	x	0.63	x	0.7	=	117.49	(75)
Northeast	0.9x	0.77	x	3.83	x	91.1	x	0.63	x	0.7	=	106.63	(75)
Northeast	0.9x	0.77	x	4.22	x	72.63	x	0.63	x	0.7	=	93.67	(75)
Northeast	0.9x	0.77	x	3.83	x	72.63	x	0.63	x	0.7	=	85.01	(75)
Northeast	0.9x	0.77	x	4.22	x	50.42	x	0.63	x	0.7	=	65.03	(75)
Northeast	0.9x	0.77	x	3.83	x	50.42	x	0.63	x	0.7	=	59.02	(75)
Northeast	0.9x	0.77	x	4.22	x	28.07	x	0.63	x	0.7	=	36.2	(75)
Northeast	0.9x	0.77	x	3.83	x	28.07	x	0.63	x	0.7	=	32.85	(75)
Northeast	0.9x	0.77	x	4.22	x	14.2	x	0.63	x	0.7	=	18.31	(75)
Northeast	0.9x	0.77	x	3.83	x	14.2	x	0.63	x	0.7	=	16.62	(75)
Northeast	0.9x	0.77	x	4.22	x	9.21	x	0.63	x	0.7	=	11.88	(75)
Northeast	0.9x	0.77	x	3.83	x	9.21	x	0.63	x	0.7	=	10.79	(75)
Southwest	0.9x	0.77	x	2.78	x	36.79		0.63	x	0.7	=	31.26	(79)
Southwest	0.9x	0.77	x	2.97	x	36.79		0.63	x	0.7	=	33.4	(79)
Southwest	0.9x	0.77	x	2.78	x	36.79		0.63	x	0.7	=	31.26	(79)
Southwest	0.9x	0.77	x	3.33	x	36.79		0.63	x	0.7	=	37.44	(79)
Southwest	0.9x	0.77	x	2.78	x	62.67		0.63	x	0.7	=	53.25	(79)
Southwest	0.9x	0.77	x	2.97	x	62.67		0.63	x	0.7	=	56.89	(79)
Southwest	0.9x	0.77	x	2.78	x	62.67		0.63	x	0.7	=	53.25	(79)
Southwest	0.9x	0.77	x	3.33	x	62.67		0.63	x	0.7	=	63.78	(79)
Southwest	0.9x	0.77	x	2.78	x	85.75		0.63	x	0.7	=	72.86	(79)
Southwest	0.9x	0.77	x	2.97	x	85.75		0.63	x	0.7	=	77.84	(79)
Southwest	0.9x	0.77	x	2.78	x	85.75		0.63	x	0.7	=	72.86	(79)
Southwest	0.9x	0.77	x	3.33	x	85.75		0.63	x	0.7	=	87.27	(79)
Southwest	0.9x	0.77	x	2.78	x	106.25		0.63	x	0.7	=	90.27	(79)
Southwest	0.9x	0.77	x	2.97	x	106.25		0.63	x	0.7	=	96.44	(79)
Southwest	0.9x	0.77	x	2.78	x	106.25		0.63	x	0.7	=	90.27	(79)
Southwest	0.9x	0.77	x	3.33	x	106.25		0.63	x	0.7	=	108.13	(79)
Southwest	0.9x	0.77	x	2.78	x	119.01		0.63	x	0.7	=	101.11	(79)
Southwest	0.9x	0.77	x	2.97	x	119.01		0.63	x	0.7	=	108.02	(79)
Southwest	0.9x	0.77	x	2.78	x	119.01		0.63	x	0.7	=	101.11	(79)

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Southwest	0.9x	0.77	x	3.33	x	119.01		0.63	x	0.7	=	121.12	(79)
Southwest	0.9x	0.77	x	2.78	x	118.15		0.63	x	0.7	=	100.38	(79)
Southwest	0.9x	0.77	x	2.97	x	118.15		0.63	x	0.7	=	107.24	(79)
Southwest	0.9x	0.77	x	2.78	x	118.15		0.63	x	0.7	=	100.38	(79)
Southwest	0.9x	0.77	x	3.33	x	118.15		0.63	x	0.7	=	120.24	(79)
Southwest	0.9x	0.77	x	2.78	x	113.91		0.63	x	0.7	=	96.78	(79)
Southwest	0.9x	0.77	x	2.97	x	113.91		0.63	x	0.7	=	103.39	(79)
Southwest	0.9x	0.77	x	2.78	x	113.91		0.63	x	0.7	=	96.78	(79)
Southwest	0.9x	0.77	x	3.33	x	113.91		0.63	x	0.7	=	115.92	(79)
Southwest	0.9x	0.77	x	2.78	x	104.39		0.63	x	0.7	=	88.69	(79)
Southwest	0.9x	0.77	x	2.97	x	104.39		0.63	x	0.7	=	94.75	(79)
Southwest	0.9x	0.77	x	2.78	x	104.39		0.63	x	0.7	=	88.69	(79)
Southwest	0.9x	0.77	x	3.33	x	104.39		0.63	x	0.7	=	106.24	(79)
Southwest	0.9x	0.77	x	2.78	x	92.85		0.63	x	0.7	=	78.89	(79)
Southwest	0.9x	0.77	x	2.97	x	92.85		0.63	x	0.7	=	84.28	(79)
Southwest	0.9x	0.77	x	2.78	x	92.85		0.63	x	0.7	=	78.89	(79)
Southwest	0.9x	0.77	x	3.33	x	92.85		0.63	x	0.7	=	94.49	(79)
Southwest	0.9x	0.77	x	2.78	x	69.27		0.63	x	0.7	=	58.85	(79)
Southwest	0.9x	0.77	x	2.97	x	69.27		0.63	x	0.7	=	62.87	(79)
Southwest	0.9x	0.77	x	2.78	x	69.27		0.63	x	0.7	=	58.85	(79)
Southwest	0.9x	0.77	x	3.33	x	69.27		0.63	x	0.7	=	70.49	(79)
Southwest	0.9x	0.77	x	2.78	x	44.07		0.63	x	0.7	=	37.44	(79)
Southwest	0.9x	0.77	x	2.97	x	44.07		0.63	x	0.7	=	40	(79)
Southwest	0.9x	0.77	x	2.78	x	44.07		0.63	x	0.7	=	37.44	(79)
Southwest	0.9x	0.77	x	3.33	x	44.07		0.63	x	0.7	=	44.85	(79)
Southwest	0.9x	0.77	x	2.78	x	31.49		0.63	x	0.7	=	26.75	(79)
Southwest	0.9x	0.77	x	2.97	x	31.49		0.63	x	0.7	=	28.58	(79)
Southwest	0.9x	0.77	x	2.78	x	31.49		0.63	x	0.7	=	26.75	(79)
Southwest	0.9x	0.77	x	3.33	x	31.49		0.63	x	0.7	=	32.04	(79)
Northwest	0.9x	0.77	x	0.8	x	11.28	x	0.63	x	0.7	=	2.76	(81)
Northwest	0.9x	0.77	x	1.92	x	11.28	x	0.63	x	0.7	=	6.62	(81)
Northwest	0.9x	0.77	x	0.8	x	22.97	x	0.63	x	0.7	=	5.62	(81)
Northwest	0.9x	0.77	x	1.92	x	22.97	x	0.63	x	0.7	=	13.48	(81)
Northwest	0.9x	0.77	x	0.8	x	41.38	x	0.63	x	0.7	=	10.12	(81)
Northwest	0.9x	0.77	x	1.92	x	41.38	x	0.63	x	0.7	=	24.28	(81)
Northwest	0.9x	0.77	x	0.8	x	67.96	x	0.63	x	0.7	=	16.61	(81)
Northwest	0.9x	0.77	x	1.92	x	67.96	x	0.63	x	0.7	=	39.87	(81)
Northwest	0.9x	0.77	x	0.8	x	91.35	x	0.63	x	0.7	=	22.33	(81)
Northwest	0.9x	0.77	x	1.92	x	91.35	x	0.63	x	0.7	=	53.6	(81)
Northwest	0.9x	0.77	x	0.8	x	97.38	x	0.63	x	0.7	=	23.81	(81)
Northwest	0.9x	0.77	x	1.92	x	97.38	x	0.63	x	0.7	=	57.14	(81)

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Northwest 0.9x	0.77	x	0.8	x	91.1	x	0.63	x	0.7	=	22.27	(81)
Northwest 0.9x	0.77	x	1.92	x	91.1	x	0.63	x	0.7	=	53.46	(81)
Northwest 0.9x	0.77	x	0.8	x	72.63	x	0.63	x	0.7	=	17.76	(81)
Northwest 0.9x	0.77	x	1.92	x	72.63	x	0.63	x	0.7	=	42.62	(81)
Northwest 0.9x	0.77	x	0.8	x	50.42	x	0.63	x	0.7	=	12.33	(81)
Northwest 0.9x	0.77	x	1.92	x	50.42	x	0.63	x	0.7	=	29.59	(81)
Northwest 0.9x	0.77	x	0.8	x	28.07	x	0.63	x	0.7	=	6.86	(81)
Northwest 0.9x	0.77	x	1.92	x	28.07	x	0.63	x	0.7	=	16.47	(81)
Northwest 0.9x	0.77	x	0.8	x	14.2	x	0.63	x	0.7	=	3.47	(81)
Northwest 0.9x	0.77	x	1.92	x	14.2	x	0.63	x	0.7	=	8.33	(81)
Northwest 0.9x	0.77	x	0.8	x	9.21	x	0.63	x	0.7	=	2.25	(81)
Northwest 0.9x	0.77	x	1.92	x	9.21	x	0.63	x	0.7	=	5.41	(81)
Rooflights 0.9x	1	x	1.91	x	26	x	0.63	x	0.7	=	19.76	(82)
Rooflights 0.9x	1	x	0.65	x	26	x	0.63	x	0.7	=	6.66	(82)
Rooflights 0.9x	1	x	0.78	x	26	x	0.63	x	0.7	=	8.08	(82)
Rooflights 0.9x	1	x	1.91	x	54	x	0.63	x	0.7	=	41.03	(82)
Rooflights 0.9x	1	x	0.65	x	54	x	0.63	x	0.7	=	13.84	(82)
Rooflights 0.9x	1	x	0.78	x	54	x	0.63	x	0.7	=	16.78	(82)
Rooflights 0.9x	1	x	1.91	x	96	x	0.63	x	0.7	=	72.95	(82)
Rooflights 0.9x	1	x	0.65	x	96	x	0.63	x	0.7	=	24.61	(82)
Rooflights 0.9x	1	x	0.78	x	96	x	0.63	x	0.7	=	29.83	(82)
Rooflights 0.9x	1	x	1.91	x	150	x	0.63	x	0.7	=	113.99	(82)
Rooflights 0.9x	1	x	0.65	x	150	x	0.63	x	0.7	=	38.45	(82)
Rooflights 0.9x	1	x	0.78	x	150	x	0.63	x	0.7	=	46.62	(82)
Rooflights 0.9x	1	x	1.91	x	192	x	0.63	x	0.7	=	145.9	(82)
Rooflights 0.9x	1	x	0.65	x	192	x	0.63	x	0.7	=	49.21	(82)
Rooflights 0.9x	1	x	0.78	x	192	x	0.63	x	0.7	=	59.67	(82)
Rooflights 0.9x	1	x	1.91	x	200	x	0.63	x	0.7	=	151.98	(82)
Rooflights 0.9x	1	x	0.65	x	200	x	0.63	x	0.7	=	51.27	(82)
Rooflights 0.9x	1	x	0.78	x	200	x	0.63	x	0.7	=	62.15	(82)
Rooflights 0.9x	1	x	1.91	x	189	x	0.63	x	0.7	=	143.62	(82)
Rooflights 0.9x	1	x	0.65	x	189	x	0.63	x	0.7	=	48.45	(82)
Rooflights 0.9x	1	x	0.78	x	189	x	0.63	x	0.7	=	58.74	(82)
Rooflights 0.9x	1	x	1.91	x	157	x	0.63	x	0.7	=	119.31	(82)
Rooflights 0.9x	1	x	0.65	x	157	x	0.63	x	0.7	=	40.24	(82)
Rooflights 0.9x	1	x	0.78	x	157	x	0.63	x	0.7	=	48.79	(82)
Rooflights 0.9x	1	x	1.91	x	115	x	0.63	x	0.7	=	87.39	(82)
Rooflights 0.9x	1	x	0.65	x	115	x	0.63	x	0.7	=	29.48	(82)
Rooflights 0.9x	1	x	0.78	x	115	x	0.63	x	0.7	=	35.74	(82)
Rooflights 0.9x	1	x	1.91	x	66	x	0.63	x	0.7	=	50.15	(82)
Rooflights 0.9x	1	x	0.65	x	66	x	0.63	x	0.7	=	16.92	(82)

Rooflights	0.9x	1	x	0.78	x	66	x	0.63	x	0.7	=	20.51	(82)
Rooflights	0.9x	1	x	1.91	x	33	x	0.63	x	0.7	=	25.08	(82)
Rooflights	0.9x	1	x	0.65	x	33	x	0.63	x	0.7	=	8.46	(82)
Rooflights	0.9x	1	x	0.78	x	33	x	0.63	x	0.7	=	10.26	(82)
Rooflights	0.9x	1	x	1.91	x	21	x	0.63	x	0.7	=	15.96	(82)
Rooflights	0.9x	1	x	0.65	x	21	x	0.63	x	0.7	=	5.38	(82)
Rooflights	0.9x	1	x	0.78	x	21	x	0.63	x	0.7	=	6.53	(82)

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

(83)m=	205	374.42	574.4	807.84	986.81	1014.18	963.53	825.76	655.11	431.03	250.26	172.33	(83)

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

(84)m=	704.67	871.86	1055.64	1262.72	1414.53	1415.99	1348.67	1217.38	1060.4	862.91	712.74	658.13	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.67	0.52	0.58	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=	19.35	19.56	19.91	20.36	20.73	20.92	20.98	20.97	20.8	20.31	19.75	19.32	(87)

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

(88)m=	19.7	19.7	19.71	19.72	19.72	19.73	19.73	19.74	19.73	19.72	19.72	19.71	(88)

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

(89)m=	1	0.99	0.98	0.92	0.78	0.56	0.38	0.44	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=	17.54	17.85	18.35	18.99	19.47	19.69	19.73	19.72	19.58	18.94	18.13	17.5	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.14	18.41	18.87	19.44	19.88	20.1	20.14	20.13	19.98	19.39	18.66	18.1	(92)

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

(93)m=	18.14	18.41	18.87	19.44	19.88	20.1	20.14	20.13	19.98	19.39	18.66	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	0.91	0.79	0.6	0.42	0.49	0.77	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	701.13	861.51	1022.97	1152.02	1115.84	846.08	570.1	593.17	815.29	820.54	705.51	655.62	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2333.97	2273.51	2075.03	1748.29	1353.51	899.53	579.61	610.09	966.98	1454.28	1921.46	2321.37	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1214.83	948.86	782.73	429.32	176.83	0	0	0	0	471.5	875.48	1239.32	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	6138.87	(98)
Space heating requirement in kWh/m²/year	53.98	(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		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	1214.83	948.86	782.73	429.32	176.83	0	0	0	0	471.5	875.48	1239.32		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1299.28	1014.82	837.15	459.16	189.12	0	0	0	0	504.28	936.35	1325.48		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													6565.64	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	217.39	191.61	201.24	180.41	176.8	157.99	151.74	166.5	166.2	187.07	197.8	212.16		
Efficiency of water heater													79.8	(216)
(217)m=	88.69	88.51	88.08	87.05	84.81	79.8	79.8	79.8	79.8	87.18	88.32	88.76		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	245.1	216.49	228.46	207.26	208.46	197.98	190.16	208.64	208.27	214.58	223.96	239.03		
Total = Sum(219a)$_{1...12}$ =													2588.39	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			6565.64	
Water heating fuel used			2588.39	
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			435.8	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1418.18	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	559.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1977.27	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	226.18	(268)
Total CO2, kg/year		sum of (265)…(271) =		2242.37	(272)

TER = 29.28 (273)

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User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 02

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	39.95	(1a)	x	2.7	(2a)	=	107.87	(3a)
Ground floor	35.19	(1b)	x	3.2	(2b)	=	112.61	(3b)
First floor	32.26	(1c)	x	4.65	(2c)	=	150.01	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	107.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	370.48	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.11	(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)	0.36	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7 (22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1	=	2.46			(26)
Windows Type 1			3.18		x1/[1/(1.4)+ 0.04]	=	4.22			(27)
Windows Type 2			3.41		x1/[1/(1.4)+ 0.04]	=	4.52			(27)
Windows Type 3			0.92		x1/[1/(1.4)+ 0.04]	=	1.22			(27)
Windows Type 4			3.18		x1/[1/(1.4)+ 0.04]	=	4.22			(27)
Windows Type 5			3.46		x1/[1/(1.4)+ 0.04]	=	4.59			(27)
Windows Type 6			3.18		x1/[1/(1.4)+ 0.04]	=	4.22			(27)
Windows Type 7			3.46		x1/[1/(1.4)+ 0.04]	=	4.59			(27)
Rooflights Type 1			2.206558		x1/[1/(1.7) + 0.04]	=	3.751149			(27b)
Rooflights Type 2			0.7398844		x1/[1/(1.7) + 0.04]	=	1.257804			(27b)
Rooflights Type 3			0.6416698		x1/[1/(1.7) + 0.04]	=	1.090839			(27b)
Floor			39.95	x	0.13	=	5.1935			(28)
Walls Type1	10.29	0	10.29	x	0.18	=	1.85			(29)
Walls Type2	5.1	3.18	1.92	x	0.18	=	0.35			(29)
Walls Type3	1.35	0.92	0.43	x	0.18	=	0.08			(29)
Walls Type4	5.21	3.41	1.8	x	0.18	=	0.32			(29)
Walls Type5	6.27	3.46	2.81	x	0.18	=	0.51			(29)

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Walls Type6	0.8	0	0.8	x	0.18	=	0.14			(29)
Walls Type7	0.96	0	0.96	x	0.18	=	0.17			(29)
Walls Type8	5.63	0	5.63	x	0.18	=	1.01			(29)
Walls Type9	4.96	0	4.96	x	0.18	=	0.89			(29)
Walls Type10	5.76	3.18	2.58	x	0.18	=	0.46			(29)
Walls Type11	0.42	0	0.42	x	0.18	=	0.08			(29)
Walls Type12	6.4	0	6.4	x	0.18	=	1.15			(29)
Walls Type13	9.11	3.46	5.65	x	0.18	=	1.02			(29)
Walls Type14	1.86	0	1.86	x	0.18	=	0.33			(29)
Walls Type15	8.6	2.46	6.14	x	0.18	=	1.11			(29)
Walls Type16	9.3	0	9.3	x	0.18	=	1.67			(29)
Walls Type17	0.6	0	0.6	x	0.18	=	0.11			(29)
Walls Type18	8.37	3.18	5.19	x	0.18	=	0.93			(29)
Roof Type1	31.76	2.95	28.81	x	0.13	=	3.75			(30)
Roof Type2	3.02	0.64	2.38	x	0.13	=	0.31			(30)
Total area of elements, m²			165.72							(31)
Party wall			28.78	x	0	=	0			(32)
Party wall			27.84	x	0	=	0			(32)
Party wall			32.1	x	0	=	0			(32)
Party wall			32.96	x	0	=	0			(32)
Party wall			38.6	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	57.18	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		9.86	(36)

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

Total fabric heat loss	(33) + (36) =	67.03	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	70.33	69.97	69.62	67.98	67.67	66.24	66.24	65.97	66.79	67.67	68.29	68.94	(38)

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

(39)m=	137.36	137	136.65	135.01	134.7	133.27	133.27	133	133.82	134.7	135.32	135.98	

Average = $Sum(39)_{1…12}$ /12= 135.01 (39)

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

(40)m=	1.28	1.28	1.27	1.26	1.25	1.24	1.24	1.24	1.25	1.25	1.26	1.27	

Average = $Sum(40)_{1…12}$ /12= 1.26 (40)

Number of days in month (Table 1a)

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

(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.8 (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 — 100.66 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	110.73	106.7	102.67	98.65	94.62	90.59	90.59	94.62	98.65	102.67	106.7	110.73	
Total = Sum(44)1…12 =												1207.91	(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=	164.2	143.61	148.2	129.2	123.97	106.98	99.13	113.75	115.11	134.15	146.44	159.02	
Total = Sum(45)1…12 =												1583.76	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.63	21.54	22.23	19.38	18.6	16.05	14.87	17.06	17.27	20.12	21.97	23.85	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.7 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.92 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.92 (55)

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

(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(56)

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

(57)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(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=	215.95	190.35	199.94	179.28	175.72	157.05	150.88	165.5	165.19	185.9	196.51	210.77	(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=	215.95	190.35	199.94	179.28	175.72	157.05	150.88	165.5	165.19	185.9	196.51	210.77	

Output from water heater (annual)1…12 | 2193.04 | (64)

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

(65)m=	95.99	85.14	90.67	83.02	82.62	75.63	74.36	79.22	78.34	86	88.75	94.27	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.87	21.2	17.24	13.05	9.76	8.24	8.9	11.57	15.53	19.72	23.02	24.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	267.77	270.54	263.54	248.64	229.82	212.14	200.32	197.54	204.54	219.45	238.27	255.95	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	(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=	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	(71)
Water heating gains (Table 5)													
(72)m=	129.02	126.7	121.87	115.31	111.04	105.04	99.94	106.48	108.8	115.6	123.27	126.71	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	488.64	486.42	470.63	444.97	418.6	393.39	377.14	383.57	396.85	422.74	452.52	475.17	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.46	x	11.28	x	0.63	x	0.7	=	11.93	(75)
Northeast 0.9x	0.77	x	3.46	x	11.28	x	0.63	x	0.7	=	11.93	(75)
Northeast 0.9x	0.77	x	3.46	x	22.97	x	0.63	x	0.7	=	24.29	(75)
Northeast 0.9x	0.77	x	3.46	x	22.97	x	0.63	x	0.7	=	24.29	(75)
Northeast 0.9x	0.77	x	3.46	x	41.38	x	0.63	x	0.7	=	43.75	(75)
Northeast 0.9x	0.77	x	3.46	x	41.38	x	0.63	x	0.7	=	43.75	(75)
Northeast 0.9x	0.77	x	3.46	x	67.96	x	0.63	x	0.7	=	71.86	(75)
Northeast 0.9x	0.77	x	3.46	x	67.96	x	0.63	x	0.7	=	71.86	(75)
Northeast 0.9x	0.77	x	3.46	x	91.35	x	0.63	x	0.7	=	96.59	(75)
Northeast 0.9x	0.77	x	3.46	x	91.35	x	0.63	x	0.7	=	96.59	(75)

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Northeast	0.9x	0.77	x	3.46	x	97.38	x	0.63	x	0.7	=	102.98	(75)
Northeast	0.9x	0.77	x	3.46	x	97.38	x	0.63	x	0.7	=	102.98	(75)
Northeast	0.9x	0.77	x	3.46	x	91.1	x	0.63	x	0.7	=	96.33	(75)
Northeast	0.9x	0.77	x	3.46	x	91.1	x	0.63	x	0.7	=	96.33	(75)
Northeast	0.9x	0.77	x	3.46	x	72.63	x	0.63	x	0.7	=	76.8	(75)
Northeast	0.9x	0.77	x	3.46	x	72.63	x	0.63	x	0.7	=	76.8	(75)
Northeast	0.9x	0.77	x	3.46	x	50.42	x	0.63	x	0.7	=	53.32	(75)
Northeast	0.9x	0.77	x	3.46	x	50.42	x	0.63	x	0.7	=	53.32	(75)
Northeast	0.9x	0.77	x	3.46	x	28.07	x	0.63	x	0.7	=	29.68	(75)
Northeast	0.9x	0.77	x	3.46	x	28.07	x	0.63	x	0.7	=	29.68	(75)
Northeast	0.9x	0.77	x	3.46	x	14.2	x	0.63	x	0.7	=	15.01	(75)
Northeast	0.9x	0.77	x	3.46	x	14.2	x	0.63	x	0.7	=	15.01	(75)
Northeast	0.9x	0.77	x	3.46	x	9.21	x	0.63	x	0.7	=	9.74	(75)
Northeast	0.9x	0.77	x	3.46	x	9.21	x	0.63	x	0.7	=	9.74	(75)
Southwest	0.9x	0.77	x	3.18	x	36.79		0.63	x	0.7	=	35.76	(79)
Southwest	0.9x	0.77	x	3.41	x	36.79		0.63	x	0.7	=	38.34	(79)
Southwest	0.9x	0.77	x	3.18	x	36.79		0.63	x	0.7	=	35.76	(79)
Southwest	0.9x	0.77	x	3.18	x	36.79		0.63	x	0.7	=	35.76	(79)
Southwest	0.9x	0.77	x	3.18	x	62.67		0.63	x	0.7	=	60.91	(79)
Southwest	0.9x	0.77	x	3.41	x	62.67		0.63	x	0.7	=	65.31	(79)
Southwest	0.9x	0.77	x	3.18	x	62.67		0.63	x	0.7	=	60.91	(79)
Southwest	0.9x	0.77	x	3.18	x	62.67		0.63	x	0.7	=	60.91	(79)
Southwest	0.9x	0.77	x	3.18	x	85.75		0.63	x	0.7	=	83.34	(79)
Southwest	0.9x	0.77	x	3.41	x	85.75		0.63	x	0.7	=	89.37	(79)
Southwest	0.9x	0.77	x	3.18	x	85.75		0.63	x	0.7	=	83.34	(79)
Southwest	0.9x	0.77	x	3.18	x	85.75		0.63	x	0.7	=	83.34	(79)
Southwest	0.9x	0.77	x	3.18	x	106.25		0.63	x	0.7	=	103.26	(79)
Southwest	0.9x	0.77	x	3.41	x	106.25		0.63	x	0.7	=	110.73	(79)
Southwest	0.9x	0.77	x	3.18	x	106.25		0.63	x	0.7	=	103.26	(79)
Southwest	0.9x	0.77	x	3.18	x	106.25		0.63	x	0.7	=	103.26	(79)
Southwest	0.9x	0.77	x	3.18	x	119.01		0.63	x	0.7	=	115.66	(79)
Southwest	0.9x	0.77	x	3.41	x	119.01		0.63	x	0.7	=	124.03	(79)
Southwest	0.9x	0.77	x	3.18	x	119.01		0.63	x	0.7	=	115.66	(79)
Southwest	0.9x	0.77	x	3.18	x	119.01		0.63	x	0.7	=	115.66	(79)
Southwest	0.9x	0.77	x	3.18	x	118.15		0.63	x	0.7	=	114.82	(79)
Southwest	0.9x	0.77	x	3.41	x	118.15		0.63	x	0.7	=	123.13	(79)
Southwest	0.9x	0.77	x	3.18	x	118.15		0.63	x	0.7	=	114.82	(79)
Southwest	0.9x	0.77	x	3.18	x	118.15		0.63	x	0.7	=	114.82	(79)
Southwest	0.9x	0.77	x	3.18	x	113.91		0.63	x	0.7	=	110.7	(79)
Southwest	0.9x	0.77	x	3.41	x	113.91		0.63	x	0.7	=	118.71	(79)
Southwest	0.9x	0.77	x	3.18	x	113.91		0.63	x	0.7	=	110.7	(79)

Southwest	0.9x	0.77	x	3.18	x	113.91		0.63	x	0.7	=	110.7	(79)
Southwest	0.9x	0.77	x	3.18	x	104.39		0.63	x	0.7	=	101.45	(79)
Southwest	0.9x	0.77	x	3.41	x	104.39		0.63	x	0.7	=	108.79	(79)
Southwest	0.9x	0.77	x	3.18	x	104.39		0.63	x	0.7	=	101.45	(79)
Southwest	0.9x	0.77	x	3.18	x	104.39		0.63	x	0.7	=	101.45	(79)
Southwest	0.9x	0.77	x	3.18	x	92.85		0.63	x	0.7	=	90.24	(79)
Southwest	0.9x	0.77	x	3.41	x	92.85		0.63	x	0.7	=	96.76	(79)
Southwest	0.9x	0.77	x	3.18	x	92.85		0.63	x	0.7	=	90.24	(79)
Southwest	0.9x	0.77	x	3.18	x	92.85		0.63	x	0.7	=	90.24	(79)
Southwest	0.9x	0.77	x	3.18	x	69.27		0.63	x	0.7	=	67.32	(79)
Southwest	0.9x	0.77	x	3.41	x	69.27		0.63	x	0.7	=	72.19	(79)
Southwest	0.9x	0.77	x	3.18	x	69.27		0.63	x	0.7	=	67.32	(79)
Southwest	0.9x	0.77	x	3.18	x	69.27		0.63	x	0.7	=	67.32	(79)
Southwest	0.9x	0.77	x	3.18	x	44.07		0.63	x	0.7	=	42.83	(79)
Southwest	0.9x	0.77	x	3.41	x	44.07		0.63	x	0.7	=	45.93	(79)
Southwest	0.9x	0.77	x	3.18	x	44.07		0.63	x	0.7	=	42.83	(79)
Southwest	0.9x	0.77	x	3.18	x	44.07		0.63	x	0.7	=	42.83	(79)
Southwest	0.9x	0.77	x	3.18	x	31.49		0.63	x	0.7	=	30.6	(79)
Southwest	0.9x	0.77	x	3.41	x	31.49		0.63	x	0.7	=	32.81	(79)
Southwest	0.9x	0.77	x	3.18	x	31.49		0.63	x	0.7	=	30.6	(79)
Southwest	0.9x	0.77	x	3.18	x	31.49		0.63	x	0.7	=	30.6	(79)
Northwest	0.9x	0.77	x	0.92	x	11.28	x	0.63	x	0.7	=	3.17	(81)
Northwest	0.9x	0.77	x	0.92	x	22.97	x	0.63	x	0.7	=	6.46	(81)
Northwest	0.9x	0.77	x	0.92	x	41.38	x	0.63	x	0.7	=	11.63	(81)
Northwest	0.9x	0.77	x	0.92	x	67.96	x	0.63	x	0.7	=	19.11	(81)
Northwest	0.9x	0.77	x	0.92	x	91.35	x	0.63	x	0.7	=	25.68	(81)
Northwest	0.9x	0.77	x	0.92	x	97.38	x	0.63	x	0.7	=	27.38	(81)
Northwest	0.9x	0.77	x	0.92	x	91.1	x	0.63	x	0.7	=	25.61	(81)
Northwest	0.9x	0.77	x	0.92	x	72.63	x	0.63	x	0.7	=	20.42	(81)
Northwest	0.9x	0.77	x	0.92	x	50.42	x	0.63	x	0.7	=	14.18	(81)
Northwest	0.9x	0.77	x	0.92	x	28.07	x	0.63	x	0.7	=	7.89	(81)
Northwest	0.9x	0.77	x	0.92	x	14.2	x	0.63	x	0.7	=	3.99	(81)
Northwest	0.9x	0.77	x	0.92	x	9.21	x	0.63	x	0.7	=	2.59	(81)
Rooflights	0.9x	1	x	2.21	x	26	x	0.63	x	0.7	=	22.77	(82)
Rooflights	0.9x	1	x	0.74	x	26	x	0.63	x	0.7	=	7.64	(82)
Rooflights	0.9x	1	x	0.64	x	26	x	0.63	x	0.7	=	6.62	(82)
Rooflights	0.9x	1	x	2.21	x	54	x	0.63	x	0.7	=	47.29	(82)
Rooflights	0.9x	1	x	0.74	x	54	x	0.63	x	0.7	=	15.86	(82)
Rooflights	0.9x	1	x	0.64	x	54	x	0.63	x	0.7	=	13.75	(82)
Rooflights	0.9x	1	x	2.21	x	96	x	0.63	x	0.7	=	84.08	(82)
Rooflights	0.9x	1	x	0.74	x	96	x	0.63	x	0.7	=	28.19	(82)

Rooflights	0.9x	1	x	0.64	x	96	x	0.63	x	0.7	=	24.45	(82)
Rooflights	0.9x	1	x	2.21	x	150	x	0.63	x	0.7	=	131.37	(82)
Rooflights	0.9x	1	x	0.74	x	150	x	0.63	x	0.7	=	44.05	(82)
Rooflights	0.9x	1	x	0.64	x	150	x	0.63	x	0.7	=	38.2	(82)
Rooflights	0.9x	1	x	2.21	x	192	x	0.63	x	0.7	=	168.15	(82)
Rooflights	0.9x	1	x	0.74	x	192	x	0.63	x	0.7	=	56.38	(82)
Rooflights	0.9x	1	x	0.64	x	192	x	0.63	x	0.7	=	48.9	(82)
Rooflights	0.9x	1	x	2.21	x	200	x	0.63	x	0.7	=	175.16	(82)
Rooflights	0.9x	1	x	0.74	x	200	x	0.63	x	0.7	=	58.73	(82)
Rooflights	0.9x	1	x	0.64	x	200	x	0.63	x	0.7	=	50.94	(82)
Rooflights	0.9x	1	x	2.21	x	189	x	0.63	x	0.7	=	165.52	(82)
Rooflights	0.9x	1	x	0.74	x	189	x	0.63	x	0.7	=	55.5	(82)
Rooflights	0.9x	1	x	0.64	x	189	x	0.63	x	0.7	=	48.13	(82)
Rooflights	0.9x	1	x	2.21	x	157	x	0.63	x	0.7	=	137.5	(82)
Rooflights	0.9x	1	x	0.74	x	157	x	0.63	x	0.7	=	46.1	(82)
Rooflights	0.9x	1	x	0.64	x	157	x	0.63	x	0.7	=	39.98	(82)
Rooflights	0.9x	1	x	2.21	x	115	x	0.63	x	0.7	=	100.72	(82)
Rooflights	0.9x	1	x	0.74	x	115	x	0.63	x	0.7	=	33.77	(82)
Rooflights	0.9x	1	x	0.64	x	115	x	0.63	x	0.7	=	29.29	(82)
Rooflights	0.9x	1	x	2.21	x	66	x	0.63	x	0.7	=	57.8	(82)
Rooflights	0.9x	1	x	0.74	x	66	x	0.63	x	0.7	=	19.38	(82)
Rooflights	0.9x	1	x	0.64	x	66	x	0.63	x	0.7	=	16.81	(82)
Rooflights	0.9x	1	x	2.21	x	33	x	0.63	x	0.7	=	28.9	(82)
Rooflights	0.9x	1	x	0.74	x	33	x	0.63	x	0.7	=	9.69	(82)
Rooflights	0.9x	1	x	0.64	x	33	x	0.63	x	0.7	=	8.4	(82)
Rooflights	0.9x	1	x	2.21	x	21	x	0.63	x	0.7	=	18.39	(82)
Rooflights	0.9x	1	x	0.74	x	21	x	0.63	x	0.7	=	6.17	(82)
Rooflights	0.9x	1	x	0.64	x	21	x	0.63	x	0.7	=	5.35	(82)

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

(83)m=	209.68	379.97	575.24	796.95	963.3	985.76	938.26	810.75	652.06	435.38	255.43	176.6	(83)

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

(84)m=	698.32	866.39	1045.87	1241.92	1381.9	1379.15	1315.4	1194.31	1048.91	858.12	707.95	651.77	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.78	0.59	0.44	0.5	0.77	0.96	0.99	1	(86)

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

(87)m=	19.64	19.85	20.18	20.57	20.85	20.97	20.99	20.99	20.9	20.5	19.99	19.6	(87)

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

(88)m=	19.86	19.86	19.86	19.87	19.88	19.89	19.89	19.89	19.88	19.88	19.87	19.87	(88)

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

(89)m=	1	0.99	0.97	0.89	0.72	0.5	0.33	0.39	0.68	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=	18.05	18.37	18.84	19.4	19.74	19.87	19.89	19.89	19.81	19.32	18.58	18.01	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.57	18.85	19.28	19.78	20.11	20.23	20.25	20.25	20.17	19.71	19.04	18.53	(92)

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

(93)m=	18.57	18.85	19.28	19.78	20.11	20.23	20.25	20.25	20.17	19.71	19.04	18.53	(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	0.96	0.89	0.73	0.53	0.37	0.42	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	694.49	854.1	1004.68	1099.85	1013.92	730.47	483.51	506.39	740.56	802.65	699.48	649.12	(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=	1960.46	1911.6	1746.33	1469.51	1132.4	750.27	486.29	511.7	811.88	1226.81	1616.38	1948.81	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	941.89	710.64	551.79	266.15	88.15	0	0	0	0	315.58	660.16	966.97	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4501.33 (98)

Space heating requirement in kWh/m²/year 41.91 (99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	941.89	710.64	551.79	266.15	88.15	0	0	0	0	315.58	660.16	966.97	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1007.36	760.04	590.15	284.66	94.28	0	0	0	0	337.52	706.06	1034.19	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4814.26 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

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Water heating

Output from water heater (calculated above)

215.95	190.35	199.94	179.28	175.72	157.05	150.88	165.5	165.19	185.9	196.51	210.77

Efficiency of water heater 79.8 (216)

(217)m=	88.29	88.01	87.38	85.87	83.08	79.8	79.8	79.8	79.8	86.21	87.8	88.38	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	244.58	216.29	228.81	208.79	211.5	196.81	189.07	207.39	207	215.62	223.82	238.48

Total = Sum(219a)$_{1...12}$ = 2588.17 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4814.26	
Water heating fuel used			2588.17	
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			421.58	(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	=	1039.88	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	559.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1598.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	218.8	(268)
Total CO2, kg/year		sum of (265)…(271) =		1856.65	(272)

TER = 25.48 (273)

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User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 03

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	40.51	(1a)	x	2.7	(2a)	=	109.38	(3a)
Ground floor	35.41	(1b)	x	3.2	(2b)	=	113.31	(3b)
First floor	32.25	(1c)	x	4.65	(2c)	=	149.96	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	108.17	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	372.65	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.11	(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)	0.36	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

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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

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

0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1	=	2.46			(26)
Windows Type 1			3.21	x1/[1/(1.4)+ 0.04]		=	4.26			(27)
Windows Type 2			3.44	x1/[1/(1.4)+ 0.04]		=	4.56			(27)
Windows Type 3			0.92	x1/[1/(1.4)+ 0.04]		=	1.22			(27)
Windows Type 4			3.21	x1/[1/(1.4)+ 0.04]		=	4.26			(27)
Windows Type 5			3.49	x1/[1/(1.4)+ 0.04]		=	4.63			(27)
Windows Type 6			3.21	x1/[1/(1.4)+ 0.04]		=	4.26			(27)
Windows Type 7			3.49	x1/[1/(1.4)+ 0.04]		=	4.63			(27)
Rooflights Type 1			2.223974	x1/[1/(1.7) + 0.04]		=	3.780755			(27b)
Rooflights Type 2			0.745724	x1/[1/(1.7) + 0.04]		=	1.267731			(27b)
Rooflights Type 3			0.6467342	x1/[1/(1.7) + 0.04]		=	1.099448			(27b)
Floor			40.51	x	0.13	=	5.2663			(28)
Walls Type1	10.29	0	10.29	x	0.18	=	1.85			(29)
Walls Type2	5.08	3.21	1.87	x	0.18	=	0.34			(29)
Walls Type3	1.35	0.92	0.43	x	0.18	=	0.08			(29)
Walls Type4	5.21	3.44	1.77	x	0.18	=	0.32			(29)
Walls Type5	6.27	3.49	2.78	x	0.18	=	0.5			(29)

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Walls Type6	0.8	0	0.8	x	0.18	=	0.14			(29)
Walls Type7	0.96	0	0.96	x	0.18	=	0.17			(29)
Walls Type8	6.02	0	6.02	x	0.18	=	1.08			(29)
Walls Type9	4.96	0	4.96	x	0.18	=	0.89			(29)
Walls Type10	5.76	3.21	2.55	x	0.18	=	0.46			(29)
Walls Type11	0.42	0	0.42	x	0.18	=	0.08			(29)
Walls Type12	6.4	0	6.4	x	0.18	=	1.15			(29)
Walls Type13	9.11	3.49	5.62	x	0.18	=	1.01			(29)
Walls Type14	1.86	0	1.86	x	0.18	=	0.33			(29)
Walls Type15	8.6	2.46	6.14	x	0.18	=	1.11			(29)
Walls Type16	9.3	0	9.3	x	0.18	=	1.67			(29)
Walls Type17	0.6	0	0.6	x	0.18	=	0.11			(29)
Walls Type18	8.37	3.21	5.16	x	0.18	=	0.93			(29)
Roof Type1	31.76	2.97	28.79	x	0.13	=	3.74			(30)
Roof Type2	3.31	0.65	2.66	x	0.13	=	0.35			(30)
Total area of elements, m²			166.94							(31)
Party wall			29.24	x	0	=	0			(32)
Party wall			28.24	x	0	=	0			(32)
Party wall			32.58	x	0	=	0			(32)
Party wall			33.47	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 57.6 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.88 (36)

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

Total fabric heat loss (33) + (36) = 67.48 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	70.71	70.35	70	68.35	68.04	66.61	66.61	66.34	67.16	68.04	68.67	69.32	(38)

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

(39)m=	138.19	137.83	137.48	135.83	135.52	134.09	134.09	133.82	134.64	135.52	136.15	136.8

Average = Sum(39)$_{1…12}$ /12= 135.83 (39)

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

(40)m=	1.28	1.27	1.27	1.26	1.25	1.24	1.24	1.24	1.24	1.25	1.26	1.26

Average = Sum(40)$_{1…12}$ /12= 1.26 (40)

Number of days in month (Table 1a)

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

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(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 — 2.8 (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 — 100.78 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	110.86	106.83	102.8	98.76	94.73	90.7	90.7	94.73	98.76	102.8	106.83	110.86	
Total = Sum(44)1…12 =												1209.36	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	164.4	143.79	148.37	129.36	124.12	107.11	99.25	113.89	115.25	134.31	146.61	159.21	
Total = Sum(45)1…12 =												1585.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.66	21.57	22.26	19.4	18.62	16.07	14.89	17.08	17.29	20.15	21.99	23.88	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.7 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.92 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.92 (55)

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

(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(56)

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

(57)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(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=	216.15	190.52	200.12	179.43	175.87	157.18	151	165.64	165.33	186.06	196.69	210.96	(62)

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

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

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

Output from water heater

(64)m=	216.15	190.52	200.12	179.43	175.87	157.18	151	165.64	165.33	186.06	196.69	210.96	

Output from water heater (annual)1…12 2194.94 (64)

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

(65)m=	96.06	85.2	90.73	83.07	82.67	75.67	74.4	79.27	78.38	86.06	88.81	94.34	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.97	21.29	17.32	13.11	9.8	8.27	8.94	11.62	15.6	19.8	23.11	24.64	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	268.9	271.69	264.66	249.69	230.79	213.03	201.17	198.38	205.41	220.38	239.28	257.04	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	(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=	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	(71)
Water heating gains (Table 5)													
(72)m=	129.11	126.79	121.95	115.38	111.11	105.1	100	106.54	108.86	115.67	123.35	126.79	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	490.04	487.82	471.98	446.23	419.76	394.46	378.16	384.59	397.92	423.9	453.79	476.52	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.49	x	11.28	x	0.63	x	0.7	=	12.03	(75)
Northeast 0.9x	0.77	x	3.49	x	11.28	x	0.63	x	0.7	=	12.03	(75)
Northeast 0.9x	0.77	x	3.49	x	22.97	x	0.63	x	0.7	=	24.5	(75)
Northeast 0.9x	0.77	x	3.49	x	22.97	x	0.63	x	0.7	=	24.5	(75)
Northeast 0.9x	0.77	x	3.49	x	41.38	x	0.63	x	0.7	=	44.13	(75)
Northeast 0.9x	0.77	x	3.49	x	41.38	x	0.63	x	0.7	=	44.13	(75)
Northeast 0.9x	0.77	x	3.49	x	67.96	x	0.63	x	0.7	=	72.48	(75)
Northeast 0.9x	0.77	x	3.49	x	67.96	x	0.63	x	0.7	=	72.48	(75)
Northeast 0.9x	0.77	x	3.49	x	91.35	x	0.63	x	0.7	=	97.43	(75)
Northeast 0.9x	0.77	x	3.49	x	91.35	x	0.63	x	0.7	=	97.43	(75)

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Northeast	0.9x	0.77	x	3.49	x	97.38	x	0.63	x	0.7	=	103.87	(75)
Northeast	0.9x	0.77	x	3.49	x	97.38	x	0.63	x	0.7	=	103.87	(75)
Northeast	0.9x	0.77	x	3.49	x	91.1	x	0.63	x	0.7	=	97.17	(75)
Northeast	0.9x	0.77	x	3.49	x	91.1	x	0.63	x	0.7	=	97.17	(75)
Northeast	0.9x	0.77	x	3.49	x	72.63	x	0.63	x	0.7	=	77.46	(75)
Northeast	0.9x	0.77	x	3.49	x	72.63	x	0.63	x	0.7	=	77.46	(75)
Northeast	0.9x	0.77	x	3.49	x	50.42	x	0.63	x	0.7	=	53.78	(75)
Northeast	0.9x	0.77	x	3.49	x	50.42	x	0.63	x	0.7	=	53.78	(75)
Northeast	0.9x	0.77	x	3.49	x	28.07	x	0.63	x	0.7	=	29.94	(75)
Northeast	0.9x	0.77	x	3.49	x	28.07	x	0.63	x	0.7	=	29.94	(75)
Northeast	0.9x	0.77	x	3.49	x	14.2	x	0.63	x	0.7	=	15.14	(75)
Northeast	0.9x	0.77	x	3.49	x	14.2	x	0.63	x	0.7	=	15.14	(75)
Northeast	0.9x	0.77	x	3.49	x	9.21	x	0.63	x	0.7	=	9.83	(75)
Northeast	0.9x	0.77	x	3.49	x	9.21	x	0.63	x	0.7	=	9.83	(75)
Southwest	0.9x	0.77	x	3.21	x	36.79		0.63	x	0.7	=	36.1	(79)
Southwest	0.9x	0.77	x	3.44	x	36.79		0.63	x	0.7	=	38.68	(79)
Southwest	0.9x	0.77	x	3.21	x	36.79		0.63	x	0.7	=	36.1	(79)
Southwest	0.9x	0.77	x	3.21	x	36.79		0.63	x	0.7	=	36.1	(79)
Southwest	0.9x	0.77	x	3.21	x	62.67		0.63	x	0.7	=	61.48	(79)
Southwest	0.9x	0.77	x	3.44	x	62.67		0.63	x	0.7	=	65.89	(79)
Southwest	0.9x	0.77	x	3.21	x	62.67		0.63	x	0.7	=	61.48	(79)
Southwest	0.9x	0.77	x	3.21	x	62.67		0.63	x	0.7	=	61.48	(79)
Southwest	0.9x	0.77	x	3.21	x	85.75		0.63	x	0.7	=	84.12	(79)
Southwest	0.9x	0.77	x	3.44	x	85.75		0.63	x	0.7	=	90.15	(79)
Southwest	0.9x	0.77	x	3.21	x	85.75		0.63	x	0.7	=	84.12	(79)
Southwest	0.9x	0.77	x	3.21	x	85.75		0.63	x	0.7	=	84.12	(79)
Southwest	0.9x	0.77	x	3.21	x	106.25		0.63	x	0.7	=	104.23	(79)
Southwest	0.9x	0.77	x	3.44	x	106.25		0.63	x	0.7	=	111.7	(79)
Southwest	0.9x	0.77	x	3.21	x	106.25		0.63	x	0.7	=	104.23	(79)
Southwest	0.9x	0.77	x	3.21	x	106.25		0.63	x	0.7	=	104.23	(79)
Southwest	0.9x	0.77	x	3.21	x	119.01		0.63	x	0.7	=	116.75	(79)
Southwest	0.9x	0.77	x	3.44	x	119.01		0.63	x	0.7	=	125.12	(79)
Southwest	0.9x	0.77	x	3.21	x	119.01		0.63	x	0.7	=	116.75	(79)
Southwest	0.9x	0.77	x	3.21	x	119.01		0.63	x	0.7	=	116.75	(79)
Southwest	0.9x	0.77	x	3.21	x	118.15		0.63	x	0.7	=	115.91	(79)
Southwest	0.9x	0.77	x	3.44	x	118.15		0.63	x	0.7	=	124.21	(79)
Southwest	0.9x	0.77	x	3.21	x	118.15		0.63	x	0.7	=	115.91	(79)
Southwest	0.9x	0.77	x	3.21	x	118.15		0.63	x	0.7	=	115.91	(79)
Southwest	0.9x	0.77	x	3.21	x	113.91		0.63	x	0.7	=	111.75	(79)
Southwest	0.9x	0.77	x	3.44	x	113.91		0.63	x	0.7	=	119.75	(79)
Southwest	0.9x	0.77	x	3.21	x	113.91		0.63	x	0.7	=	111.75	(79)

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Southwest	0.9x	0.77	x	3.21	x	113.91		0.63	x	0.7	=	111.75	(79)
Southwest	0.9x	0.77	x	3.21	x	104.39		0.63	x	0.7	=	102.41	(79)
Southwest	0.9x	0.77	x	3.44	x	104.39		0.63	x	0.7	=	109.75	(79)
Southwest	0.9x	0.77	x	3.21	x	104.39		0.63	x	0.7	=	102.41	(79)
Southwest	0.9x	0.77	x	3.21	x	104.39		0.63	x	0.7	=	102.41	(79)
Southwest	0.9x	0.77	x	3.21	x	92.85		0.63	x	0.7	=	91.09	(79)
Southwest	0.9x	0.77	x	3.44	x	92.85		0.63	x	0.7	=	97.62	(79)
Southwest	0.9x	0.77	x	3.21	x	92.85		0.63	x	0.7	=	91.09	(79)
Southwest	0.9x	0.77	x	3.21	x	92.85		0.63	x	0.7	=	91.09	(79)
Southwest	0.9x	0.77	x	3.21	x	69.27		0.63	x	0.7	=	67.95	(79)
Southwest	0.9x	0.77	x	3.44	x	69.27		0.63	x	0.7	=	72.82	(79)
Southwest	0.9x	0.77	x	3.21	x	69.27		0.63	x	0.7	=	67.95	(79)
Southwest	0.9x	0.77	x	3.21	x	69.27		0.63	x	0.7	=	67.95	(79)
Southwest	0.9x	0.77	x	3.21	x	44.07		0.63	x	0.7	=	43.23	(79)
Southwest	0.9x	0.77	x	3.44	x	44.07		0.63	x	0.7	=	46.33	(79)
Southwest	0.9x	0.77	x	3.21	x	44.07		0.63	x	0.7	=	43.23	(79)
Southwest	0.9x	0.77	x	3.21	x	44.07		0.63	x	0.7	=	43.23	(79)
Southwest	0.9x	0.77	x	3.21	x	31.49		0.63	x	0.7	=	30.89	(79)
Southwest	0.9x	0.77	x	3.44	x	31.49		0.63	x	0.7	=	33.1	(79)
Southwest	0.9x	0.77	x	3.21	x	31.49		0.63	x	0.7	=	30.89	(79)
Southwest	0.9x	0.77	x	3.21	x	31.49		0.63	x	0.7	=	30.89	(79)
Northwest	0.9x	0.77	x	0.92	x	11.28	x	0.63	x	0.7	=	3.17	(81)
Northwest	0.9x	0.77	x	0.92	x	22.97	x	0.63	x	0.7	=	6.46	(81)
Northwest	0.9x	0.77	x	0.92	x	41.38	x	0.63	x	0.7	=	11.63	(81)
Northwest	0.9x	0.77	x	0.92	x	67.96	x	0.63	x	0.7	=	19.11	(81)
Northwest	0.9x	0.77	x	0.92	x	91.35	x	0.63	x	0.7	=	25.68	(81)
Northwest	0.9x	0.77	x	0.92	x	97.38	x	0.63	x	0.7	=	27.38	(81)
Northwest	0.9x	0.77	x	0.92	x	91.1	x	0.63	x	0.7	=	25.61	(81)
Northwest	0.9x	0.77	x	0.92	x	72.63	x	0.63	x	0.7	=	20.42	(81)
Northwest	0.9x	0.77	x	0.92	x	50.42	x	0.63	x	0.7	=	14.18	(81)
Northwest	0.9x	0.77	x	0.92	x	28.07	x	0.63	x	0.7	=	7.89	(81)
Northwest	0.9x	0.77	x	0.92	x	14.2	x	0.63	x	0.7	=	3.99	(81)
Northwest	0.9x	0.77	x	0.92	x	9.21	x	0.63	x	0.7	=	2.59	(81)
Rooflights	0.9x	1	x	2.22	x	26	x	0.63	x	0.7	=	22.95	(82)
Rooflights	0.9x	1	x	0.75	x	26	x	0.63	x	0.7	=	7.7	(82)
Rooflights	0.9x	1	x	0.65	x	26	x	0.63	x	0.7	=	6.67	(82)
Rooflights	0.9x	1	x	2.22	x	54	x	0.63	x	0.7	=	47.67	(82)
Rooflights	0.9x	1	x	0.75	x	54	x	0.63	x	0.7	=	15.98	(82)
Rooflights	0.9x	1	x	0.65	x	54	x	0.63	x	0.7	=	13.86	(82)
Rooflights	0.9x	1	x	2.22	x	96	x	0.63	x	0.7	=	84.74	(82)
Rooflights	0.9x	1	x	0.75	x	96	x	0.63	x	0.7	=	28.41	(82)

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Rooflights 0.9x	1	x	0.65	x	96	x	0.63	x	0.7	=	24.64	(82)
Rooflights 0.9x	1	x	2.22	x	150	x	0.63	x	0.7	=	132.4	(82)
Rooflights 0.9x	1	x	0.75	x	150	x	0.63	x	0.7	=	44.4	(82)
Rooflights 0.9x	1	x	0.65	x	150	x	0.63	x	0.7	=	38.5	(82)
Rooflights 0.9x	1	x	2.22	x	192	x	0.63	x	0.7	=	169.48	(82)
Rooflights 0.9x	1	x	0.75	x	192	x	0.63	x	0.7	=	56.83	(82)
Rooflights 0.9x	1	x	0.65	x	192	x	0.63	x	0.7	=	49.28	(82)
Rooflights 0.9x	1	x	2.22	x	200	x	0.63	x	0.7	=	176.54	(82)
Rooflights 0.9x	1	x	0.75	x	200	x	0.63	x	0.7	=	59.2	(82)
Rooflights 0.9x	1	x	0.65	x	200	x	0.63	x	0.7	=	51.34	(82)
Rooflights 0.9x	1	x	2.22	x	189	x	0.63	x	0.7	=	166.83	(82)
Rooflights 0.9x	1	x	0.75	x	189	x	0.63	x	0.7	=	55.94	(82)
Rooflights 0.9x	1	x	0.65	x	189	x	0.63	x	0.7	=	48.51	(82)
Rooflights 0.9x	1	x	2.22	x	157	x	0.63	x	0.7	=	138.58	(82)
Rooflights 0.9x	1	x	0.75	x	157	x	0.63	x	0.7	=	46.47	(82)
Rooflights 0.9x	1	x	0.65	x	157	x	0.63	x	0.7	=	40.3	(82)
Rooflights 0.9x	1	x	2.22	x	115	x	0.63	x	0.7	=	101.51	(82)
Rooflights 0.9x	1	x	0.75	x	115	x	0.63	x	0.7	=	34.04	(82)
Rooflights 0.9x	1	x	0.65	x	115	x	0.63	x	0.7	=	29.52	(82)
Rooflights 0.9x	1	x	2.22	x	66	x	0.63	x	0.7	=	58.26	(82)
Rooflights 0.9x	1	x	0.75	x	66	x	0.63	x	0.7	=	19.53	(82)
Rooflights 0.9x	1	x	0.65	x	66	x	0.63	x	0.7	=	16.94	(82)
Rooflights 0.9x	1	x	2.22	x	33	x	0.63	x	0.7	=	29.13	(82)
Rooflights 0.9x	1	x	0.75	x	33	x	0.63	x	0.7	=	9.77	(82)
Rooflights 0.9x	1	x	0.65	x	33	x	0.63	x	0.7	=	8.47	(82)
Rooflights 0.9x	1	x	2.22	x	21	x	0.63	x	0.7	=	18.54	(82)
Rooflights 0.9x	1	x	0.75	x	21	x	0.63	x	0.7	=	6.22	(82)
Rooflights 0.9x	1	x	0.65	x	21	x	0.63	x	0.7	=	5.39	(82)

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

(83)m=	211.53	383.3	580.22	803.78	971.5	994.13	946.23	817.67	657.68	439.18	257.68	178.16	(83)

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

(84)m=	701.56	871.12	1052.2	1250.01	1391.26	1388.59	1324.38	1202.26	1055.61	863.08	711.46	654.68	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.78	0.59	0.44	0.5	0.77	0.96	0.99	1	(86)

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

(87)m=	19.64	19.85	20.18	20.58	20.85	20.97	20.99	20.99	20.9	20.5	19.99	19.6	(87)

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

(88)m=	19.86	19.86	19.86	19.88	19.88	19.89	19.89	19.89	19.88	19.88	19.87	19.87	(88)

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

(89)m=	1	0.99	0.97	0.89	0.72	0.5	0.33	0.39	0.68	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=	18.06	18.37	18.84	19.4	19.74	19.87	19.89	19.89	19.81	19.32	18.58	18.01	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.57	18.86	19.28	19.79	20.11	20.23	20.25	20.25	20.17	19.71	19.05	18.53	(92)

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

(93)m=	18.57	18.86	19.28	19.79	20.11	20.23	20.25	20.25	20.17	19.71	19.05	18.53	(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	0.96	0.89	0.73	0.53	0.37	0.42	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	697.76	858.84	1010.88	1107.09	1020.63	735.24	486.69	509.72	745.39	807.47	703.02	652.05	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1972.58	1923.47	1757.24	1478.78	1139.58	755.09	489.47	515.05	817.08	1234.53	1626.45	1960.92	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	948.47	715.44	555.29	267.62	88.5	0	0	0	0	317.74	664.87	973.79	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4531.72 (98)

Space heating requirement in kWh/m²/year 41.89 (99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	948.47	715.44	555.29	267.62	88.5	0	0	0	0	317.74	664.87	973.79	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1014.41	765.17	593.89	286.23	94.66	0	0	0	0	339.83	711.09	1041.49	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4846.76 (211)

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

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

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

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Water heating

Output from water heater (calculated above)

216.15	190.52	200.12	179.43	175.87	157.18	151	165.64	165.33	186.06	196.69	210.96

Efficiency of water heater 79.8 (216)

(217)m=	88.3	88.02	87.4	85.88	83.09	79.8	79.8	79.8	79.8	86.23	87.81	88.39	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	244.78	216.46	228.98	208.94	211.66	196.97	189.22	207.56	207.18	215.77	223.99	238.67

Total = $Sum(219a)_{1...12}$ = 2590.18 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4846.76	
Water heating fuel used		2590.18	
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		423.36	(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	=	1046.9	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	559.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1606.38	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	219.73	(268)
Total CO2, kg/year			sum of (265)…(271) =		1865.03	(272)

TER = 25.41 (273)

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User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 04

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	41.19	(1a)	x	2.7	(2a)	=	111.21	(3a)
Ground floor	35.68	(1b)	x	3.2	(2b)	=	114.18	(3b)
First floor	32.25	(1c)	x	4.65	(2c)	=	149.96	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	109.12	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	375.35	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.11	(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)	0.36	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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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

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

0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1	=	2.46			(26)
Windows Type 1			3.24	x1/[1/(1.4)+ 0.04]		=	4.3			(27)
Windows Type 2			3.47	x1/[1/(1.4)+ 0.04]		=	4.6			(27)
Windows Type 3			0.93	x1/[1/(1.4)+ 0.04]		=	1.23			(27)
Windows Type 4			3.24	x1/[1/(1.4)+ 0.04]		=	4.3			(27)
Windows Type 5			3.52	x1/[1/(1.4)+ 0.04]		=	4.67			(27)
Windows Type 6			3.24	x1/[1/(1.4)+ 0.04]		=	4.3			(27)
Windows Type 7			3.52	x1/[1/(1.4)+ 0.04]		=	4.67			(27)
Rooflights Type 1			2.24546	x1/[1/(1.7) + 0.04]		=	3.817282			(27b)
Rooflights Type 2			0.7529287	x1/[1/(1.7) + 0.04]		=	1.279979			(27b)
Rooflights Type 3			0.6529825	x1/[1/(1.7) + 0.04]		=	1.11007			(27b)
Floor			41.19	x	0.13	=	5.3547			(28)
Walls Type1	10.29	0	10.29	x	0.18	=	1.85			(29)
Walls Type2	5.08	3.24	1.84	x	0.18	=	0.33			(29)
Walls Type3	1.35	0.93	0.42	x	0.18	=	0.08			(29)
Walls Type4	5.21	3.47	1.74	x	0.18	=	0.31			(29)
Walls Type5	6.27	3.52	2.75	x	0.18	=	0.5			(29)

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Walls Type6	0.8	0	0.8	x	0.18	=	0.14			(29)
Walls Type7	0.96	0	0.96	x	0.18	=	0.17			(29)
Walls Type8	6.62	0	6.62	x	0.18	=	1.19			(29)
Walls Type9	4.96	0	4.96	x	0.18	=	0.89			(29)
Walls Type10	5.76	3.24	2.52	x	0.18	=	0.45			(29)
Walls Type11	0.42	0	0.42	x	0.18	=	0.08			(29)
Walls Type12	6.4	0	6.4	x	0.18	=	1.15			(29)
Walls Type13	9.11	3.52	5.59	x	0.18	=	1.01			(29)
Walls Type14	1.86	0	1.86	x	0.18	=	0.33			(29)
Walls Type15	8.6	2.46	6.14	x	0.18	=	1.11			(29)
Walls Type16	9.3	0	9.3	x	0.18	=	1.67			(29)
Walls Type17	0.6	0	0.6	x	0.18	=	0.11			(29)
Walls Type18	8.37	3.24	5.13	x	0.18	=	0.92			(29)
Roof Type1	31.76	3	28.76	x	0.13	=	3.74			(30)
Roof Type2	3.67	0.65	3.02	x	0.13	=	0.39			(30)
Total area of elements, m²			168.58							(31)
Party wall			29.65	x	0	=	0			(32)
Party wall			28.67	x	0	=	0			(32)
Party wall			33.12	x	0	=	0			(32)
Party wall			34.08	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	58.11	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		9.91	(36)

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

Total fabric heat loss	(33) + (36) =	68.02	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	71.18	70.82	70.47	68.82	68.51	67.07	67.07	66.8	67.62	68.51	69.13	69.79	(38)

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

(39)m=	139.2	138.84	138.49	136.84	136.53	135.09	135.09	134.82	135.64	136.53	137.15	137.81

Average = Sum(39)$_{1…12}$ /12= 136.84 (39)

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

(40)m=	1.28	1.27	1.27	1.25	1.25	1.24	1.24	1.24	1.24	1.25	1.26	1.26

Average = Sum(40)$_{1…12}$ /12= 1.25 (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 — 2.81 (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 — 100.92 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	111.02	106.98	102.94	98.91	94.87	90.83	90.83	94.87	98.91	102.94	106.98	111.02	
Total = Sum(44)1…12 =												1211.09	(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=	164.63	143.99	148.59	129.54	124.3	107.26	99.39	114.05	115.41	134.5	146.82	159.44	
Total = Sum(45)1…12 =												1587.93	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.7	21.6	22.29	19.43	18.64	16.09	14.91	17.11	17.31	20.18	22.02	23.92	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.7 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.92 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.92 (55)

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

(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(56)

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

(57)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(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=	216.38	190.73	200.33	179.62	176.04	157.34	151.14	165.8	165.49	186.25	196.9	211.19	(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=	216.38	190.73	200.33	179.62	176.04	157.34	151.14	165.8	165.49	186.25	196.9	211.19	

Output from water heater (annual)$_{1...12}$ 2197.2 (64)

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

(65)m=	96.14	85.27	90.8	83.13	82.73	75.73	74.44	79.32	78.44	86.12	88.88	94.41	(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=	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	24.1	21.4	17.41	13.18	9.85	8.32	8.99	11.68	15.68	19.9	23.23	24.77	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	270.29	273.09	266.02	250.98	231.98	214.13	202.21	199.4	206.47	221.52	240.51	258.36	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	(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=	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	(71)
Water heating gains (Table 5)													
(72)m=	129.22	126.89	122.05	115.46	111.19	105.17	100.06	106.61	108.94	115.75	123.44	126.9	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	491.74	489.52	473.61	447.76	421.16	395.76	379.39	385.83	399.23	425.31	455.33	478.16	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.52	x	11.28	x	0.63	x	0.7	=	12.14	(75)
Northeast 0.9x	0.77	x	3.52	x	11.28	x	0.63	x	0.7	=	12.14	(75)
Northeast 0.9x	0.77	x	3.52	x	22.97	x	0.63	x	0.7	=	24.71	(75)
Northeast 0.9x	0.77	x	3.52	x	22.97	x	0.63	x	0.7	=	24.71	(75)
Northeast 0.9x	0.77	x	3.52	x	41.38	x	0.63	x	0.7	=	44.51	(75)
Northeast 0.9x	0.77	x	3.52	x	41.38	x	0.63	x	0.7	=	44.51	(75)
Northeast 0.9x	0.77	x	3.52	x	67.96	x	0.63	x	0.7	=	73.1	(75)
Northeast 0.9x	0.77	x	3.52	x	67.96	x	0.63	x	0.7	=	73.1	(75)
Northeast 0.9x	0.77	x	3.52	x	91.35	x	0.63	x	0.7	=	98.27	(75)
Northeast 0.9x	0.77	x	3.52	x	91.35	x	0.63	x	0.7	=	98.27	(75)

Northeast	0.9x	0.77	x	3.52	x	97.38	x	0.63	x	0.7	=	104.76	(75)
Northeast	0.9x	0.77	x	3.52	x	97.38	x	0.63	x	0.7	=	104.76	(75)
Northeast	0.9x	0.77	x	3.52	x	91.1	x	0.63	x	0.7	=	98	(75)
Northeast	0.9x	0.77	x	3.52	x	91.1	x	0.63	x	0.7	=	98	(75)
Northeast	0.9x	0.77	x	3.52	x	72.63	x	0.63	x	0.7	=	78.13	(75)
Northeast	0.9x	0.77	x	3.52	x	72.63	x	0.63	x	0.7	=	78.13	(75)
Northeast	0.9x	0.77	x	3.52	x	50.42	x	0.63	x	0.7	=	54.24	(75)
Northeast	0.9x	0.77	x	3.52	x	50.42	x	0.63	x	0.7	=	54.24	(75)
Northeast	0.9x	0.77	x	3.52	x	28.07	x	0.63	x	0.7	=	30.19	(75)
Northeast	0.9x	0.77	x	3.52	x	28.07	x	0.63	x	0.7	=	30.19	(75)
Northeast	0.9x	0.77	x	3.52	x	14.2	x	0.63	x	0.7	=	15.27	(75)
Northeast	0.9x	0.77	x	3.52	x	14.2	x	0.63	x	0.7	=	15.27	(75)
Northeast	0.9x	0.77	x	3.52	x	9.21	x	0.63	x	0.7	=	9.91	(75)
Northeast	0.9x	0.77	x	3.52	x	9.21	x	0.63	x	0.7	=	9.91	(75)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.63	x	0.7	=	36.43	(79)
Southwest	0.9x	0.77	x	3.47	x	36.79		0.63	x	0.7	=	39.02	(79)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.63	x	0.7	=	36.43	(79)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.63	x	0.7	=	36.43	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.63	x	0.7	=	62.06	(79)
Southwest	0.9x	0.77	x	3.47	x	62.67		0.63	x	0.7	=	66.46	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.63	x	0.7	=	62.06	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.63	x	0.7	=	62.06	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.63	x	0.7	=	84.91	(79)
Southwest	0.9x	0.77	x	3.47	x	85.75		0.63	x	0.7	=	90.94	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.63	x	0.7	=	84.91	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.63	x	0.7	=	84.91	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.63	x	0.7	=	105.21	(79)
Southwest	0.9x	0.77	x	3.47	x	106.25		0.63	x	0.7	=	112.68	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.63	x	0.7	=	105.21	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.63	x	0.7	=	105.21	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.63	x	0.7	=	117.84	(79)
Southwest	0.9x	0.77	x	3.47	x	119.01		0.63	x	0.7	=	126.21	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.63	x	0.7	=	117.84	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.63	x	0.7	=	117.84	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.63	x	0.7	=	116.99	(79)
Southwest	0.9x	0.77	x	3.47	x	118.15		0.63	x	0.7	=	125.3	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.63	x	0.7	=	116.99	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.63	x	0.7	=	116.99	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.63	x	0.7	=	112.79	(79)
Southwest	0.9x	0.77	x	3.47	x	113.91		0.63	x	0.7	=	120.8	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.63	x	0.7	=	112.79	(79)

TER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	3.24	x	113.91		0.63	x	0.7	=	112.79	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.63	x	0.7	=	103.37	(79)
Southwest	0.9x	0.77	x	3.47	x	104.39		0.63	x	0.7	=	110.7	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.63	x	0.7	=	103.37	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.63	x	0.7	=	103.37	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.63	x	0.7	=	91.94	(79)
Southwest	0.9x	0.77	x	3.47	x	92.85		0.63	x	0.7	=	98.47	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.63	x	0.7	=	91.94	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.63	x	0.7	=	91.94	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.63	x	0.7	=	68.59	(79)
Southwest	0.9x	0.77	x	3.47	x	69.27		0.63	x	0.7	=	73.46	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.63	x	0.7	=	68.59	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.63	x	0.7	=	68.59	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.63	x	0.7	=	43.64	(79)
Southwest	0.9x	0.77	x	3.47	x	44.07		0.63	x	0.7	=	46.74	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.63	x	0.7	=	43.64	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.63	x	0.7	=	43.64	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.63	x	0.7	=	31.18	(79)
Southwest	0.9x	0.77	x	3.47	x	31.49		0.63	x	0.7	=	33.39	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.63	x	0.7	=	31.18	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.63	x	0.7	=	31.18	(79)
Northwest	0.9x	0.77	x	0.93	x	11.28	x	0.63	x	0.7	=	3.21	(81)
Northwest	0.9x	0.77	x	0.93	x	22.97	x	0.63	x	0.7	=	6.53	(81)
Northwest	0.9x	0.77	x	0.93	x	41.38	x	0.63	x	0.7	=	11.76	(81)
Northwest	0.9x	0.77	x	0.93	x	67.96	x	0.63	x	0.7	=	19.31	(81)
Northwest	0.9x	0.77	x	0.93	x	91.35	x	0.63	x	0.7	=	25.96	(81)
Northwest	0.9x	0.77	x	0.93	x	97.38	x	0.63	x	0.7	=	27.68	(81)
Northwest	0.9x	0.77	x	0.93	x	91.1	x	0.63	x	0.7	=	25.89	(81)
Northwest	0.9x	0.77	x	0.93	x	72.63	x	0.63	x	0.7	=	20.64	(81)
Northwest	0.9x	0.77	x	0.93	x	50.42	x	0.63	x	0.7	=	14.33	(81)
Northwest	0.9x	0.77	x	0.93	x	28.07	x	0.63	x	0.7	=	7.98	(81)
Northwest	0.9x	0.77	x	0.93	x	14.2	x	0.63	x	0.7	=	4.04	(81)
Northwest	0.9x	0.77	x	0.93	x	9.21	x	0.63	x	0.7	=	2.62	(81)
Rooflights	0.9x	1	x	2.25	x	26	x	0.63	x	0.7	=	23.17	(82)
Rooflights	0.9x	1	x	0.75	x	26	x	0.63	x	0.7	=	7.77	(82)
Rooflights	0.9x	1	x	0.65	x	26	x	0.63	x	0.7	=	6.74	(82)
Rooflights	0.9x	1	x	2.25	x	54	x	0.63	x	0.7	=	48.13	(82)
Rooflights	0.9x	1	x	0.75	x	54	x	0.63	x	0.7	=	16.14	(82)
Rooflights	0.9x	1	x	0.65	x	54	x	0.63	x	0.7	=	14	(82)
Rooflights	0.9x	1	x	2.25	x	96	x	0.63	x	0.7	=	85.56	(82)
Rooflights	0.9x	1	x	0.75	x	96	x	0.63	x	0.7	=	28.69	(82)

Rooflights 0.9x	1	x	0.65	x	96	x	0.63	x	0.7	=	24.88	(82)
Rooflights 0.9x	1	x	2.25	x	150	x	0.63	x	0.7	=	133.68	(82)
Rooflights 0.9x	1	x	0.75	x	150	x	0.63	x	0.7	=	44.83	(82)
Rooflights 0.9x	1	x	0.65	x	150	x	0.63	x	0.7	=	38.88	(82)
Rooflights 0.9x	1	x	2.25	x	192	x	0.63	x	0.7	=	171.11	(82)
Rooflights 0.9x	1	x	0.75	x	192	x	0.63	x	0.7	=	57.38	(82)
Rooflights 0.9x	1	x	0.65	x	192	x	0.63	x	0.7	=	49.76	(82)
Rooflights 0.9x	1	x	2.25	x	200	x	0.63	x	0.7	=	178.24	(82)
Rooflights 0.9x	1	x	0.75	x	200	x	0.63	x	0.7	=	59.77	(82)
Rooflights 0.9x	1	x	0.65	x	200	x	0.63	x	0.7	=	51.83	(82)
Rooflights 0.9x	1	x	2.25	x	189	x	0.63	x	0.7	=	168.44	(82)
Rooflights 0.9x	1	x	0.75	x	189	x	0.63	x	0.7	=	56.48	(82)
Rooflights 0.9x	1	x	0.65	x	189	x	0.63	x	0.7	=	48.98	(82)
Rooflights 0.9x	1	x	2.25	x	157	x	0.63	x	0.7	=	139.92	(82)
Rooflights 0.9x	1	x	0.75	x	157	x	0.63	x	0.7	=	46.92	(82)
Rooflights 0.9x	1	x	0.65	x	157	x	0.63	x	0.7	=	40.69	(82)
Rooflights 0.9x	1	x	2.25	x	115	x	0.63	x	0.7	=	102.49	(82)
Rooflights 0.9x	1	x	0.75	x	115	x	0.63	x	0.7	=	34.37	(82)
Rooflights 0.9x	1	x	0.65	x	115	x	0.63	x	0.7	=	29.8	(82)
Rooflights 0.9x	1	x	2.25	x	66	x	0.63	x	0.7	=	58.82	(82)
Rooflights 0.9x	1	x	0.75	x	66	x	0.63	x	0.7	=	19.72	(82)
Rooflights 0.9x	1	x	0.65	x	66	x	0.63	x	0.7	=	17.11	(82)
Rooflights 0.9x	1	x	2.25	x	33	x	0.63	x	0.7	=	29.41	(82)
Rooflights 0.9x	1	x	0.75	x	33	x	0.63	x	0.7	=	9.86	(82)
Rooflights 0.9x	1	x	0.65	x	33	x	0.63	x	0.7	=	8.55	(82)
Rooflights 0.9x	1	x	2.25	x	21	x	0.63	x	0.7	=	18.72	(82)
Rooflights 0.9x	1	x	0.75	x	21	x	0.63	x	0.7	=	6.28	(82)
Rooflights 0.9x	1	x	0.65	x	21	x	0.63	x	0.7	=	5.44	(82)

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

(83)m=	213.48	386.84	585.59	811.21	980.48	1003.32	954.97	825.23	663.76	443.23	260.05	179.81	(83)

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

(84)m=	705.22	876.36	1059.2	1258.97	1401.65	1399.08	1334.37	1211.06	1062.99	868.55	715.38	657.97	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.78	0.59	0.44	0.5	0.77	0.96	0.99	1	(86)

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

(87)m=	19.64	19.85	20.18	20.58	20.85	20.97	20.99	20.99	20.9	20.5	19.99	19.6	(87)

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

(88)m=	19.86	19.86	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.87	19.87	(88)

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

(89)m=	1	0.99	0.97	0.89	0.72	0.5	0.33	0.39	0.68	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=	18.06	18.37	18.84	19.4	19.75	19.87	19.89	19.89	19.81	19.32	18.58	18.01	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.58	18.86	19.28	19.79	20.11	20.23	20.25	20.25	20.17	19.71	19.05	18.54	(92)

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

(93)m=	18.58	18.86	19.28	19.79	20.11	20.23	20.25	20.25	20.17	19.71	19.05	18.54	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.89	0.73	0.53	0.37	0.42	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	701.45	864.12	1017.85	1115.39	1028.55	741	490.56	513.76	751.11	812.92	707	655.37	(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=	1987.35	1937.9	1770.47	1490.03	1148.31	760.96	493.35	519.12	823.39	1243.9	1638.71	1975.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	956.71	721.58	559.95	269.74	89.1	0	0	0	0	320.64	670.83	982.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4570.85 (98)

Space heating requirement in kWh/m²/year 41.89 (99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	956.71	721.58	559.95	269.74	89.1	0	0	0	0	320.64	670.83	982.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1023.22	771.74	598.88	288.49	95.29	0	0	0	0	342.94	717.47	1050.59	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4888.61 (211)

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

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

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

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

216.38	190.73	200.33	179.62	176.04	157.34	151.14	165.8	165.49	186.25	196.9	211.19

Efficiency of water heater 79.8 (216)

(217)m=	88.32	88.03	87.41	85.9	83.1	79.8	79.8	79.8	79.8	86.25	87.83	88.4	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	245.01	216.66	229.18	209.11	211.84	197.16	189.4	207.77	207.38	215.94	224.19	238.89

Total = $Sum(219a)_{1...12}$ = 2592.53 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4888.61	
Water heating fuel used			2592.53	
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			425.55	(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	=	1055.94	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	559.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1615.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	220.86	(268)
Total CO2, kg/year		sum of (265)…(271) =		1875.71	(272)

TER = 25.33 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 05

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	41.06	(1a)	x	2.7	(2a)	=	110.86	(3a)
Ground floor	35.9	(1b)	x	3.2	(2b)	=	114.88	(3b)
First floor	32.25	(1c)	x	4.65	(2c)	=	149.96	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	109.21	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	375.7	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.11	(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)	0.36	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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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

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

0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1	=	2.46			(26)
Windows Type 1			3.24	x1/[1/(1.4)+ 0.04]		=	4.3			(27)
Windows Type 2			3.47	x1/[1/(1.4)+ 0.04]		=	4.6			(27)
Windows Type 3			0.93	x1/[1/(1.4)+ 0.04]		=	1.23			(27)
Windows Type 4			3.24	x1/[1/(1.4)+ 0.04]		=	4.3			(27)
Windows Type 5			3.53	x1/[1/(1.4)+ 0.04]		=	4.68			(27)
Windows Type 6			3.24	x1/[1/(1.4)+ 0.04]		=	4.3			(27)
Windows Type 7			3.53	x1/[1/(1.4)+ 0.04]		=	4.68			(27)
Rooflights Type 1			2.247496	x1/[1/(1.7) + 0.04]		=	3.820743			(27b)
Rooflights Type 2			0.7536114	x1/[1/(1.7) + 0.04]		=	1.281139			(27b)
Rooflights Type 3			0.6535745	x1/[1/(1.7) + 0.04]		=	1.111077			(27b)
Floor			41.06	x	0.13	=	5.3378			(28)
Walls Type1	10.31	0	10.31	x	0.18	=	1.86			(29)
Walls Type2	5.08	3.24	1.84	x	0.18	=	0.33			(29)
Walls Type3	1.35	0.93	0.42	x	0.18	=	0.08			(29)
Walls Type4	5.21	3.47	1.74	x	0.18	=	0.31			(29)
Walls Type5	6.27	3.53	2.74	x	0.18	=	0.49			(29)

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Walls Type6	0.8	0	0.8	x	0.18	=	0.14			(29)
Walls Type7	0.96	0	0.96	x	0.18	=	0.17			(29)
Walls Type8	6.75	0	6.75	x	0.18	=	1.22			(29)
Walls Type9	5	0	5	x	0.18	=	0.9			(29)
Walls Type10	5.76	3.24	2.52	x	0.18	=	0.45			(29)
Walls Type11	0.42	0	0.42	x	0.18	=	0.08			(29)
Walls Type12	6.4	0	6.4	x	0.18	=	1.15			(29)
Walls Type13	9.11	3.53	5.58	x	0.18	=	1			(29)
Walls Type14	1.86	0	1.86	x	0.18	=	0.33			(29)
Walls Type15	8.6	2.46	6.14	x	0.18	=	1.11			(29)
Walls Type16	9.3	0	9.3	x	0.18	=	1.67			(29)
Walls Type17	0.6	0	0.6	x	0.18	=	0.11			(29)
Walls Type18	8.37	3.24	5.13	x	0.18	=	0.92			(29)
Roof Type1	31.76	3	28.76	x	0.13	=	3.74			(30)
Roof Type2	3.34	0.65	2.69	x	0.13	=	0.35			(30)
Total area of elements, m²			168.31							(31)
Party wall			30.19	x	0	=	0			(32)
Party wall			27.95	x	0	=	0			(32)
Party wall			33.7	x	0	=	0			(32)
Party wall			33.09	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 58.11 (33)

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

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

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

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

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

Total fabric heat loss (33) + (36) = 68.01 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	71.24	70.88	70.53	68.88	68.57	67.13	67.13	66.86	67.68	68.57	69.19	69.85	(38)

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

(39)m=	139.26	138.9	138.54	136.89	136.58	135.14	135.14	134.87	135.7	136.58	137.21	137.86	

Average = Sum(39)$_{1…12}$ /12= 136.89 (39)

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

(40)m=	1.28	1.27	1.27	1.25	1.25	1.24	1.24	1.23	1.24	1.25	1.26	1.26

Average = Sum(40)$_{1…12}$ /12= 1.25 (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 — 2.81 (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 — 100.94 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	111.03	106.99	102.96	98.92	94.88	90.84	90.84	94.88	98.92	102.96	106.99	111.03		
										Total = Sum(44)$_{1...12}$ =			1211.25	(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=	164.66	144.01	148.6	129.56	124.31	107.27	99.4	114.07	115.43	134.52	146.84	159.46		
										Total = Sum(45)$_{1...12}$ =			1588.14	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	24.7	21.6	22.29	19.43	18.65	16.09	14.91	17.11	17.31	20.18	22.03	23.92		(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.7 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.92 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.92 (55)

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

(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(56)

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

(57)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(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=	216.4	190.75	200.35	179.63	176.06	157.35	151.15	165.81	165.51	186.27	196.92	211.21	(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=	216.4	190.75	200.35	179.63	176.06	157.35	151.15	165.81	165.51	186.27	196.92	211.21	

Output from water heater (annual)$_{1...12}$ 2197.41 (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=	96.15	85.27	90.81	83.14	82.73	75.73	74.45	79.32	78.44	86.13	88.89	94.42	(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):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	24.11	21.41	17.41	13.18	9.85	8.32	8.99	11.69	15.68	19.91	23.24	24.78	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	270.42	273.22	266.15	251.1	232.09	214.23	202.3	199.5	206.57	221.62	240.62	258.48	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	(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=	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	(71)
Water heating gains (Table 5)													
(72)m=	129.23	126.9	122.05	115.47	111.2	105.18	100.07	106.62	108.95	115.76	123.45	126.91	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	491.9	489.68	473.77	447.9	421.3	395.89	379.51	385.95	399.35	425.45	455.47	478.32	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.53	x	11.28	x	0.63	x	0.7	=	12.17	(75)
Northeast 0.9x	0.77	x	3.53	x	11.28	x	0.63	x	0.7	=	12.17	(75)
Northeast 0.9x	0.77	x	3.53	x	22.97	x	0.63	x	0.7	=	24.78	(75)
Northeast 0.9x	0.77	x	3.53	x	22.97	x	0.63	x	0.7	=	24.78	(75)
Northeast 0.9x	0.77	x	3.53	x	41.38	x	0.63	x	0.7	=	44.64	(75)
Northeast 0.9x	0.77	x	3.53	x	41.38	x	0.63	x	0.7	=	44.64	(75)
Northeast 0.9x	0.77	x	3.53	x	67.96	x	0.63	x	0.7	=	73.31	(75)
Northeast 0.9x	0.77	x	3.53	x	67.96	x	0.63	x	0.7	=	73.31	(75)
Northeast 0.9x	0.77	x	3.53	x	91.35	x	0.63	x	0.7	=	98.55	(75)
Northeast 0.9x	0.77	x	3.53	x	91.35	x	0.63	x	0.7	=	98.55	(75)

Northeast	0.9x	0.77	x	3.53	x	97.38	x	0.63	x	0.7	=	105.06	(75)
Northeast	0.9x	0.77	x	3.53	x	97.38	x	0.63	x	0.7	=	105.06	(75)
Northeast	0.9x	0.77	x	3.53	x	91.1	x	0.63	x	0.7	=	98.28	(75)
Northeast	0.9x	0.77	x	3.53	x	91.1	x	0.63	x	0.7	=	98.28	(75)
Northeast	0.9x	0.77	x	3.53	x	72.63	x	0.63	x	0.7	=	78.35	(75)
Northeast	0.9x	0.77	x	3.53	x	72.63	x	0.63	x	0.7	=	78.35	(75)
Northeast	0.9x	0.77	x	3.53	x	50.42	x	0.63	x	0.7	=	54.39	(75)
Northeast	0.9x	0.77	x	3.53	x	50.42	x	0.63	x	0.7	=	54.39	(75)
Northeast	0.9x	0.77	x	3.53	x	28.07	x	0.63	x	0.7	=	30.28	(75)
Northeast	0.9x	0.77	x	3.53	x	28.07	x	0.63	x	0.7	=	30.28	(75)
Northeast	0.9x	0.77	x	3.53	x	14.2	x	0.63	x	0.7	=	15.32	(75)
Northeast	0.9x	0.77	x	3.53	x	14.2	x	0.63	x	0.7	=	15.32	(75)
Northeast	0.9x	0.77	x	3.53	x	9.21	x	0.63	x	0.7	=	9.94	(75)
Northeast	0.9x	0.77	x	3.53	x	9.21	x	0.63	x	0.7	=	9.94	(75)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.63	x	0.7	=	36.43	(79)
Southwest	0.9x	0.77	x	3.47	x	36.79		0.63	x	0.7	=	39.02	(79)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.63	x	0.7	=	36.43	(79)
Southwest	0.9x	0.77	x	3.24	x	36.79		0.63	x	0.7	=	36.43	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.63	x	0.7	=	62.06	(79)
Southwest	0.9x	0.77	x	3.47	x	62.67		0.63	x	0.7	=	66.46	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.63	x	0.7	=	62.06	(79)
Southwest	0.9x	0.77	x	3.24	x	62.67		0.63	x	0.7	=	62.06	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.63	x	0.7	=	84.91	(79)
Southwest	0.9x	0.77	x	3.47	x	85.75		0.63	x	0.7	=	90.94	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.63	x	0.7	=	84.91	(79)
Southwest	0.9x	0.77	x	3.24	x	85.75		0.63	x	0.7	=	84.91	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.63	x	0.7	=	105.21	(79)
Southwest	0.9x	0.77	x	3.47	x	106.25		0.63	x	0.7	=	112.68	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.63	x	0.7	=	105.21	(79)
Southwest	0.9x	0.77	x	3.24	x	106.25		0.63	x	0.7	=	105.21	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.63	x	0.7	=	117.84	(79)
Southwest	0.9x	0.77	x	3.47	x	119.01		0.63	x	0.7	=	126.21	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.63	x	0.7	=	117.84	(79)
Southwest	0.9x	0.77	x	3.24	x	119.01		0.63	x	0.7	=	117.84	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.63	x	0.7	=	116.99	(79)
Southwest	0.9x	0.77	x	3.47	x	118.15		0.63	x	0.7	=	125.3	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.63	x	0.7	=	116.99	(79)
Southwest	0.9x	0.77	x	3.24	x	118.15		0.63	x	0.7	=	116.99	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.63	x	0.7	=	112.79	(79)
Southwest	0.9x	0.77	x	3.47	x	113.91		0.63	x	0.7	=	120.8	(79)
Southwest	0.9x	0.77	x	3.24	x	113.91		0.63	x	0.7	=	112.79	(79)

Southwest	0.9x	0.77	x	3.24	x	113.91		0.63	x	0.7	=	112.79	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.63	x	0.7	=	103.37	(79)
Southwest	0.9x	0.77	x	3.47	x	104.39		0.63	x	0.7	=	110.7	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.63	x	0.7	=	103.37	(79)
Southwest	0.9x	0.77	x	3.24	x	104.39		0.63	x	0.7	=	103.37	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.63	x	0.7	=	91.94	(79)
Southwest	0.9x	0.77	x	3.47	x	92.85		0.63	x	0.7	=	98.47	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.63	x	0.7	=	91.94	(79)
Southwest	0.9x	0.77	x	3.24	x	92.85		0.63	x	0.7	=	91.94	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.63	x	0.7	=	68.59	(79)
Southwest	0.9x	0.77	x	3.47	x	69.27		0.63	x	0.7	=	73.46	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.63	x	0.7	=	68.59	(79)
Southwest	0.9x	0.77	x	3.24	x	69.27		0.63	x	0.7	=	68.59	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.63	x	0.7	=	43.64	(79)
Southwest	0.9x	0.77	x	3.47	x	44.07		0.63	x	0.7	=	46.74	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.63	x	0.7	=	43.64	(79)
Southwest	0.9x	0.77	x	3.24	x	44.07		0.63	x	0.7	=	43.64	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.63	x	0.7	=	31.18	(79)
Southwest	0.9x	0.77	x	3.47	x	31.49		0.63	x	0.7	=	33.39	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.63	x	0.7	=	31.18	(79)
Southwest	0.9x	0.77	x	3.24	x	31.49		0.63	x	0.7	=	31.18	(79)
Northwest	0.9x	0.77	x	0.93	x	11.28	x	0.63	x	0.7	=	3.21	(81)
Northwest	0.9x	0.77	x	0.93	x	22.97	x	0.63	x	0.7	=	6.53	(81)
Northwest	0.9x	0.77	x	0.93	x	41.38	x	0.63	x	0.7	=	11.76	(81)
Northwest	0.9x	0.77	x	0.93	x	67.96	x	0.63	x	0.7	=	19.31	(81)
Northwest	0.9x	0.77	x	0.93	x	91.35	x	0.63	x	0.7	=	25.96	(81)
Northwest	0.9x	0.77	x	0.93	x	97.38	x	0.63	x	0.7	=	27.68	(81)
Northwest	0.9x	0.77	x	0.93	x	91.1	x	0.63	x	0.7	=	25.89	(81)
Northwest	0.9x	0.77	x	0.93	x	72.63	x	0.63	x	0.7	=	20.64	(81)
Northwest	0.9x	0.77	x	0.93	x	50.42	x	0.63	x	0.7	=	14.33	(81)
Northwest	0.9x	0.77	x	0.93	x	28.07	x	0.63	x	0.7	=	7.98	(81)
Northwest	0.9x	0.77	x	0.93	x	14.2	x	0.63	x	0.7	=	4.04	(81)
Northwest	0.9x	0.77	x	0.93	x	9.21	x	0.63	x	0.7	=	2.62	(81)
Rooflights	0.9x	1	x	2.25	x	26	x	0.63	x	0.7	=	23.19	(82)
Rooflights	0.9x	1	x	0.75	x	26	x	0.63	x	0.7	=	7.78	(82)
Rooflights	0.9x	1	x	0.65	x	26	x	0.63	x	0.7	=	6.74	(82)
Rooflights	0.9x	1	x	2.25	x	54	x	0.63	x	0.7	=	48.17	(82)
Rooflights	0.9x	1	x	0.75	x	54	x	0.63	x	0.7	=	16.15	(82)
Rooflights	0.9x	1	x	0.65	x	54	x	0.63	x	0.7	=	14.01	(82)
Rooflights	0.9x	1	x	2.25	x	96	x	0.63	x	0.7	=	85.63	(82)
Rooflights	0.9x	1	x	0.75	x	96	x	0.63	x	0.7	=	28.71	(82)

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Rooflights	0.9x	1	x	0.65	x	96	x	0.63	x	0.7	=	24.9	(82)
Rooflights	0.9x	1	x	2.25	x	150	x	0.63	x	0.7	=	133.8	(82)
Rooflights	0.9x	1	x	0.75	x	150	x	0.63	x	0.7	=	44.87	(82)
Rooflights	0.9x	1	x	0.65	x	150	x	0.63	x	0.7	=	38.91	(82)
Rooflights	0.9x	1	x	2.25	x	192	x	0.63	x	0.7	=	171.27	(82)
Rooflights	0.9x	1	x	0.75	x	192	x	0.63	x	0.7	=	57.43	(82)
Rooflights	0.9x	1	x	0.65	x	192	x	0.63	x	0.7	=	49.81	(82)
Rooflights	0.9x	1	x	2.25	x	200	x	0.63	x	0.7	=	178.41	(82)
Rooflights	0.9x	1	x	0.75	x	200	x	0.63	x	0.7	=	59.82	(82)
Rooflights	0.9x	1	x	0.65	x	200	x	0.63	x	0.7	=	51.88	(82)
Rooflights	0.9x	1	x	2.25	x	189	x	0.63	x	0.7	=	168.59	(82)
Rooflights	0.9x	1	x	0.75	x	189	x	0.63	x	0.7	=	56.53	(82)
Rooflights	0.9x	1	x	0.65	x	189	x	0.63	x	0.7	=	49.03	(82)
Rooflights	0.9x	1	x	2.25	x	157	x	0.63	x	0.7	=	140.05	(82)
Rooflights	0.9x	1	x	0.75	x	157	x	0.63	x	0.7	=	46.96	(82)
Rooflights	0.9x	1	x	0.65	x	157	x	0.63	x	0.7	=	40.73	(82)
Rooflights	0.9x	1	x	2.25	x	115	x	0.63	x	0.7	=	102.58	(82)
Rooflights	0.9x	1	x	0.75	x	115	x	0.63	x	0.7	=	34.4	(82)
Rooflights	0.9x	1	x	0.65	x	115	x	0.63	x	0.7	=	29.83	(82)
Rooflights	0.9x	1	x	2.25	x	66	x	0.63	x	0.7	=	58.87	(82)
Rooflights	0.9x	1	x	0.75	x	66	x	0.63	x	0.7	=	19.74	(82)
Rooflights	0.9x	1	x	0.65	x	66	x	0.63	x	0.7	=	17.12	(82)
Rooflights	0.9x	1	x	2.25	x	33	x	0.63	x	0.7	=	29.44	(82)
Rooflights	0.9x	1	x	0.75	x	33	x	0.63	x	0.7	=	9.87	(82)
Rooflights	0.9x	1	x	0.65	x	33	x	0.63	x	0.7	=	8.56	(82)
Rooflights	0.9x	1	x	2.25	x	21	x	0.63	x	0.7	=	18.73	(82)
Rooflights	0.9x	1	x	0.75	x	21	x	0.63	x	0.7	=	6.28	(82)
Rooflights	0.9x	1	x	0.65	x	21	x	0.63	x	0.7	=	5.45	(82)

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

(83)m=	213.58	387.05	585.96	811.82	981.29	1004.17	955.78	825.88	664.22	443.49	260.18	179.89	(83)

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

(84)m=	705.48	876.73	1059.73	1259.73	1402.59	1400.06	1335.29	1211.83	1063.57	868.94	715.66	658.21	(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	0.92	0.78	0.59	0.44	0.5	0.77	0.96	0.99	1	(86)

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

(87)m=	19.64	19.85	20.18	20.58	20.85	20.97	20.99	20.99	20.9	20.5	19.99	19.6	(87)

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

(88)m=	19.86	19.86	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.88	19.87	(88)

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

(89)m=	1	0.99	0.97	0.89	0.72	0.5	0.33	0.39	0.68	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=	18.06	18.37	18.85	19.4	19.75	19.87	19.89	19.89	19.81	19.32	18.59	18.01	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.57	18.85	19.28	19.79	20.11	20.23	20.25	20.25	20.17	19.71	19.04	18.53	(92)

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

(93)m=	18.57	18.85	19.28	19.79	20.11	20.23	20.25	20.25	20.17	19.71	19.04	18.53	(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	0.96	0.89	0.73	0.53	0.37	0.42	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	701.71	864.49	1018.34	1115.92	1028.84	740.93	490.3	513.53	751.18	813.24	707.27	655.61	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1987.48	1938.06	1770.62	1490.14	1148.3	760.8	493.08	518.86	823.26	1243.9	1638.78	1975.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	956.61	721.44	559.7	269.44	88.88	0	0	0	0	320.41	670.69	982.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4569.38 (98)

Space heating requirement in kWh/m²/year 41.84 (99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	956.61	721.44	559.7	269.44	88.88	0	0	0	0	320.41	670.69	982.22	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1023.11	771.59	598.61	288.17	95.06	0	0	0	0	342.68	717.31	1050.5	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4887.04 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

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Water heating

Output from water heater (calculated above)

	216.4	190.75	200.35	179.63	176.06	157.35	151.15	165.81	165.51	186.27	196.92	211.21	
Efficiency of water heater													79.8 (216)
(217)m=	88.32	88.03	87.41	85.89	83.1	79.8	79.8	79.8	79.8	86.25	87.83	88.4	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	245.03	216.68	229.21	209.14	211.88	197.18	189.41	207.79	207.4	215.97	224.21	238.92

Total = $\text{Sum}(219a)_{1...12}$ = 2592.81 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4887.04	
Water heating fuel used			2592.81	
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			425.75	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1055.6	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	560.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1615.65	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	220.96	(268)
Total CO2, kg/year		sum of (265)…(271) =		1875.54	(272)

TER = 25.31 (273)

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User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 06

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	38.62	(1a)	x	2.7	(2a)	=	104.27	(3a)
Ground floor	34.58	(1b)	x	3.2	(2b)	=	110.66	(3b)
First floor	31.61	(1c)	x	4.65	(2c)	=	146.99	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	104.81	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	361.92	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.11	(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)	0.36	(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) =	0.33	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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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

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

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1	=	2.46			(26)
Windows Type 1			3.15	x1/[1/(1.4)+ 0.04]		=	4.18			(27)
Windows Type 2			3.25	x1/[1/(1.4)+ 0.04]		=	4.31			(27)
Windows Type 3			0.91	x1/[1/(1.4)+ 0.04]		=	1.21			(27)
Windows Type 4			3.15	x1/[1/(1.4)+ 0.04]		=	4.18			(27)
Windows Type 5			3.3	x1/[1/(1.4)+ 0.04]		=	4.37			(27)
Windows Type 6			3.15	x1/[1/(1.4)+ 0.04]		=	4.18			(27)
Windows Type 7			3.3	x1/[1/(1.4)+ 0.04]		=	4.37			(27)
Rooflights Type 1			2.183144	x1/[1/(1.7) + 0.04]		=	3.711344			(27b)
Rooflights Type 2			0.7320334	x1/[1/(1.7) + 0.04]		=	1.244457			(27b)
Rooflights Type 3			0.6348608	x1/[1/(1.7) + 0.04]		=	1.079263			(27b)
Floor			38.62	x	0.13	=	5.0206			(28)
Walls Type1	10.15	0	10.15	x	0.18	=	1.83			(29)
Walls Type2	26.7	0	26.7	x	0.18	=	4.81			(29)
Walls Type3	5.08	3.15	1.93	x	0.18	=	0.35			(29)
Walls Type4	1.35	0	1.35	x	0.18	=	0.24			(29)
Walls Type5	5	3.25	1.75	x	0.18	=	0.32			(29)

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Walls Type6	6.02	3.3	2.72	x	0.18	=	0.49				(29)
Walls Type7	0.8	0	0.8	x	0.18	=	0.14				(29)
Walls Type8	0.96	0	0.96	x	0.18	=	0.17				(29)
Walls Type9	5.28	0	5.28	x	0.18	=	0.95				(29)
Walls Type10	5	0	5	x	0.18	=	0.9				(29)
Walls Type11	5.76	3.15	2.61	x	0.18	=	0.47				(29)
Walls Type12	0.42	0	0.42	x	0.18	=	0.08				(29)
Walls Type13	6.18	0	6.18	x	0.18	=	1.11				(29)
Walls Type14	8.74	3.3	5.44	x	0.18	=	0.98				(29)
Walls Type15	1.86	0	1.86	x	0.18	=	0.33				(29)
Walls Type16	8.6	2.46	6.14	x	0.18	=	1.11				(29)
Walls Type17	40	0	40	x	0.18	=	7.2				(29)
Walls Type18	8.97	0	8.97	x	0.18	=	1.61				(29)
Walls Type19	0.6	0	0.6	x	0.18	=	0.11				(29)
Walls Type20	8.37	3.15	5.22	x	0.18	=	0.94				(29)
Roof Type1	31.14	2.92	28.22	x	0.13	=	3.67				(30)
Roof Type2	2.38	0.63	1.75	x	0.13	=	0.23				(30)
Total area of elements, m²			228.89								(31)
Party wall			29.19	x	0	=	0				(32)
Party wall			32.58	x	0	=	0				(32)
Party wall			38.73	x	0	=	0				(32)

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	67.96	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: 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		9.07	(36)

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

Total fabric heat loss	(33) + (36) =	77.03	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	70.51	70.09	69.68	67.75	67.39	65.71	65.71	65.4	66.36	67.39	68.12	68.89	(38)

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

(39)m=	147.54	147.12	146.71	144.78	144.42	142.74	142.74	142.43	143.39	144.42	145.15	145.91

Average = Sum(39)$_{1…12}$ /12= 144.78 (39)

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

(40)m=	1.41	1.4	1.4	1.38	1.38	1.36	1.36	1.36	1.37	1.38	1.38	1.39

Average = Sum(40)$_{1…12}$ /12= 1.38 (40)

Number of days in month (Table 1a)

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

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4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.78 (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 — 100.22 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	110.24	106.23	102.23	98.22	94.21	90.2	90.2	94.21	98.22	102.23	106.23	110.24		
Total = Sum(44)1…12 =													1202.65	(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=	163.49	142.99	147.55	128.64	123.43	106.51	98.7	113.26	114.61	133.57	145.8	158.33		
Total = Sum(45)1…12 =													1576.86	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	24.52	21.45	22.13	19.3	18.51	15.98	14.8	16.99	17.19	20.04	21.87	23.75		(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.7 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.92 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.92 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H													
(57)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(57)

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m													
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m													
(62)m=	215.23	189.73	199.3	178.71	175.18	156.59	150.44	165	164.69	185.31	195.88	210.07	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)													
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)													
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(64)m=	215.23	189.73	199.3	178.71	175.18	156.59	150.44	165	164.69	185.31	195.88	210.07	

Output from water heater (annual)$_{1…12}$ 2186.13 (64)

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

(65)m=	95.76	84.93	90.46	82.83	82.44	75.48	74.21	79.06	78.17	85.81	88.54	94.04	(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=	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	(66)

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

(67)m=	23.52	20.89	16.99	12.86	9.62	8.12	8.77	11.4	15.3	19.43	22.68	24.18	(67)

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

(68)m=	263.88	266.62	259.72	245.03	226.48	209.05	197.41	194.67	201.57	216.26	234.81	252.23	(68)

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

(69)m=	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	(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=	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	(71)

Water heating gains (Table 5)

(72)m=	128.71	126.39	121.58	115.05	110.8	104.83	99.75	106.26	108.57	115.33	122.97	126.4	(72)

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

(73)m=	483.8	481.6	465.99	440.63	414.6	389.7	373.63	380.03	393.14	418.73	448.16	470.51	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	3.3	x	11.28	x	0.63	x	0.7	=	11.38	(75)
Northeast 0.9x	0.77	x	3.3	x	11.28	x	0.63	x	0.7	=	11.38	(75)
Northeast 0.9x	0.77	x	3.3	x	22.97	x	0.63	x	0.7	=	23.16	(75)
Northeast 0.9x	0.77	x	3.3	x	22.97	x	0.63	x	0.7	=	23.16	(75)
Northeast 0.9x	0.77	x	3.3	x	41.38	x	0.63	x	0.7	=	41.73	(75)
Northeast 0.9x	0.77	x	3.3	x	41.38	x	0.63	x	0.7	=	41.73	(75)
Northeast 0.9x	0.77	x	3.3	x	67.96	x	0.63	x	0.7	=	68.54	(75)
Northeast 0.9x	0.77	x	3.3	x	67.96	x	0.63	x	0.7	=	68.54	(75)
Northeast 0.9x	0.77	x	3.3	x	91.35	x	0.63	x	0.7	=	92.12	(75)
Northeast 0.9x	0.77	x	3.3	x	91.35	x	0.63	x	0.7	=	92.12	(75)
Northeast 0.9x	0.77	x	3.3	x	97.38	x	0.63	x	0.7	=	98.21	(75)
Northeast 0.9x	0.77	x	3.3	x	97.38	x	0.63	x	0.7	=	98.21	(75)

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Northeast	0.9x	0.77	x	3.3	x	91.1	x	0.63	x	0.7	=	91.88	(75)
Northeast	0.9x	0.77	x	3.3	x	91.1	x	0.63	x	0.7	=	91.88	(75)
Northeast	0.9x	0.77	x	3.3	x	72.63	x	0.63	x	0.7	=	73.25	(75)
Northeast	0.9x	0.77	x	3.3	x	72.63	x	0.63	x	0.7	=	73.25	(75)
Northeast	0.9x	0.77	x	3.3	x	50.42	x	0.63	x	0.7	=	50.85	(75)
Northeast	0.9x	0.77	x	3.3	x	50.42	x	0.63	x	0.7	=	50.85	(75)
Northeast	0.9x	0.77	x	3.3	x	28.07	x	0.63	x	0.7	=	28.31	(75)
Northeast	0.9x	0.77	x	3.3	x	28.07	x	0.63	x	0.7	=	28.31	(75)
Northeast	0.9x	0.77	x	3.3	x	14.2	x	0.63	x	0.7	=	14.32	(75)
Northeast	0.9x	0.77	x	3.3	x	14.2	x	0.63	x	0.7	=	14.32	(75)
Northeast	0.9x	0.77	x	3.3	x	9.21	x	0.63	x	0.7	=	9.29	(75)
Northeast	0.9x	0.77	x	3.3	x	9.21	x	0.63	x	0.7	=	9.29	(75)
Southwest	0.9x	0.77	x	3.15	x	36.79		0.63	x	0.7	=	35.42	(79)
Southwest	0.9x	0.77	x	3.25	x	36.79		0.63	x	0.7	=	36.55	(79)
Southwest	0.9x	0.77	x	3.15	x	36.79		0.63	x	0.7	=	35.42	(79)
Southwest	0.9x	0.77	x	3.15	x	36.79		0.63	x	0.7	=	35.42	(79)
Southwest	0.9x	0.77	x	3.15	x	62.67		0.63	x	0.7	=	60.33	(79)
Southwest	0.9x	0.77	x	3.25	x	62.67		0.63	x	0.7	=	62.25	(79)
Southwest	0.9x	0.77	x	3.15	x	62.67		0.63	x	0.7	=	60.33	(79)
Southwest	0.9x	0.77	x	3.15	x	62.67		0.63	x	0.7	=	60.33	(79)
Southwest	0.9x	0.77	x	3.15	x	85.75		0.63	x	0.7	=	82.55	(79)
Southwest	0.9x	0.77	x	3.25	x	85.75		0.63	x	0.7	=	85.17	(79)
Southwest	0.9x	0.77	x	3.15	x	85.75		0.63	x	0.7	=	82.55	(79)
Southwest	0.9x	0.77	x	3.15	x	85.75		0.63	x	0.7	=	82.55	(79)
Southwest	0.9x	0.77	x	3.15	x	106.25		0.63	x	0.7	=	102.29	(79)
Southwest	0.9x	0.77	x	3.25	x	106.25		0.63	x	0.7	=	105.53	(79)
Southwest	0.9x	0.77	x	3.15	x	106.25		0.63	x	0.7	=	102.29	(79)
Southwest	0.9x	0.77	x	3.15	x	106.25		0.63	x	0.7	=	102.29	(79)
Southwest	0.9x	0.77	x	3.15	x	119.01		0.63	x	0.7	=	114.57	(79)
Southwest	0.9x	0.77	x	3.25	x	119.01		0.63	x	0.7	=	118.21	(79)
Southwest	0.9x	0.77	x	3.15	x	119.01		0.63	x	0.7	=	114.57	(79)
Southwest	0.9x	0.77	x	3.15	x	119.01		0.63	x	0.7	=	114.57	(79)
Southwest	0.9x	0.77	x	3.15	x	118.15		0.63	x	0.7	=	113.74	(79)
Southwest	0.9x	0.77	x	3.25	x	118.15		0.63	x	0.7	=	117.35	(79)
Southwest	0.9x	0.77	x	3.15	x	118.15		0.63	x	0.7	=	113.74	(79)
Southwest	0.9x	0.77	x	3.15	x	118.15		0.63	x	0.7	=	113.74	(79)
Southwest	0.9x	0.77	x	3.15	x	113.91		0.63	x	0.7	=	109.66	(79)
Southwest	0.9x	0.77	x	3.25	x	113.91		0.63	x	0.7	=	113.14	(79)
Southwest	0.9x	0.77	x	3.15	x	113.91		0.63	x	0.7	=	109.66	(79)
Southwest	0.9x	0.77	x	3.15	x	113.91		0.63	x	0.7	=	109.66	(79)
Southwest	0.9x	0.77	x	3.15	x	104.39		0.63	x	0.7	=	100.49	(79)

Southwest	0.9x	0.77	x	3.25	x	104.39		0.63	x	0.7	=	103.68	(79)
Southwest	0.9x	0.77	x	3.15	x	104.39		0.63	x	0.7	=	100.49	(79)
Southwest	0.9x	0.77	x	3.15	x	104.39		0.63	x	0.7	=	100.49	(79)
Southwest	0.9x	0.77	x	3.15	x	92.85		0.63	x	0.7	=	89.39	(79)
Southwest	0.9x	0.77	x	3.25	x	92.85		0.63	x	0.7	=	92.22	(79)
Southwest	0.9x	0.77	x	3.15	x	92.85		0.63	x	0.7	=	89.39	(79)
Southwest	0.9x	0.77	x	3.15	x	92.85		0.63	x	0.7	=	89.39	(79)
Southwest	0.9x	0.77	x	3.15	x	69.27		0.63	x	0.7	=	66.68	(79)
Southwest	0.9x	0.77	x	3.25	x	69.27		0.63	x	0.7	=	68.8	(79)
Southwest	0.9x	0.77	x	3.15	x	69.27		0.63	x	0.7	=	66.68	(79)
Southwest	0.9x	0.77	x	3.15	x	69.27		0.63	x	0.7	=	66.68	(79)
Southwest	0.9x	0.77	x	3.15	x	44.07		0.63	x	0.7	=	42.43	(79)
Southwest	0.9x	0.77	x	3.25	x	44.07		0.63	x	0.7	=	43.77	(79)
Southwest	0.9x	0.77	x	3.15	x	44.07		0.63	x	0.7	=	42.43	(79)
Southwest	0.9x	0.77	x	3.15	x	44.07		0.63	x	0.7	=	42.43	(79)
Southwest	0.9x	0.77	x	3.15	x	31.49		0.63	x	0.7	=	30.31	(79)
Southwest	0.9x	0.77	x	3.25	x	31.49		0.63	x	0.7	=	31.28	(79)
Southwest	0.9x	0.77	x	3.15	x	31.49		0.63	x	0.7	=	30.31	(79)
Southwest	0.9x	0.77	x	3.15	x	31.49		0.63	x	0.7	=	30.31	(79)
Northwest	0.9x	0.77	x	0.91	x	11.28	x	0.63	x	0.7	=	3.14	(81)
Northwest	0.9x	0.77	x	0.91	x	22.97	x	0.63	x	0.7	=	6.39	(81)
Northwest	0.9x	0.77	x	0.91	x	41.38	x	0.63	x	0.7	=	11.51	(81)
Northwest	0.9x	0.77	x	0.91	x	67.96	x	0.63	x	0.7	=	18.9	(81)
Northwest	0.9x	0.77	x	0.91	x	91.35	x	0.63	x	0.7	=	25.4	(81)
Northwest	0.9x	0.77	x	0.91	x	97.38	x	0.63	x	0.7	=	27.08	(81)
Northwest	0.9x	0.77	x	0.91	x	91.1	x	0.63	x	0.7	=	25.34	(81)
Northwest	0.9x	0.77	x	0.91	x	72.63	x	0.63	x	0.7	=	20.2	(81)
Northwest	0.9x	0.77	x	0.91	x	50.42	x	0.63	x	0.7	=	14.02	(81)
Northwest	0.9x	0.77	x	0.91	x	28.07	x	0.63	x	0.7	=	7.81	(81)
Northwest	0.9x	0.77	x	0.91	x	14.2	x	0.63	x	0.7	=	3.95	(81)
Northwest	0.9x	0.77	x	0.91	x	9.21	x	0.63	x	0.7	=	2.56	(81)
Rooflights	0.9x	1	x	2.18	x	26	x	0.63	x	0.7	=	22.53	(82)
Rooflights	0.9x	1	x	0.73	x	26	x	0.63	x	0.7	=	7.55	(82)
Rooflights	0.9x	1	x	0.63	x	26	x	0.63	x	0.7	=	6.55	(82)
Rooflights	0.9x	1	x	2.18	x	54	x	0.63	x	0.7	=	46.79	(82)
Rooflights	0.9x	1	x	0.73	x	54	x	0.63	x	0.7	=	15.69	(82)
Rooflights	0.9x	1	x	0.63	x	54	x	0.63	x	0.7	=	13.61	(82)
Rooflights	0.9x	1	x	2.18	x	96	x	0.63	x	0.7	=	83.18	(82)
Rooflights	0.9x	1	x	0.73	x	96	x	0.63	x	0.7	=	27.89	(82)
Rooflights	0.9x	1	x	0.63	x	96	x	0.63	x	0.7	=	24.19	(82)
Rooflights	0.9x	1	x	2.18	x	150	x	0.63	x	0.7	=	129.97	(82)

Rooflights 0.9x	1	x	0.73	x	150	x	0.63	x	0.7	=	43.58	(82)
Rooflights 0.9x	1	x	0.63	x	150	x	0.63	x	0.7	=	37.8	(82)
Rooflights 0.9x	1	x	2.18	x	192	x	0.63	x	0.7	=	166.37	(82)
Rooflights 0.9x	1	x	0.73	x	192	x	0.63	x	0.7	=	55.78	(82)
Rooflights 0.9x	1	x	0.63	x	192	x	0.63	x	0.7	=	48.38	(82)
Rooflights 0.9x	1	x	2.18	x	200	x	0.63	x	0.7	=	173.3	(82)
Rooflights 0.9x	1	x	0.73	x	200	x	0.63	x	0.7	=	58.11	(82)
Rooflights 0.9x	1	x	0.63	x	200	x	0.63	x	0.7	=	50.4	(82)
Rooflights 0.9x	1	x	2.18	x	189	x	0.63	x	0.7	=	163.77	(82)
Rooflights 0.9x	1	x	0.73	x	189	x	0.63	x	0.7	=	54.91	(82)
Rooflights 0.9x	1	x	0.63	x	189	x	0.63	x	0.7	=	47.62	(82)
Rooflights 0.9x	1	x	2.18	x	157	x	0.63	x	0.7	=	136.04	(82)
Rooflights 0.9x	1	x	0.73	x	157	x	0.63	x	0.7	=	45.62	(82)
Rooflights 0.9x	1	x	0.63	x	157	x	0.63	x	0.7	=	39.56	(82)
Rooflights 0.9x	1	x	2.18	x	115	x	0.63	x	0.7	=	99.65	(82)
Rooflights 0.9x	1	x	0.73	x	115	x	0.63	x	0.7	=	33.41	(82)
Rooflights 0.9x	1	x	0.63	x	115	x	0.63	x	0.7	=	28.98	(82)
Rooflights 0.9x	1	x	2.18	x	66	x	0.63	x	0.7	=	57.19	(82)
Rooflights 0.9x	1	x	0.73	x	66	x	0.63	x	0.7	=	19.18	(82)
Rooflights 0.9x	1	x	0.63	x	66	x	0.63	x	0.7	=	16.63	(82)
Rooflights 0.9x	1	x	2.18	x	33	x	0.63	x	0.7	=	28.59	(82)
Rooflights 0.9x	1	x	0.73	x	33	x	0.63	x	0.7	=	9.59	(82)
Rooflights 0.9x	1	x	0.63	x	33	x	0.63	x	0.7	=	8.32	(82)
Rooflights 0.9x	1	x	2.18	x	21	x	0.63	x	0.7	=	18.2	(82)
Rooflights 0.9x	1	x	0.73	x	21	x	0.63	x	0.7	=	6.1	(82)
Rooflights 0.9x	1	x	0.63	x	21	x	0.63	x	0.7	=	5.29	(82)

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

(83)m=	205.34	372.05	563.07	779.71	942.1	963.89	917.51	793.07	638.14	426.26	250.13	172.95	(83)

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

(84)m=	689.14	853.65	1029.05	1220.35	1356.7	1353.59	1291.14	1173.1	1031.29	844.99	698.29	643.46	(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	0.63	0.48	0.54	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=	19.48	19.7	20.04	20.47	20.79	20.95	20.99	20.98	20.86	20.41	19.86	19.45	(87)

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

(88)m=	19.76	19.76	19.76	19.78	19.78	19.79	19.79	19.79	19.79	19.78	19.77	19.77	(88)

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

(89)m=	1	0.99	0.97	0.9	0.75	0.53	0.35	0.41	0.71	0.94	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=	17.76	18.08	18.57	19.18	19.59	19.76	19.79	19.79	19.68	19.11	18.33	17.72		(90)

fLA = Living area ÷ (4) = 0.32 (91)

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

(92)m=	18.31	18.6	19.05	19.59	19.98	20.15	20.18	20.17	20.06	19.53	18.83	18.28	(92)

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

(93)m=	18.31	18.6	19.05	19.59	19.98	20.15	20.18	20.17	20.06	19.53	18.83	18.28	(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	0.96	0.9	0.76	0.56	0.39	0.45	0.73	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	685	841.27	990.21	1092.96	1029.15	758.67	505.25	527.9	753.69	793.59	689.62	640.54	(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, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2067.76	2015.65	1840.63	1548.32	1195.23	791.5	510.49	537.38	854.63	1290.06	1701.94	2054.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1028.77	789.19	632.71	327.86	123.56	0	0	0	0	369.37	728.87	1051.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5052.11 (98)

Space heating requirement in kWh/m²/year 48.2 (99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1028.77	789.19	632.71	327.86	123.56	0	0	0	0	369.37	728.87	1051.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1100.29	844.05	676.7	350.65	132.15	0	0	0	0	395.05	779.54	1124.89	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 5403.33 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

215.23	189.73	199.3	178.71	175.18	156.59	150.44	165	164.69	185.31	195.88	210.07

Efficiency of water heater 79.8 (216)

(217)m=	88.45	88.21	87.68	86.41	83.9	79.8	79.8	79.8	79.8	86.62	88	88.52	(217)

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

(219)m=	243.34	215.09	227.29	206.82	208.78	196.23	188.53	206.77	206.38	213.94	222.58	237.31

Total = $Sum(219a)_{1...12}$ = 2573.06 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			5403.33	
Water heating fuel used			2573.06	
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			415.46	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1167.12	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	555.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1722.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	215.62	(268)
Total CO2, kg/year		sum of (265)…(271) =		1977.45	(272)

TER = 27.91 (273)

11.3. Be Lean

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 01

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	42.14	(1a)	x	2.7	(2a)	=	113.78	(3a)
Ground floor	36.79	(1b)	x	3.2	(2b)	=	117.73	(3b)
First floor	34.79	(1c)	x	4.65	(2c)	=	161.77	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	113.72	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	393.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(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) =	0.3	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

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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

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

0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.19	x1/[1/(1.4)+ 0.04]		=	6.88			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			7.38	x1/[1/(1.4)+ 0.04]		=	9.78			(27)
Windows Type 6			5.83	x1/[1/(1.4)+ 0.04]		=	7.73			(27)
Windows Type 7			3.36	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 8			6.71	x1/[1/(1.4)+ 0.04]		=	8.9			(27)
Rooflights Type 1			3.35	x1/[1/(1.4) + 0.04]		=	4.69			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			1.37	x1/[1/(1.4) + 0.04]		=	1.918			(27b)
Floor			42.14	x	0.13	=	5.478199			(28)
Walls Type1	12.61	0	12.61	x	0.15	=	1.89			(29)
Walls Type2	5.08	4.86	0.22	x	0.15	=	0.03			(29)
Walls Type3	1.35	1.4	-0.05	x	0.15	=	-0.01			(29)
Walls Type4	5.18	5.19	-0.01	x	0.15	=	0			(29)

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Walls Type5	14.63	0	14.63	x	0.15	=	2.19				(29)
Walls Type6	1.7	0	1.7	x	0.15	=	0.26				(29)
Walls Type7	13.5	0	13.5	x	0.15	=	2.03				(29)
Walls Type8	5.22	0	5.22	x	0.15	=	0.78				(29)
Walls Type9	5.76	4.86	0.9	x	0.15	=	0.14				(29)
Walls Type10	0.42	0	0.42	x	0.15	=	0.06				(29)
Walls Type11	6.18	0	6.18	x	0.15	=	0.93				(29)
Walls Type12	15.33	0	15.33	x	0.15	=	2.3				(29)
Walls Type13	2.02	0	2.02	x	0.15	=	0.3				(29)
Walls Type14	16	0	16	x	0.15	=	2.4				(29)
Walls Type15	11.53	6.71	4.82	x	0.15	=	0.72				(29)
Walls Type16	2	0	2	x	0.15	=	0.3				(29)
Walls Type17	9.63	2.46	7.17	x	0.15	=	1.08				(29)
Walls Type18	9.3	0	9.3	x	0.15	=	1.4				(29)
Walls Type19	0.6	0	0.6	x	0.15	=	0.09				(29)
Walls Type20	10.04	5.83	4.21	x	0.15	=	0.63				(29)
Walls Type21	5.77	0	5.77	x	0.15	=	0.87				(29)
Walls Type22	1.91	0	1.91	x	0.15	=	0.29				(29)
Walls Type23	17.21	0	17.21	x	0.15	=	2.58				(29)
Walls Type24	2.65	0	2.65	x	0.15	=	0.4				(29)
Walls Type25	16.14	0	16.14	x	0.15	=	2.42				(29)
Walls Type26	3.94	0	3.94	x	0.15	=	0.59				(29)
Walls Type27	9.7	7.38	2.32	x	0.15	=	0.35				(29)
Walls Type28	5.81	3.36	2.45	x	0.15	=	0.37				(29)
Roof Type1	33.58	4.48	29.1	x	0.13	=	3.78				(30)
Roof Type2	4.01	1.37	2.64	x	0.13	=	0.34				(30)
Total area of elements, m²			290.94								(31)
Party wall			27.41	x	0	=	0				(32)
Party wall			27.94	x	0	=	0				(32)
Party wall			40	x	0	=	0				(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	98.66	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		18.67	(36)

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

Total fabric heat loss	(33) + (36) =	117.34	(37)

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

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

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(38)m=	74.55	74.18	73.81	72.08	71.76	70.25	70.25	69.98	70.83	71.76	72.41	73.09	(38)

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

(39)m=	191.89	191.51	191.14	189.42	189.09	187.59	187.59	187.31	188.17	189.09	189.75	190.43	

Average = Sum(39)1…12 /12= 189.41 (39)

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

(40)m=	1.69	1.68	1.68	1.67	1.66	1.65	1.65	1.65	1.65	1.66	1.67	1.67

Average = Sum(40)1…12 /12= 1.67 (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 2.84 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.54 (43)

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

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

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

(44)m=	111.69	107.63	103.57	99.51	95.45	91.39	91.39	95.45	99.51	103.57	107.63	111.69

Total = Sum(44)1…12 = 1218.49 (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=	165.64	144.87	149.49	130.33	125.06	107.91	100	114.75	116.12	135.33	147.72	160.41

Total = Sum(45)1…12 = 1597.63 (45)

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

(46)m=	24.85	21.73	22.42	19.55	18.76	16.19	15	17.21	17.42	20.3	22.16	24.06	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.85 (55)

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

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(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=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(57)

DER WorkSheet: New dwelling design stage

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=	215.18	189.62	199.04	178.28	174.6	155.86	149.54	164.29	164.07	184.87	195.67	209.96	(62)

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

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

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

Output from water heater

(64)m=	215.18	189.62	199.04	178.28	174.6	155.86	149.54	164.29	164.07	184.87	195.67	209.96

Output from water heater (annual)$_{1...12}$ | 2180.98 | (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=	94.71	83.97	89.34	81.69	81.22	74.24	72.88	77.79	76.97	84.63	87.47	92.97	(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=	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	(66)

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

(67)m=	24.68	21.92	17.82	13.49	10.09	8.52	9.2	11.96	16.05	20.38	23.79	25.36	(67)

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

(68)m=	276.8	279.67	272.43	257.02	237.57	219.29	207.08	204.2	211.44	226.85	246.3	264.58	(68)

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

(69)m=	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	(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=	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	(71)

Water heating gains (Table 5)

(72)m=	127.3	124.95	120.08	113.46	109.16	103.11	97.96	104.56	106.9	113.75	121.49	124.96	(72)

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

(73)m=	497.3	495.07	478.87	452.51	425.35	399.44	382.77	389.25	402.93	429.52	460.12	483.44	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	7.38	x	11.28	x	0.76	x	0.7	=	30.7	(75)
Northeast 0.9x	0.77	x	6.71	x	11.28	x	0.76	x	0.7	=	27.91	(75)

Northeast	0.9x	0.77	x	7.38	x	22.97	x	0.76	x	0.7	=	62.49	(75)
Northeast	0.9x	0.77	x	6.71	x	22.97	x	0.76	x	0.7	=	56.82	(75)
Northeast	0.9x	0.77	x	7.38	x	41.38	x	0.76	x	0.7	=	112.58	(75)
Northeast	0.9x	0.77	x	6.71	x	41.38	x	0.76	x	0.7	=	102.36	(75)
Northeast	0.9x	0.77	x	7.38	x	67.96	x	0.76	x	0.7	=	184.9	(75)
Northeast	0.9x	0.77	x	6.71	x	67.96	x	0.76	x	0.7	=	168.11	(75)
Northeast	0.9x	0.77	x	7.38	x	91.35	x	0.76	x	0.7	=	248.54	(75)
Northeast	0.9x	0.77	x	6.71	x	91.35	x	0.76	x	0.7	=	225.97	(75)
Northeast	0.9x	0.77	x	7.38	x	97.38	x	0.76	x	0.7	=	264.97	(75)
Northeast	0.9x	0.77	x	6.71	x	97.38	x	0.76	x	0.7	=	240.91	(75)
Northeast	0.9x	0.77	x	7.38	x	91.1	x	0.76	x	0.7	=	247.87	(75)
Northeast	0.9x	0.77	x	6.71	x	91.1	x	0.76	x	0.7	=	225.37	(75)
Northeast	0.9x	0.77	x	7.38	x	72.63	x	0.76	x	0.7	=	197.61	(75)
Northeast	0.9x	0.77	x	6.71	x	72.63	x	0.76	x	0.7	=	179.67	(75)
Northeast	0.9x	0.77	x	7.38	x	50.42	x	0.76	x	0.7	=	137.19	(75)
Northeast	0.9x	0.77	x	6.71	x	50.42	x	0.76	x	0.7	=	124.73	(75)
Northeast	0.9x	0.77	x	7.38	x	28.07	x	0.76	x	0.7	=	76.37	(75)
Northeast	0.9x	0.77	x	6.71	x	28.07	x	0.76	x	0.7	=	69.43	(75)
Northeast	0.9x	0.77	x	7.38	x	14.2	x	0.76	x	0.7	=	38.63	(75)
Northeast	0.9x	0.77	x	6.71	x	14.2	x	0.76	x	0.7	=	35.12	(75)
Northeast	0.9x	0.77	x	7.38	x	9.21	x	0.76	x	0.7	=	25.07	(75)
Northeast	0.9x	0.77	x	6.71	x	9.21	x	0.76	x	0.7	=	22.79	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.19	x	36.79		0.76	x	0.7	=	70.4	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.83	x	36.79		0.76	x	0.7	=	79.08	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.19	x	62.67		0.76	x	0.7	=	119.92	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.83	x	62.67		0.76	x	0.7	=	134.71	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.19	x	85.75		0.76	x	0.7	=	164.08	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.83	x	85.75		0.76	x	0.7	=	184.32	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.19	x	106.25		0.76	x	0.7	=	203.3	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.83	x	106.25		0.76	x	0.7	=	228.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.19	x	119.01		0.76	x	0.7	=	227.72	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)

Southwest	0.9x	0.77	x	5.83	x	119.01		0.76	x	0.7	=	255.8	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.19	x	118.15		0.76	x	0.7	=	226.07	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.83	x	118.15		0.76	x	0.7	=	253.95	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.19	x	113.91		0.76	x	0.7	=	217.96	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.83	x	113.91		0.76	x	0.7	=	244.83	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.19	x	104.39		0.76	x	0.7	=	199.74	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.83	x	104.39		0.76	x	0.7	=	224.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.19	x	92.85		0.76	x	0.7	=	177.67	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.83	x	92.85		0.76	x	0.7	=	199.57	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.19	x	69.27		0.76	x	0.7	=	132.54	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.83	x	69.27		0.76	x	0.7	=	148.88	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.19	x	44.07		0.76	x	0.7	=	84.33	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.83	x	44.07		0.76	x	0.7	=	94.72	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.19	x	31.49		0.76	x	0.7	=	60.25	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.83	x	31.49		0.76	x	0.7	=	67.68	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	3.36	x	11.28	x	0.76	x	0.7	=	13.98	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	3.36	x	22.97	x	0.76	x	0.7	=	28.45	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	3.36	x	41.38	x	0.76	x	0.7	=	51.26	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	3.36	x	67.96	x	0.76	x	0.7	=	84.18	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	3.36	x	91.35	x	0.76	x	0.7	=	113.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	3.36	x	97.38	x	0.76	x	0.7	=	120.64	(81)

DER WorkSheet: New dwelling design stage

Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	3.36	x	91.1	x	0.76	x	0.7	=	112.85	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	3.36	x	72.63	x	0.76	x	0.7	=	89.97	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	3.36	x	50.42	x	0.76	x	0.7	=	62.46	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	3.36	x	28.07	x	0.76	x	0.7	=	34.77	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	3.36	x	14.2	x	0.76	x	0.7	=	17.59	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Northwest	0.9x	0.77	x	3.36	x	9.21	x	0.76	x	0.7	=	11.41	(81)
Rooflights	0.9x	1	x	3.35	x	26	x	0.76	x	0.7	=	41.7	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	1.37	x	26	x	0.76	x	0.7	=	17.05	(82)
Rooflights	0.9x	1	x	3.35	x	54	x	0.76	x	0.7	=	86.61	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	1.37	x	54	x	0.76	x	0.7	=	35.42	(82)
Rooflights	0.9x	1	x	3.35	x	96	x	0.76	x	0.7	=	153.98	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)
Rooflights	0.9x	1	x	1.37	x	96	x	0.76	x	0.7	=	62.97	(82)
Rooflights	0.9x	1	x	3.35	x	150	x	0.76	x	0.7	=	240.6	(82)
Rooflights	0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights	0.9x	1	x	1.37	x	150	x	0.76	x	0.7	=	98.39	(82)
Rooflights	0.9x	1	x	3.35	x	192	x	0.76	x	0.7	=	307.96	(82)
Rooflights	0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights	0.9x	1	x	1.37	x	192	x	0.76	x	0.7	=	125.94	(82)
Rooflights	0.9x	1	x	3.35	x	200	x	0.76	x	0.7	=	320.8	(82)
Rooflights	0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights	0.9x	1	x	1.37	x	200	x	0.76	x	0.7	=	131.19	(82)
Rooflights	0.9x	1	x	3.35	x	189	x	0.76	x	0.7	=	303.15	(82)
Rooflights	0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights	0.9x	1	x	1.37	x	189	x	0.76	x	0.7	=	123.98	(82)
Rooflights	0.9x	1	x	3.35	x	157	x	0.76	x	0.7	=	251.82	(82)
Rooflights	0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights	0.9x	1	x	1.37	x	157	x	0.76	x	0.7	=	102.99	(82)
Rooflights	0.9x	1	x	3.35	x	115	x	0.76	x	0.7	=	184.46	(82)
Rooflights	0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights	0.9x	1	x	1.37	x	115	x	0.76	x	0.7	=	75.43	(82)
Rooflights	0.9x	1	x	3.35	x	66	x	0.76	x	0.7	=	105.86	(82)
Rooflights	0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)

Rooflights 0.9x	1	x	1.37	x	66	x	0.76	x	0.7	=	43.29	(82)
Rooflights 0.9x	1	x	3.35	x	33	x	0.76	x	0.7	=	52.93	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	1.37	x	33	x	0.76	x	0.7	=	21.65	(82)
Rooflights 0.9x	1	x	3.35	x	21	x	0.76	x	0.7	=	33.68	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	1.37	x	21	x	0.76	x	0.7	=	13.78	(82)

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

(83)m=	432.57	790.08	1212.15	1704.84	2082.6	2140.39	2033.49	1742.68	1382.49	909.56	528.07	363.62	(83)

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

(84)m=	929.88	1285.15	1691.02	2157.35	2507.95	2539.83	2416.26	2131.93	1785.42	1339.08	988.19	847.06	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.81	0.63	0.46	0.34	0.4	0.65	0.91	0.98	1	(86)

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

(87)m=	19.28	19.63	20.1	20.6	20.87	20.97	20.99	20.99	20.9	20.44	19.74	19.22	(87)

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

(88)m=	20.16	20.16	20.16	20.17	20.17	20.18	20.18	20.18	20.17	20.17	20.17	20.16	(88)

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

(89)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.28	0.33	0.59	0.89	0.98	0.99	(89)

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

(90)m=	18.56	18.9	19.37	19.84	20.08	20.16	20.17	20.17	20.11	19.7	19.03	18.51	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	18.8	19.14	19.61	20.09	20.34	20.43	20.44	20.44	20.37	19.95	19.26	18.74	(92)

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

(93)m=	19.4	19.74	20.21	20.69	20.94	21.03	21.04	21.04	20.97	20.55	19.86	19.34	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.8	0.63	0.46	0.34	0.4	0.65	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	920.87	1248.38	1558.69	1734.79	1583.19	1167.48	823.96	852.14	1159.69	1206.26	968.06	841.1	(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=	2897.46	2841.96	2620.3	2232.71	1747.31	1205.69	833.52	869.23	1292.48	1880.56	2421.8	2883.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1470.58	1070.89	789.84	358.5	122.1	0	0	0	0	501.68	1046.69	1519.67	

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Total per year (kWh/year) = Sum(98)1...5,9...12 =	6879.95	(98)
Space heating requirement in kWh/m²/year	60.5	(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		85.4	(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)	1470.58	1070.89	789.84	358.5	122.1	0	0	0	0	501.68	1046.69	1519.67		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1721.99	1253.96	924.87	419.79	142.97	0	0	0	0	587.45	1225.63	1779.47		(211)
Total (kWh/year) =Sum(211)1...5,10...12=													8056.15	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	215.18	189.62	199.04	178.28	174.6	155.86	149.54	164.29	164.07	184.87	195.67	209.96		
Efficiency of water heater													75.3	(216)
(217)m=	88.14	87.75	86.89	84.76	80.86	75.3	75.3	75.3	75.3	85.77	87.63	88.25		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	244.13	216.08	229.06	210.34	215.93	206.99	198.6	218.19	217.88	215.55	223.28	237.91		
Total = Sum(219a)1...12 =													2633.94	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			8056.15	
Water heating fuel used			2633.94	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		39		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		84	(231)
Electricity for lighting			435.8	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1740.13	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	568.93	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2309.06	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	43.6	(267)
Electricity for lighting	(232) x	0.519	=	226.18	(268)
Total CO2, kg/year		sum of (265)…(271) =		2578.83	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		22.68	(273)
EI rating (section 14)				78	(274)

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User Details:			
Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 02

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	39.95	(1a)	x	2.7	(2a)	=	107.87	(3a)
Ground floor	35.19	(1b)	x	3.2	(2b)	=	112.61	(3b)
First floor	32.26	(1c)	x	4.65	(2c)	=	150.01	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	107.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	370.48	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.33	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.28	(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

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

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.21	x1/[1/(1.4)+ 0.04]		=	6.91			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 7			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]		=	4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]		=	1.372			(27b)
Floor			39.95	x	0.13	=	5.1935			(28)
Walls Type1	10.29	0	10.29	x	0.15	=	1.54			(29)
Walls Type2	5.1	4.86	0.24	x	0.15	=	0.04			(29)
Walls Type3	1.35	1.4	-0.05	x	0.15	=	-0.01			(29)
Walls Type4	5.21	5.21	0	x	0.15	=	0			(29)
Walls Type5	6.27	5.29	0.98	x	0.15	=	0.15			(29)

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Walls Type6	0.8	0	0.8	x	0.15	=	0.12			(29)
Walls Type7	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type8	5.63	0	5.63	x	0.15	=	0.84			(29)
Walls Type9	4.96	0	4.96	x	0.15	=	0.74			(29)
Walls Type10	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type11	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type12	6.4	0	6.4	x	0.15	=	0.96			(29)
Walls Type13	9.11	5.29	3.82	x	0.15	=	0.57			(29)
Walls Type14	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type15	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type16	9.3	0	9.3	x	0.15	=	1.4			(29)
Walls Type17	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type18	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.76	4.5	27.26	x	0.13	=	3.54			(30)
Roof Type2	3.02	0.98	2.04	x	0.13	=	0.27			(30)
Total area of elements, m²			165.72							(31)
Party wall			28.78	x	0	=	0			(32)
Party wall			27.84	x	0	=	0			(32)
Party wall			32.1	x	0	=	0			(32)
Party wall			32.96	x	0	=	0			(32)
Party wall			38.6	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 70.34 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 15.84 (36)

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

Total fabric heat loss (33) + (36) = 86.18 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	69.19	68.87	68.57	67.13	66.86	65.6	65.6	65.37	66.08	66.86	67.4	67.97	(38)

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

(39)m=	155.37	155.06	154.75	153.31	153.04	151.79	151.79	151.55	152.27	153.04	153.58	154.15

Average = Sum(39)$_{1…12}$ /12= 153.31 (39)

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

(40)m=	1.45	1.44	1.44	1.43	1.42	1.41	1.41	1.41	1.42	1.42	1.43	1.44

Average = Sum(40)$_{1…12}$ /12= 1.43 (40)

Number of days in month (Table 1a)

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

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(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 — 2.8 (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 — 100.66 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	110.73	106.7	102.67	98.65	94.62	90.59	90.59	94.62	98.65	102.67	106.7	110.73		
											Total = Sum(44)$_{1...12}$ =		1207.91	(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=	164.2	143.61	148.2	129.2	123.97	106.98	99.13	113.75	115.11	134.15	146.44	159.02		
											Total = Sum(45)$_{1...12}$ =		1583.76	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	24.63	21.54	22.23	19.38	18.6	16.05	14.87	17.06	17.27	20.12	21.97	23.85		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 210 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.57 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.85 (55)

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

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(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=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(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=	213.75	188.36	197.74	177.15	173.51	154.92	148.67	163.3	163.06	183.7	194.38	208.57	(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=	213.75	188.36	197.74	177.15	173.51	154.92	148.67	163.3	163.06	183.7	194.38	208.57	

Output from water heater (annual)1…12 | 2167.11 | (64)

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

(65)m=	94.23	83.55	88.91	81.32	80.86	73.93	72.6	77.46	76.63	84.24	87.05	92.51	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.87	21.2	17.24	13.05	9.76	8.24	8.9	11.57	15.53	19.72	23.02	24.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	267.77	270.54	263.54	248.64	229.82	212.14	200.32	197.54	204.54	219.45	238.27	255.95	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	(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=	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	(71)
Water heating gains (Table 5)													
(72)m=	126.66	124.33	119.5	112.94	108.68	102.68	97.58	104.11	106.43	113.23	120.9	124.34	(72)
Total internal gains =							(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m						
(73)m=	486.27	484.05	468.26	442.6	416.23	391.02	374.77	381.2	394.48	420.37	450.15	472.8	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)

Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.21	x	36.79		0.76	x	0.7	=	70.67	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.21	x	62.67		0.76	x	0.7	=	120.38	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.21	x	85.75		0.76	x	0.7	=	164.71	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.21	x	106.25		0.76	x	0.7	=	204.09	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.21	x	119.01		0.76	x	0.7	=	228.6	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.21	x	118.15		0.76	x	0.7	=	226.94	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.21	x	113.91		0.76	x	0.7	=	218.8	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.21	x	104.39		0.76	x	0.7	=	200.51	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.21	x	92.85		0.76	x	0.7	=	178.35	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.21	x	69.27		0.76	x	0.7	=	133.05	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.21	x	44.07		0.76	x	0.7	=	84.65	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.21	x	31.49		0.76	x	0.7	=	60.48	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)

DER WorkSheet: New dwelling design stage

Rooflights	0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights	0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)
Rooflights	0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights	0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights	0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights	0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights	0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights	0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights	0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights	0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights	0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights	0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights	0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights	0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights	0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights	0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights	0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights	0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights	0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights	0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights	0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights	0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights	0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights	0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights	0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights	0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights	0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights	0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

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

(83)m=	386.5	700.4	1060.31	1468.94	1775.54	1816.92	1729.37	1494.36	1201.89	802.52	470.83	325.54	(83)

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

(84)m=	872.77	1184.45	1528.57	1911.54	2191.77	2207.94	2104.14	1875.55	1596.37	1222.89	920.99	798.34	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.8	0.61	0.43	0.32	0.37	0.62	0.9	0.98	1	(86)

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

(87)m=	19.57	19.89	20.31	20.72	20.93	20.99	21	20.99	20.94	20.59	19.98	19.51	(87)

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

(88)m=	20.28	20.28	20.28	20.29	20.29	20.29	20.29	20.29	20.29	20.29	20.28	20.28	(88)

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

(89)m=	0.99	0.97	0.92	0.77	0.57	0.39	0.27	0.31	0.56	0.88	0.98	0.99	(89)

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

(90)m=	18.94	19.26	19.67	20.06	20.23	20.29	20.29	20.29	20.25	19.95	19.35	18.88	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	19.14	19.46	19.88	20.28	20.46	20.52	20.52	20.52	20.48	20.16	19.56	19.09	(92)

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

(93)m=	19.74	20.06	20.48	20.88	21.06	21.12	21.12	21.12	21.08	20.76	20.16	19.69	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.79	0.61	0.44	0.32	0.38	0.62	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	864.79	1150.64	1404.49	1515.24	1341.33	971.05	682.72	708.5	991.92	1091.5	902.25	793.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2399.28	2351.09	2163.62	1836.27	1432.59	988.91	686.58	715.7	1062.93	1554.62	2005.31	2387.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1141.66	806.7	564.79	231.14	67.9	0	0	0	0	344.56	794.2	1186.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5137.06 (98)

Space heating requirement in kWh/m²/year 47.83 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		85.4	(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)													
	1141.66	806.7	564.79	231.14	67.9	0	0	0	0	344.56	794.2	1186.11	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1336.84	944.61	661.34	270.66	79.51	0	0	0	0	403.47	929.98	1388.88	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 6015.29 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

	213.75	188.36	197.74	177.15	173.51	154.92	148.67	163.3	163.06	183.7	194.38	208.57	
Efficiency of water heater												75.3	(216)
(217)m=	87.63	87.09	85.93	83.16	79.01	75.3	75.3	75.3	75.3	84.51	86.97	87.77	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.92	216.27	230.11	213.01	219.61	205.74	197.44	216.86	216.54	217.37	223.5	237.63	
								Total = Sum(219a)$_{1...12}$ =				2638.02	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			6015.29	
Water heating fuel used			2638.02	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		39		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		84	(231)
Electricity for lighting			421.58	(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	=	1299.3	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	569.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1869.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	43.6	(267)
Electricity for lighting	(232) x	0.519	=	218.8	(268)
Total CO2, kg/year		sum of (265)…(271) =		2131.51	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.85	(273)
EI rating (section 14)				81	(274)

DER WorkSheet: New dwelling design stage

User Details:			
Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 03

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	40.51	(1a)	x	2.7	(2a)	=	109.38	(3a)
Ground floor	35.41	(1b)	x	3.2	(2b)	=	113.31	(3b)
First floor	32.25	(1c)	x	4.65	(2c)	=	149.96	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	108.17	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	372.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(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

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

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.21	x1/[1/(1.4)+ 0.04]		=	6.91			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 7			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]		=	4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]		=	1.372			(27b)
Floor			40.51	x	0.13	=	5.2663			(28)
Walls Type1	10.29	0	10.29	x	0.15	=	1.54			(29)
Walls Type2	5.08	4.86	0.22	x	0.15	=	0.03			(29)
Walls Type3	1.35	1.4	-0.05	x	0.15	=	-0.01			(29)
Walls Type4	5.21	5.21	0	x	0.15	=	0			(29)
Walls Type5	6.27	5.29	0.98	x	0.15	=	0.15			(29)

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Walls Type6	0.8	0	0.8	x	0.15	=	0.12			(29)
Walls Type7	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type8	6.02	0	6.02	x	0.15	=	0.9			(29)
Walls Type9	4.96	0	4.96	x	0.15	=	0.74			(29)
Walls Type10	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type11	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type12	6.4	0	6.4	x	0.15	=	0.96			(29)
Walls Type13	9.11	5.29	3.82	x	0.15	=	0.57			(29)
Walls Type14	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type15	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type16	9.3	0	9.3	x	0.15	=	1.4			(29)
Walls Type17	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type18	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.76	4.5	27.26	x	0.13	=	3.54			(30)
Roof Type2	3.31	0.98	2.33	x	0.13	=	0.3			(30)
Total area of elements, m²			166.94							(31)
Party wall			29.24	x	0	=	0			(32)
Party wall			28.24	x	0	=	0			(32)
Party wall			32.58	x	0	=	0			(32)
Party wall			33.47	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	70.51	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		15.9	(36)

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

Total fabric heat loss	(33) + (36) =	86.41	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	69.55	69.24	68.93	67.49	67.22	65.96	65.96	65.73	66.45	67.22	67.77	68.34	(38)

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

(39)m=	155.96	155.65	155.34	153.9	153.63	152.37	152.37	152.14	152.86	153.63	154.17	154.74	

Average = $Sum(39)_{1…12}$ /12= 153.9 (39)

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

(40)m=	1.44	1.44	1.44	1.42	1.42	1.41	1.41	1.41	1.41	1.42	1.43	1.43

Average = $Sum(40)_{1…12}$ /12= 1.42 (40)

Number of days in month (Table 1a)

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

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(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 2.8 (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) + 36 100.78 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	110.86	106.83	102.8	98.76	94.73	90.7	90.7	94.73	98.76	102.8	106.83	110.86		
												Total = Sum(44)1...12 =	1209.36	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	164.4	143.79	148.37	129.36	124.12	107.11	99.25	113.89	115.25	134.31	146.61	159.21		
												Total = Sum(45)1...12 =	1585.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	24.66	21.57	22.26	19.4	18.62	16.07	14.89	17.08	17.29	20.15	21.99	23.88		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.85 (55)

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

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(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=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(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=	213.94	188.53	197.92	177.3	173.66	155.05	148.79	163.43	163.2	183.86	194.56	208.76	(62)

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

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

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

Output from water heater

(64)m=	213.94	188.53	197.92	177.3	173.66	155.05	148.79	163.43	163.2	183.86	194.56	208.76	

Output from water heater (annual)$_{1...12}$ 2169.01 (64)

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

(65)m=	94.3	83.61	88.97	81.37	80.91	73.97	72.64	77.5	76.68	84.29	87.11	92.57	(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):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.97	21.29	17.32	13.11	9.8	8.27	8.94	11.62	15.6	19.8	23.11	24.64	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	268.9	271.69	264.66	249.69	230.79	213.03	201.17	198.38	205.41	220.38	239.28	257.04	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	(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=	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	(71)
Water heating gains (Table 5)													
(72)m=	126.75	124.42	119.58	113.01	108.74	102.74	97.63	104.17	106.5	113.3	120.98	124.43	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	487.67	485.45	469.61	443.86	417.39	392.09	375.79	382.22	395.55	421.53	451.42	474.15	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)

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Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.21	x	36.79		0.76	x	0.7	=	70.67	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.21	x	62.67		0.76	x	0.7	=	120.38	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.21	x	85.75		0.76	x	0.7	=	164.71	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.21	x	106.25		0.76	x	0.7	=	204.09	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.21	x	119.01		0.76	x	0.7	=	228.6	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.21	x	118.15		0.76	x	0.7	=	226.94	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.21	x	113.91		0.76	x	0.7	=	218.8	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)

DER WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.21	x	104.39		0.76	x	0.7	=	200.51	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.21	x	92.85		0.76	x	0.7	=	178.35	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.21	x	69.27		0.76	x	0.7	=	133.05	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.21	x	44.07		0.76	x	0.7	=	84.65	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.21	x	31.49		0.76	x	0.7	=	60.48	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)

Rooflights 0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights 0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)
Rooflights 0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights 0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights 0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights 0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights 0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights 0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights 0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights 0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights 0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights 0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights 0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights 0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights 0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights 0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights 0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights 0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights 0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights 0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights 0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights 0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights 0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

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

(83)m=	386.5	700.4	1060.31	1468.94	1775.54	1816.92	1729.37	1494.36	1201.89	802.52	470.83	325.54	(83)

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

(84)m=	874.17	1185.85	1529.91	1912.8	2192.93	2209.01	2105.15	1876.58	1597.44	1224.05	922.25	799.69	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.8	0.61	0.43	0.32	0.37	0.62	0.9	0.98	1	(86)

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

(87)m=	19.57	19.89	20.31	20.72	20.93	20.99	21	20.99	20.94	20.59	19.98	19.51	(87)

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

(88)m=	20.28	20.28	20.28	20.29	20.29	20.3	20.3	20.3	20.29	20.29	20.29	20.28	(88)

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

(89)m=	0.99	0.97	0.92	0.77	0.57	0.39	0.27	0.31	0.57	0.88	0.98	0.99	(89)

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

(90)m=	18.94	19.26	19.67	20.06	20.24	20.29	20.29	20.29	20.26	19.95	19.35	18.89	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	19.15	19.47	19.88	20.28	20.46	20.52	20.53	20.52	20.48	20.16	19.56	19.09	(92)

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

(93)m=	19.75	20.07	20.48	20.88	21.06	21.12	21.13	21.12	21.08	20.76	20.16	19.69	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.79	0.61	0.44	0.33	0.38	0.62	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	866.34	1152.57	1407.34	1519.62	1346.26	975.03	685.66	711.52	995.64	1094.06	903.82	794.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2408.99	2360.41	2172.08	1843.53	1438.39	993.04	689.55	718.78	1067.33	1560.82	2013.4	2397.11	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1147.74	811.67	568.96	233.22	68.54	0	0	0	0	347.26	798.9	1192.29	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5168.59 (98)

Space heating requirement in kWh/m²/year 47.78 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		85.4	(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)													
	1147.74	811.67	568.96	233.22	68.54	0	0	0	0	347.26	798.9	1192.29	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1343.95	950.43	666.24	273.09	80.26	0	0	0	0	406.63	935.48	1396.12	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 6052.21 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

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Water heating

Output from water heater (calculated above)

	213.94	188.53	197.92	177.3	173.66	155.05	148.79	163.43	163.2	183.86	194.56	208.76	
Efficiency of water heater												75.3	(216)
(217)m=	87.64	87.11	85.95	83.19	79.04	75.3	75.3	75.3	75.3	84.53	86.98	87.78	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	244.12	216.44	230.27	213.12	219.73	205.91	197.6	217.04	216.73	217.5	223.67	237.83	
Total = Sum(219a)$_{1...12}$ =												2639.95	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		6052.21	
Water heating fuel used		2639.95	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	39		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		84	(231)
Electricity for lighting		423.36	(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	=	1307.28	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	570.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1877.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	43.6	(267)
Electricity for lighting	(232) x	0.519	=	219.73	(268)
Total CO2, kg/year		sum of (265)…(271) =		2140.83	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.79	(273)
EI rating (section 14)				81	(274)

DER WorkSheet: New dwelling design stage

User Details:			
Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 04

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	41.19	(1a)	x	2.7	(2a)	=	111.21	(3a)
Ground floor	35.68	(1b)	x	3.2	(2b)	=	114.18	(3b)
First floor	32.25	(1c)	x	4.65	(2c)	=	149.96	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	109.12	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	375.35	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13 (8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.36	0.35	0.35	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.21	x1/[1/(1.4)+ 0.04]		=	6.91			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 7			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]		=	4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]		=	1.372			(27b)
Floor			41.19	x	0.13	=	5.3547			(28)
Walls Type1	10.29	0	10.29	x	0.15	=	1.54			(29)
Walls Type2	5.08	4.86	0.22	x	0.15	=	0.03			(29)
Walls Type3	1.35	1.4	-0.05	x	0.15	=	-0.01			(29)
Walls Type4	5.21	5.21	0	x	0.15	=	0			(29)
Walls Type5	6.27	5.29	0.98	x	0.15	=	0.15			(29)

Walls Type6	0.8	0	0.8	x	0.15	=	0.12			(29)
Walls Type7	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type8	6.62	0	6.62	x	0.15	=	0.99			(29)
Walls Type9	4.96	0	4.96	x	0.15	=	0.74			(29)
Walls Type10	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type11	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type12	6.4	0	6.4	x	0.15	=	0.96			(29)
Walls Type13	9.11	5.29	3.82	x	0.15	=	0.57			(29)
Walls Type14	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type15	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type16	9.3	0	9.3	x	0.15	=	1.4			(29)
Walls Type17	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type18	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.76	4.5	27.26	x	0.13	=	3.54			(30)
Roof Type2	3.67	0.98	2.69	x	0.13	=	0.35			(30)
Total area of elements, m²			168.58							(31)
Party wall			29.65	x	0	=	0			(32)
Party wall			28.67	x	0	=	0			(32)
Party wall			33.12	x	0	=	0			(32)
Party wall			34.08	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 70.74 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 15.97 (36)

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

Total fabric heat loss (33) + (36) = 86.7 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	70.01	69.7	69.39	67.94	67.67	66.42	66.42	66.18	66.9	67.67	68.22	68.79	(38)

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

(39)m=	156.71	156.4	156.09	154.65	154.38	153.12	153.12	152.89	153.6	154.38	154.92	155.5

Average = Sum(39)$_{1…12}$ /12= 154.65 (39)

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

(40)m=	1.44	1.43	1.43	1.42	1.41	1.4	1.4	1.4	1.41	1.41	1.42	1.42

Average = Sum(40)$_{1…12}$ /12= 1.42 (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 2.81 (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) + 36 100.92 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	111.02	106.98	102.94	98.91	94.87	90.83	90.83	94.87	98.91	102.94	106.98	111.02	
Total = Sum(44)1…12 =												1211.09	(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=	164.63	143.99	148.59	129.54	124.3	107.26	99.39	114.05	115.41	134.5	146.82	159.44	
Total = Sum(45)1…12 =												1587.93	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.7	21.6	22.29	19.43	18.64	16.09	14.91	17.11	17.31	20.18	22.02	23.92	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.85 (55)

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

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(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=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

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

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

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

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

(62)m=	214.18	188.74	198.13	177.49	173.84	155.2	148.94	163.6	163.36	184.05	194.77	208.98	(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=	214.18	188.74	198.13	177.49	173.84	155.2	148.94	163.6	163.36	184.05	194.77	208.98	

Output from water heater (annual)$_{1...12}$ 2171.27 (64)

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

(65)m=	94.38	83.68	89.04	81.43	80.96	74.02	72.68	77.56	76.73	84.36	87.18	92.65	(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=	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	24.1	21.4	17.41	13.18	9.85	8.32	8.99	11.68	15.68	19.9	23.23	24.77	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	270.29	273.09	266.02	250.98	231.98	214.13	202.21	199.4	206.47	221.52	240.51	258.36	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	(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=	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	(71)
Water heating gains (Table 5)													
(72)m=	126.85	124.52	119.68	113.1	108.82	102.81	97.69	104.24	106.57	113.38	121.08	124.53	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	489.37	487.15	471.25	445.39	418.8	393.39	377.02	383.47	396.86	422.95	452.96	475.8	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast	0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast	0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast	0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast	0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast	0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast	0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast	0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast	0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast	0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)
Northeast	0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)

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Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.21	x	36.79		0.76	x	0.7	=	70.67	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.21	x	62.67		0.76	x	0.7	=	120.38	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.21	x	85.75		0.76	x	0.7	=	164.71	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.21	x	106.25		0.76	x	0.7	=	204.09	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.21	x	119.01		0.76	x	0.7	=	228.6	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.21	x	118.15		0.76	x	0.7	=	226.94	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.21	x	113.91		0.76	x	0.7	=	218.8	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)

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Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.21	x	104.39		0.76	x	0.7	=	200.51	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.21	x	92.85		0.76	x	0.7	=	178.35	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.21	x	69.27		0.76	x	0.7	=	133.05	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.21	x	44.07		0.76	x	0.7	=	84.65	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.21	x	31.49		0.76	x	0.7	=	60.48	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)

Rooflights 0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights 0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)
Rooflights 0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights 0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights 0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights 0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights 0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights 0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights 0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights 0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights 0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights 0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights 0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights 0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights 0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights 0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights 0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights 0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights 0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights 0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights 0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights 0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights 0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

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

(83)m=	386.5	700.4	1060.31	1468.94	1775.54	1816.92	1729.37	1494.36	1201.89	802.52	470.83	325.54	(83)

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

(84)m=	875.88	1187.55	1531.55	1914.33	2194.34	2210.32	2106.39	1877.82	1598.75	1225.47	923.79	801.33	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.8	0.61	0.44	0.32	0.37	0.62	0.9	0.98	1	(86)

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

(87)m=	19.57	19.89	20.31	20.72	20.93	20.99	21	20.99	20.94	20.59	19.98	19.51	(87)

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

(88)m=	20.28	20.28	20.28	20.29	20.29	20.3	20.3	20.3	20.3	20.29	20.29	20.29	(88)

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

(89)m=	0.99	0.97	0.92	0.78	0.57	0.39	0.27	0.32	0.57	0.88	0.98	0.99	(89)

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

(90)m=	18.94	19.26	19.67	20.06	20.24	20.29	20.3	20.3	20.26	19.95	19.36	18.89	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	19.15	19.47	19.88	20.28	20.46	20.52	20.53	20.53	20.48	20.16	19.56	19.1	(92)

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

(93)m=	19.75	20.07	20.48	20.88	21.06	21.12	21.13	21.13	21.08	20.76	20.16	19.7	(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	0.97	0.92	0.8	0.62	0.44	0.33	0.38	0.63	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	868.21	1154.91	1410.82	1525.05	1352.44	980.05	689.36	715.33	1000.3	1097.2	905.73	796.34	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2421.29	2372.21	2182.79	1852.73	1445.73	998.27	693.29	722.67	1072.88	1568.65	2023.64	2409.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1155.49	818.03	574.34	235.93	69.4	0	0	0	0	350.76	804.89	1200.16	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5209 (98)

Space heating requirement in kWh/m²/year 47.74 (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) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		85.4	(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)													
	1155.49	818.03	574.34	235.93	69.4	0	0	0	0	350.76	804.89	1200.16	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1353.03	957.88	672.53	276.27	81.27	0	0	0	0	410.72	942.5	1405.34	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 6099.53 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

214.18	188.74	198.13	177.49	173.84	155.2	148.94	163.6	163.36	184.05	194.77	208.98

Efficiency of water heater 75.3 (216)

(217)m=	87.65	87.12	85.98	83.23	79.07	75.3	75.3	75.3	75.3	84.56	87	87.79	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	244.35	216.63	230.44	213.24	219.86	206.12	197.79	217.26	216.95	217.64	223.87	238.05

Total = Sum(219a)$_{1...12}$ = 2642.2 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			6099.53	
Water heating fuel used			2642.2	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		39		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		84	(231)
Electricity for lighting			425.55	(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	=	1317.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	570.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1888.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	43.6	(267)
Electricity for lighting	(232) x	0.519	=	220.86	(268)
Total CO2, kg/year		sum of (265)…(271) =		2152.67	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.73	(273)
El rating (section 14)				81	(274)

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User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 05

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	41.06	(1a)	x	2.7	(2a)	=	110.86	(3a)
Ground floor	35.9	(1b)	x	3.2	(2b)	=	114.88	(3b)
First floor	32.25	(1c)	x	4.65	(2c)	=	149.96	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	109.21	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	375.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(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

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

0.36	0.35	0.35	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.21	x1/[1/(1.4)+ 0.04]		=	6.91			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 7			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]		=	4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]		=	1.372			(27b)
Floor			41.06	x	0.13	=	5.3378			(28)
Walls Type1	10.31	0	10.31	x	0.15	=	1.55			(29)
Walls Type2	5.08	4.86	0.22	x	0.15	=	0.03			(29)
Walls Type3	1.35	1.4	-0.05	x	0.15	=	-0.01			(29)
Walls Type4	5.21	5.21	0	x	0.15	=	0			(29)
Walls Type5	6.27	5.29	0.98	x	0.15	=	0.15			(29)

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Walls Type6	0.8	0	0.8	x	0.15	=	0.12			(29)
Walls Type7	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type8	6.75	0	6.75	x	0.15	=	1.01			(29)
Walls Type9	5	0	5	x	0.15	=	0.75			(29)
Walls Type10	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type11	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type12	6.4	0	6.4	x	0.15	=	0.96			(29)
Walls Type13	9.11	5.29	3.82	x	0.15	=	0.57			(29)
Walls Type14	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type15	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type16	9.3	0	9.3	x	0.15	=	1.4			(29)
Walls Type17	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type18	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.76	4.5	27.26	x	0.13	=	3.54			(30)
Roof Type2	3.34	0.98	2.36	x	0.13	=	0.31			(30)
Total area of elements, m²			168.31							(31)
Party wall			30.19	x	0	=	0			(32)
Party wall			27.95	x	0	=	0			(32)
Party wall			33.7	x	0	=	0			(32)
Party wall			33.09	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	70.7	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		15.95	(36)

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

Total fabric heat loss	(33) + (36) =	86.65	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	70.07	69.76	69.45	68	67.73	66.48	66.48	66.24	66.96	67.73	68.28	68.85	(38)

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

(39)m=	156.72	156.41	156.1	154.66	154.39	153.13	153.13	152.9	153.61	154.39	154.93	155.5

Average = Sum(39)$_{1…12}$ /12= 154.66 (39)

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

(40)m=	1.44	1.43	1.43	1.42	1.41	1.4	1.4	1.4	1.41	1.41	1.42	1.42

Average = Sum(40)$_{1…12}$ /12= 1.42 (40)

Number of days in month (Table 1a)

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

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(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 — 2.81 (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 — 100.94 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	111.03	106.99	102.96	98.92	94.88	90.84	90.84	94.88	98.92	102.96	106.99	111.03	
Total = Sum(44)1…12 = 1211.25													(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=	164.66	144.01	148.6	129.56	124.31	107.27	99.4	114.07	115.43	134.52	146.84	159.46	
Total = Sum(45)1…12 = 1588.14													(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.7	21.6	22.29	19.43	18.65	16.09	14.91	17.11	17.31	20.18	22.03	23.92	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 210 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.57 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.85 (55)

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

(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(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=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(57)

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

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

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

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

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

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

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

(62)m=	214.2	188.76	198.15	177.5	173.86	155.22	148.95	163.61	163.38	184.07	194.79	209	(62)

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

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

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

Output from water heater

(64)m=	214.2	188.76	198.15	177.5	173.86	155.22	148.95	163.61	163.38	184.07	194.79	209	

Output from water heater (annual)$_{1...12}$ 2171.48 (64)

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

(65)m=	94.38	83.68	89.05	81.43	80.97	74.03	72.69	77.56	76.74	84.36	87.18	92.66	(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=	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	24.11	21.41	17.41	13.18	9.85	8.32	8.99	11.69	15.68	19.91	23.24	24.78	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	270.42	273.22	266.15	251.1	232.09	214.23	202.3	199.5	206.57	221.62	240.62	258.48	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	(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=	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	(71)
Water heating gains (Table 5)													
(72)m=	126.86	124.53	119.69	113.1	108.83	102.81	97.7	104.25	106.58	113.39	121.09	124.54	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	489.53	487.31	471.4	445.53	418.93	393.52	377.14	383.58	396.98	423.08	453.1	475.95	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)

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Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.21	x	36.79		0.76	x	0.7	=	70.67	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.21	x	62.67		0.76	x	0.7	=	120.38	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.21	x	85.75		0.76	x	0.7	=	164.71	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.21	x	106.25		0.76	x	0.7	=	204.09	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.21	x	119.01		0.76	x	0.7	=	228.6	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.21	x	118.15		0.76	x	0.7	=	226.94	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.21	x	113.91		0.76	x	0.7	=	218.8	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)

Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.21	x	104.39		0.76	x	0.7	=	200.51	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.21	x	92.85		0.76	x	0.7	=	178.35	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.21	x	69.27		0.76	x	0.7	=	133.05	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.21	x	44.07		0.76	x	0.7	=	84.65	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.21	x	31.49		0.76	x	0.7	=	60.48	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)

Rooflights 0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights 0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)
Rooflights 0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights 0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights 0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights 0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights 0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights 0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights 0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights 0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights 0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights 0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights 0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights 0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights 0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights 0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights 0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights 0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights 0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights 0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights 0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights 0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights 0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

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

(83)m=	386.5	700.4	1060.31	1468.94	1775.54	1816.92	1729.37	1494.36	1201.89	802.52	470.83	325.54	(83)

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

(84)m=	876.04	1187.71	1531.71	1914.47	2194.47	2210.44	2106.51	1877.94	1598.87	1225.6	923.94	801.49	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.8	0.61	0.44	0.32	0.37	0.62	0.9	0.98	1	(86)

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

(87)m=	19.57	19.89	20.31	20.72	20.93	20.99	21	20.99	20.94	20.59	19.98	19.51	(87)

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

(88)m=	20.28	20.28	20.29	20.29	20.29	20.3	20.3	20.3	20.3	20.29	20.29	20.29	(88)

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

(89)m=	0.99	0.97	0.92	0.78	0.57	0.39	0.27	0.32	0.57	0.88	0.98	0.99	(89)

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

(90)m=	18.95	19.26	19.67	20.06	20.24	20.29	20.3	20.3	20.26	19.95	19.36	18.89	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	19.15	19.47	19.88	20.28	20.46	20.52	20.53	20.52	20.48	20.16	19.56	19.09	(92)

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

(93)m=	19.75	20.07	20.48	20.88	21.06	21.12	21.13	21.12	21.08	20.76	20.16	19.69	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.8	0.62	0.44	0.33	0.38	0.63	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	868.39	1155.11	1411.04	1525.21	1352.42	979.86	689.11	715.1	1000.23	1097.36	905.9	796.5	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2421.29	2372.19	2182.71	1852.59	1445.52	998.03	693.02	722.41	1072.66	1568.51	2023.58	2409.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1155.36	817.88	574.12	235.71	69.27	0	0	0	0	350.53	804.73	1200.04	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 5207.65 (98)

Space heating requirement in kWh/m²/year 47.68 (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		85.4	(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)													
	1155.36	817.88	574.12	235.71	69.27	0	0	0	0	350.53	804.73	1200.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1352.88	957.7	672.27	276.01	81.11	0	0	0	0	410.46	942.31	1405.2	

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 6097.95 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

214.2	188.76	198.15	177.5	173.86	155.22	148.95	163.61	163.38	184.07	194.79	209

Efficiency of water heater 75.3 (216)

(217)m=	87.65	87.12	85.98	83.23	79.06	75.3	75.3	75.3	75.3	84.56	87	87.79	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	244.38	216.66	230.47	213.27	219.9	206.13	197.81	217.28	216.97	217.67	223.89	238.08

Total = $Sum(219a)_{1...12}$ = 2642.5 (219)

Annual totals	kWh/year	kWh/year	
Space heating fuel used, main system 1		6097.95	
Water heating fuel used		2642.5	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	39		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		84	(231)
Electricity for lighting		425.75	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	1317.16	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	570.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1887.94	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	43.6	(267)
Electricity for lighting	(232) x	0.519 =	220.96	(268)
Total CO2, kg/year		sum of (265)…(271) =	2152.5	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	19.71	(273)
EI rating (section 14)			81	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 06

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	38.62	(1a)	x	2.7	(2a)	=	104.27	(3a)
Ground floor	34.58	(1b)	x	3.2	(2b)	=	110.66	(3b)
First floor	31.61	(1c)	x	4.65	(2c)	=	146.99	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	104.81	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	361.92	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.14 (8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(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) =	0.31	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.01	x1/[1/(1.4)+ 0.04]		=	6.64			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			5.09	x1/[1/(1.4)+ 0.04]		=	6.75			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 7			5.09	x1/[1/(1.4)+ 0.04]		=	6.75			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]		=	4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]		=	1.372			(27b)
Floor			38.62	x	0.13	=	5.0206			(28)
Walls Type1	10.15	0	10.15	x	0.15	=	1.52			(29)
Walls Type2	26.7	0	26.7	x	0.15	=	4.01			(29)
Walls Type3	5.08	4.86	0.22	x	0.15	=	0.03			(29)
Walls Type4	1.35	0	1.35	x	0.15	=	0.2			(29)
Walls Type5	5	5.01	-0.01	x	0.15	=	0			(29)

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Walls Type6	6.02	5.09	0.93	x	0.15	=	0.14			(29)
Walls Type7	0.8	1.4	-0.6	x	0.15	=	-0.09			(29)
Walls Type8	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type9	5.28	0	5.28	x	0.15	=	0.79			(29)
Walls Type10	5	0	5	x	0.15	=	0.75			(29)
Walls Type11	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type12	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type13	6.18	0	6.18	x	0.15	=	0.93			(29)
Walls Type14	8.74	5.09	3.65	x	0.15	=	0.55			(29)
Walls Type15	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type16	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type17	40	0	40	x	0.15	=	6			(29)
Walls Type18	8.97	0	8.97	x	0.15	=	1.35			(29)
Walls Type19	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type20	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.14	4.5	26.64	x	0.13	=	3.46			(30)
Roof Type2	2.38	0.98	1.4	x	0.13	=	0.18			(30)
Total area of elements, m²			227.98							(31)
Party wall			29.19	x	0	=	0			(32)
Party wall			32.58	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 79.03 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 15.38 (36)

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

Total fabric heat loss (33) + (36) = 94.41 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	69.21	68.85	68.48	66.79	66.47	64.99	64.99	64.72	65.56	66.47	67.11	67.78	(38)

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

(39)m=	163.62	163.25	162.89	161.19	160.87	159.39	159.39	159.12	159.96	160.87	161.52	162.19	

Average = $Sum(39)_{1…12}$ /12= 161.19 (39)

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

(40)m=	1.56	1.56	1.55	1.54	1.53	1.52	1.52	1.52	1.53	1.53	1.54	1.55

Average = $Sum(40)_{1…12}$ /12= 1.54 (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)

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4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.78 (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 — 100.22 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	110.24	106.23	102.23	98.22	94.21	90.2	90.2	94.21	98.22	102.23	106.23	110.24	
Total = Sum(44)1…12 =												1202.65	(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=	163.49	142.99	147.55	128.64	123.43	106.51	98.7	113.26	114.61	133.57	145.8	158.33	
Total = Sum(45)1…12 =												1576.86	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.52	21.45	22.13	19.3	18.51	15.98	14.8	16.99	17.19	20.04	21.87	23.75	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 210 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.57 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.85 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.85 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(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=	26.28	23.74	26.28	25.43	26.28	25.43	26.28	26.28	25.43	26.28	25.43	26.28	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m													
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m													
(62)m=	213.03	187.74	197.09	176.58	172.97	154.46	148.24	162.8	162.56	183.11	193.74	207.87	(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)

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Output from water heater

(64)m=	213.03	187.74	197.09	176.58	172.97	154.46	148.24	162.8	162.56	183.11	193.74	207.87	

Output from water heater (annual)$_{1...12}$ 2160.2 (64)

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

(65)m=	93.99	83.34	88.7	81.13	80.68	73.77	72.45	77.29	76.46	84.05	86.83	92.28	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.52	20.89	16.99	12.86	9.62	8.12	8.77	11.4	15.3	19.43	22.68	24.18	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	263.88	266.62	259.72	245.03	226.48	209.05	197.41	194.67	201.57	216.26	234.81	252.23	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	(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=	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	(71)
Water heating gains (Table 5)													
(72)m=	126.34	124.02	119.21	112.68	108.44	102.46	97.38	103.89	106.2	112.97	120.6	124.03	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	481.44	479.23	463.62	438.27	412.23	387.33	371.26	377.66	390.78	416.36	445.79	468.14	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.09	x	11.28	x	0.76	x	0.7	=	21.17	(75)
Northeast 0.9x	0.77	x	5.09	x	11.28	x	0.76	x	0.7	=	21.17	(75)
Northeast 0.9x	0.77	x	5.09	x	22.97	x	0.76	x	0.7	=	43.1	(75)
Northeast 0.9x	0.77	x	5.09	x	22.97	x	0.76	x	0.7	=	43.1	(75)
Northeast 0.9x	0.77	x	5.09	x	41.38	x	0.76	x	0.7	=	77.65	(75)
Northeast 0.9x	0.77	x	5.09	x	41.38	x	0.76	x	0.7	=	77.65	(75)
Northeast 0.9x	0.77	x	5.09	x	67.96	x	0.76	x	0.7	=	127.52	(75)
Northeast 0.9x	0.77	x	5.09	x	67.96	x	0.76	x	0.7	=	127.52	(75)
Northeast 0.9x	0.77	x	5.09	x	91.35	x	0.76	x	0.7	=	171.42	(75)
Northeast 0.9x	0.77	x	5.09	x	91.35	x	0.76	x	0.7	=	171.42	(75)
Northeast 0.9x	0.77	x	5.09	x	97.38	x	0.76	x	0.7	=	182.75	(75)
Northeast 0.9x	0.77	x	5.09	x	97.38	x	0.76	x	0.7	=	182.75	(75)

DER WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	5.09	x	91.1	x	0.76	x	0.7	=	170.96	(75)
Northeast	0.9x	0.77	x	5.09	x	91.1	x	0.76	x	0.7	=	170.96	(75)
Northeast	0.9x	0.77	x	5.09	x	72.63	x	0.76	x	0.7	=	136.29	(75)
Northeast	0.9x	0.77	x	5.09	x	72.63	x	0.76	x	0.7	=	136.29	(75)
Northeast	0.9x	0.77	x	5.09	x	50.42	x	0.76	x	0.7	=	94.62	(75)
Northeast	0.9x	0.77	x	5.09	x	50.42	x	0.76	x	0.7	=	94.62	(75)
Northeast	0.9x	0.77	x	5.09	x	28.07	x	0.76	x	0.7	=	52.67	(75)
Northeast	0.9x	0.77	x	5.09	x	28.07	x	0.76	x	0.7	=	52.67	(75)
Northeast	0.9x	0.77	x	5.09	x	14.2	x	0.76	x	0.7	=	26.64	(75)
Northeast	0.9x	0.77	x	5.09	x	14.2	x	0.76	x	0.7	=	26.64	(75)
Northeast	0.9x	0.77	x	5.09	x	9.21	x	0.76	x	0.7	=	17.29	(75)
Northeast	0.9x	0.77	x	5.09	x	9.21	x	0.76	x	0.7	=	17.29	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.01	x	36.79		0.76	x	0.7	=	67.96	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.01	x	62.67		0.76	x	0.7	=	115.76	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.01	x	85.75		0.76	x	0.7	=	158.39	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.01	x	106.25		0.76	x	0.7	=	196.25	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.01	x	119.01		0.76	x	0.7	=	219.82	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.01	x	118.15		0.76	x	0.7	=	218.23	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.01	x	113.91		0.76	x	0.7	=	210.4	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)

Southwest	0.9x	0.77	x	5.01	x	104.39		0.76	x	0.7	=	192.82	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.01	x	92.85		0.76	x	0.7	=	171.5	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.01	x	69.27		0.76	x	0.7	=	127.94	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.01	x	44.07		0.76	x	0.7	=	81.4	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.01	x	31.49		0.76	x	0.7	=	58.16	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)
Rooflights	0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights	0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)

Rooflights 0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights 0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights 0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights 0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights 0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights 0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights 0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights 0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights 0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights 0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights 0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights 0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights 0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights 0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights 0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights 0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights 0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights 0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights 0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights 0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights 0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

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

(83)m=	382.13	692.39	1047.88	1451.08	1753.29	1793.85	1707.53	1475.95	1187.61	793.27	465.49	321.85	(83)

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

(84)m=	863.56	1171.62	1511.5	1889.35	2165.52	2181.18	2078.8	1853.61	1578.39	1209.63	911.28	790	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.81	0.63	0.46	0.33	0.39	0.64	0.91	0.98	0.99	(86)

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

(87)m=	19.44	19.76	20.2	20.65	20.9	20.98	21	20.99	20.92	20.52	19.87	19.38	(87)

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

(88)m=	20.22	20.22	20.22	20.23	20.23	20.24	20.24	20.24	20.24	20.23	20.23	20.23	(88)

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

(89)m=	0.99	0.97	0.92	0.79	0.59	0.41	0.28	0.33	0.58	0.89	0.98	0.99	(89)

DER WorkSheet: New dwelling design stage

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

(90)m=	18.76	19.09	19.52	19.95	20.16	20.23	20.24	20.24	20.19	19.83	19.2	18.71		(90)
										fLA = Living area ÷ (4) =			0.32	(91)

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

(92)m=	18.98	19.3	19.74	20.17	20.4	20.47	20.48	20.48	20.42	20.05	19.42	18.93	(92)

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

(93)m=	19.58	19.9	20.34	20.77	21	21.07	21.08	21.08	21.02	20.65	20.02	19.53	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.97	0.92	0.81	0.63	0.46	0.34	0.4	0.64	0.9	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	855.18	1138.11	1393.93	1522.03	1371.53	1004.37	708.2	733.59	1012.41	1085.84	892.37	784.43		(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=	2500.11	2449.52	2254.38	1914.1	1495.5	1031.27	714.47	744.81	1107.57	1617.36	2086.64	2485.84		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	1223.83	881.27	640.17	282.29	92.24	0	0	0	0	395.45	859.87	1265.85		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				5640.96	(98)
Space heating requirement in kWh/m²/year													53.82	(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		85.4	(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)														
	1223.83	881.27	640.17	282.29	92.24	0	0	0	0	395.45	859.87	1265.85		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1433.06	1031.93	749.62	330.55	108.01	0	0	0	0	463.06	1006.88	1482.26		
									Total (kWh/year) =Sum(211)$_{1...5,10....12}$=				6605.35	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10....12}$=				0	(215)

Water heating

Output from water heater (calculated above)														
	213.03	187.74	197.09	176.58	172.97	154.46	148.24	162.8	162.56	183.11	193.74	207.87		
Efficiency of water heater													75.3	(216)

(217)m=	87.79	87.32	86.33	83.92	79.94	75.3	75.3	75.3	75.3	85	87.19	87.91	(217)

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

(219)m=	242.66	214.99	228.32	210.41	216.37	205.12	196.87	216.2	215.88	215.41	222.22	236.45

Total = Sum(219a)$_{1...12}$ = 2620.9 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		6605.35	
Water heating fuel used		2620.9	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	39		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		84	(231)
Electricity for lighting		415.46	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	1426.75	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	566.11	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1992.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	43.6	(267)
Electricity for lighting	(232) x	0.519 =	215.62	(268)
Total CO2, kg/year		sum of (265)…(271) =	2252.09	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	21.49	(273)
EI rating (section 14)			80	(274)

11.4. Be Green

DER WorkSheet: New dwelling design stage

User Details:			
Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 01

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	42.14	(1a)	x	2.7	(2a)	=	113.78	(3a)
Ground floor	36.79	(1b)	x	3.2	(2b)	=	117.73	(3b)
First floor	34.79	(1c)	x	4.65	(2c)	=	161.77	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	113.72	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	393.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(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) =	0.3	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

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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

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

0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.19	x1/[1/(1.4)+ 0.04]		=	6.88			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			7.38	x1/[1/(1.4)+ 0.04]		=	9.78			(27)
Windows Type 6			5.83	x1/[1/(1.4)+ 0.04]		=	7.73			(27)
Windows Type 7			3.36	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 8			6.71	x1/[1/(1.4)+ 0.04]		=	8.9			(27)
Rooflights Type 1			3.35	x1/[1/(1.4) + 0.04]		=	4.69			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			1.37	x1/[1/(1.4) + 0.04]		=	1.918			(27b)
Floor			42.14	x	0.13	=	5.478199			(28)
Walls Type1	12.61	0	12.61	x	0.15	=	1.89			(29)
Walls Type2	5.08	4.86	0.22	x	0.15	=	0.03			(29)
Walls Type3	1.35	1.4	-0.05	x	0.15	=	-0.01			(29)
Walls Type4	5.18	5.19	-0.01	x	0.15	=	0			(29)

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Walls Type5	14.63	0	14.63	x	0.15	=	2.19			(29)
Walls Type6	1.7	0	1.7	x	0.15	=	0.26			(29)
Walls Type7	13.5	0	13.5	x	0.15	=	2.03			(29)
Walls Type8	5.22	0	5.22	x	0.15	=	0.78			(29)
Walls Type9	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type10	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type11	6.18	0	6.18	x	0.15	=	0.93			(29)
Walls Type12	15.33	0	15.33	x	0.15	=	2.3			(29)
Walls Type13	2.02	0	2.02	x	0.15	=	0.3			(29)
Walls Type14	16	0	16	x	0.15	=	2.4			(29)
Walls Type15	11.53	6.71	4.82	x	0.15	=	0.72			(29)
Walls Type16	2	0	2	x	0.15	=	0.3			(29)
Walls Type17	9.63	2.46	7.17	x	0.15	=	1.08			(29)
Walls Type18	9.3	0	9.3	x	0.15	=	1.4			(29)
Walls Type19	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type20	10.04	5.83	4.21	x	0.15	=	0.63			(29)
Walls Type21	5.77	0	5.77	x	0.15	=	0.87			(29)
Walls Type22	1.91	0	1.91	x	0.15	=	0.29			(29)
Walls Type23	17.21	0	17.21	x	0.15	=	2.58			(29)
Walls Type24	2.65	0	2.65	x	0.15	=	0.4			(29)
Walls Type25	16.14	0	16.14	x	0.15	=	2.42			(29)
Walls Type26	3.94	0	3.94	x	0.15	=	0.59			(29)
Walls Type27	9.7	7.38	2.32	x	0.15	=	0.35			(29)
Walls Type28	5.81	3.36	2.45	x	0.15	=	0.37			(29)
Roof Type1	33.58	4.48	29.1	x	0.13	=	3.78			(30)
Roof Type2	4.01	1.37	2.64	x	0.13	=	0.34			(30)
Total area of elements, m²			290.94							(31)
Party wall			27.41	x	0	=	0			(32)
Party wall			27.94	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	98.66	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		18.67	(36)

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

Total fabric heat loss	(33) + (36) =	117.34	(37)

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

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

(38)m=	74.55	74.18	73.81	72.08	71.76	70.25	70.25	69.98	70.83	71.76	72.41	73.09	(38)

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

(39)m=	191.89	191.51	191.14	189.42	189.09	187.59	187.59	187.31	188.17	189.09	189.75	190.43	

Average = Sum(39)$_{1…12}$ /12= 189.41 (39)

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

(40)m=	1.69	1.68	1.68	1.67	1.66	1.65	1.65	1.65	1.65	1.66	1.67	1.67	

Average = Sum(40)$_{1…12}$ /12= 1.67 (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 2.84 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.54 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	111.69	107.63	103.57	99.51	95.45	91.39	91.39	95.45	99.51	103.57	107.63	111.69	

Total = Sum(44)$_{1…12}$ = 1218.49 (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=	165.64	144.87	149.49	130.33	125.06	107.91	100	114.75	116.12	135.33	147.72	160.41	

Total = Sum(45)$_{1…12}$ = 1597.63 (45)

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

(46)m=	24.85	21.73	22.42	19.55	18.76	16.19	15	17.21	17.42	20.3	22.16	24.06	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.57 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.94 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.94 (55)

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

(56)m=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	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=	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=	194.84	171.25	178.7	158.59	154.26	136.17	129.2	143.95	144.38	164.53	175.98	189.62	(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=	194.84	171.25	178.7	158.59	154.26	136.17	129.2	143.95	144.38	164.53	175.98	189.62

Output from water heater (annual)$_{1...12}$ | 1941.46 | (64)

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

(65)m=	78.44	69.27	73.07	65.94	64.94	58.49	56.61	61.52	61.22	68.36	71.72	76.7	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	141.77	(66)

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

(67)m=	24.68	21.92	17.82	13.49	10.09	8.52	9.2	11.96	16.05	20.38	23.79	25.36	(67)

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

(68)m=	276.8	279.67	272.43	257.02	237.57	219.29	207.08	204.2	211.44	226.85	246.3	264.58	(68)

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

(69)m=	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	37.18	(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=	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	-113.42	(71)

Water heating gains (Table 5)

(72)m=	105.43	103.08	98.21	91.59	87.29	81.24	76.09	82.68	85.02	91.88	99.62	103.09	(72)

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

(73)m=	472.43	470.2	454	427.63	400.48	374.57	357.9	364.38	378.05	404.64	435.24	458.57	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	7.38	x	11.28	x	0.76	x	0.7	=	30.7	(75)
Northeast 0.9x	0.77	x	6.71	x	11.28	x	0.76	x	0.7	=	27.91	(75)

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Northeast	0.9x	0.77	x	7.38	x	22.97	x	0.76	x	0.7	=	62.49	(75)
Northeast	0.9x	0.77	x	6.71	x	22.97	x	0.76	x	0.7	=	56.82	(75)
Northeast	0.9x	0.77	x	7.38	x	41.38	x	0.76	x	0.7	=	112.58	(75)
Northeast	0.9x	0.77	x	6.71	x	41.38	x	0.76	x	0.7	=	102.36	(75)
Northeast	0.9x	0.77	x	7.38	x	67.96	x	0.76	x	0.7	=	184.9	(75)
Northeast	0.9x	0.77	x	6.71	x	67.96	x	0.76	x	0.7	=	168.11	(75)
Northeast	0.9x	0.77	x	7.38	x	91.35	x	0.76	x	0.7	=	248.54	(75)
Northeast	0.9x	0.77	x	6.71	x	91.35	x	0.76	x	0.7	=	225.97	(75)
Northeast	0.9x	0.77	x	7.38	x	97.38	x	0.76	x	0.7	=	264.97	(75)
Northeast	0.9x	0.77	x	6.71	x	97.38	x	0.76	x	0.7	=	240.91	(75)
Northeast	0.9x	0.77	x	7.38	x	91.1	x	0.76	x	0.7	=	247.87	(75)
Northeast	0.9x	0.77	x	6.71	x	91.1	x	0.76	x	0.7	=	225.37	(75)
Northeast	0.9x	0.77	x	7.38	x	72.63	x	0.76	x	0.7	=	197.61	(75)
Northeast	0.9x	0.77	x	6.71	x	72.63	x	0.76	x	0.7	=	179.67	(75)
Northeast	0.9x	0.77	x	7.38	x	50.42	x	0.76	x	0.7	=	137.19	(75)
Northeast	0.9x	0.77	x	6.71	x	50.42	x	0.76	x	0.7	=	124.73	(75)
Northeast	0.9x	0.77	x	7.38	x	28.07	x	0.76	x	0.7	=	76.37	(75)
Northeast	0.9x	0.77	x	6.71	x	28.07	x	0.76	x	0.7	=	69.43	(75)
Northeast	0.9x	0.77	x	7.38	x	14.2	x	0.76	x	0.7	=	38.63	(75)
Northeast	0.9x	0.77	x	6.71	x	14.2	x	0.76	x	0.7	=	35.12	(75)
Northeast	0.9x	0.77	x	7.38	x	9.21	x	0.76	x	0.7	=	25.07	(75)
Northeast	0.9x	0.77	x	6.71	x	9.21	x	0.76	x	0.7	=	22.79	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.19	x	36.79		0.76	x	0.7	=	70.4	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.83	x	36.79		0.76	x	0.7	=	79.08	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.19	x	62.67		0.76	x	0.7	=	119.92	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.83	x	62.67		0.76	x	0.7	=	134.71	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.19	x	85.75		0.76	x	0.7	=	164.08	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.83	x	85.75		0.76	x	0.7	=	184.32	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.19	x	106.25		0.76	x	0.7	=	203.3	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.83	x	106.25		0.76	x	0.7	=	228.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.19	x	119.01		0.76	x	0.7	=	227.72	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)

Southwest	0.9x	0.77	x	5.83	x	119.01		0.76	x	0.7	=	255.8	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.19	x	118.15		0.76	x	0.7	=	226.07	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.83	x	118.15		0.76	x	0.7	=	253.95	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.19	x	113.91		0.76	x	0.7	=	217.96	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.83	x	113.91		0.76	x	0.7	=	244.83	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.19	x	104.39		0.76	x	0.7	=	199.74	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.83	x	104.39		0.76	x	0.7	=	224.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.19	x	92.85		0.76	x	0.7	=	177.67	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.83	x	92.85		0.76	x	0.7	=	199.57	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.19	x	69.27		0.76	x	0.7	=	132.54	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.83	x	69.27		0.76	x	0.7	=	148.88	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.19	x	44.07		0.76	x	0.7	=	84.33	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.83	x	44.07		0.76	x	0.7	=	94.72	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.19	x	31.49		0.76	x	0.7	=	60.25	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.83	x	31.49		0.76	x	0.7	=	67.68	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	3.36	x	11.28	x	0.76	x	0.7	=	13.98	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	3.36	x	22.97	x	0.76	x	0.7	=	28.45	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	3.36	x	41.38	x	0.76	x	0.7	=	51.26	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	3.36	x	67.96	x	0.76	x	0.7	=	84.18	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	3.36	x	91.35	x	0.76	x	0.7	=	113.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	3.36	x	97.38	x	0.76	x	0.7	=	120.64	(81)

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Northwest 0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest 0.9x	0.77	x	3.36	x	91.1	x	0.76	x	0.7	=	112.85	(81)
Northwest 0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest 0.9x	0.77	x	3.36	x	72.63	x	0.76	x	0.7	=	89.97	(81)
Northwest 0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest 0.9x	0.77	x	3.36	x	50.42	x	0.76	x	0.7	=	62.46	(81)
Northwest 0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest 0.9x	0.77	x	3.36	x	28.07	x	0.76	x	0.7	=	34.77	(81)
Northwest 0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest 0.9x	0.77	x	3.36	x	14.2	x	0.76	x	0.7	=	17.59	(81)
Northwest 0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Northwest 0.9x	0.77	x	3.36	x	9.21	x	0.76	x	0.7	=	11.41	(81)
Rooflights 0.9x	1	x	3.35	x	26	x	0.76	x	0.7	=	41.7	(82)
Rooflights 0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights 0.9x	1	x	1.37	x	26	x	0.76	x	0.7	=	17.05	(82)
Rooflights 0.9x	1	x	3.35	x	54	x	0.76	x	0.7	=	86.61	(82)
Rooflights 0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights 0.9x	1	x	1.37	x	54	x	0.76	x	0.7	=	35.42	(82)
Rooflights 0.9x	1	x	3.35	x	96	x	0.76	x	0.7	=	153.98	(82)
Rooflights 0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)
Rooflights 0.9x	1	x	1.37	x	96	x	0.76	x	0.7	=	62.97	(82)
Rooflights 0.9x	1	x	3.35	x	150	x	0.76	x	0.7	=	240.6	(82)
Rooflights 0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights 0.9x	1	x	1.37	x	150	x	0.76	x	0.7	=	98.39	(82)
Rooflights 0.9x	1	x	3.35	x	192	x	0.76	x	0.7	=	307.96	(82)
Rooflights 0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights 0.9x	1	x	1.37	x	192	x	0.76	x	0.7	=	125.94	(82)
Rooflights 0.9x	1	x	3.35	x	200	x	0.76	x	0.7	=	320.8	(82)
Rooflights 0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights 0.9x	1	x	1.37	x	200	x	0.76	x	0.7	=	131.19	(82)
Rooflights 0.9x	1	x	3.35	x	189	x	0.76	x	0.7	=	303.15	(82)
Rooflights 0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights 0.9x	1	x	1.37	x	189	x	0.76	x	0.7	=	123.98	(82)
Rooflights 0.9x	1	x	3.35	x	157	x	0.76	x	0.7	=	251.82	(82)
Rooflights 0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights 0.9x	1	x	1.37	x	157	x	0.76	x	0.7	=	102.99	(82)
Rooflights 0.9x	1	x	3.35	x	115	x	0.76	x	0.7	=	184.46	(82)
Rooflights 0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights 0.9x	1	x	1.37	x	115	x	0.76	x	0.7	=	75.43	(82)
Rooflights 0.9x	1	x	3.35	x	66	x	0.76	x	0.7	=	105.86	(82)
Rooflights 0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)

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Rooflights 0.9x	1	x	1.37	x	66	x	0.76	x	0.7	=	43.29	(82)
Rooflights 0.9x	1	x	3.35	x	33	x	0.76	x	0.7	=	52.93	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	1.37	x	33	x	0.76	x	0.7	=	21.65	(82)
Rooflights 0.9x	1	x	3.35	x	21	x	0.76	x	0.7	=	33.68	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	1.37	x	21	x	0.76	x	0.7	=	13.78	(82)

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

(83)m=	432.57	790.08	1212.15	1704.84	2082.6	2140.39	2033.49	1742.68	1382.49	909.56	528.07	363.62	(83)

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

(84)m=	905	1260.28	1666.15	2132.48	2483.07	2514.96	2391.38	2107.06	1760.54	1314.21	963.31	822.19	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.82	0.64	0.46	0.34	0.4	0.66	0.92	0.99	1	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.55	19.55	19.55	19.57	19.57	19.58	19.58	19.58	19.57	19.57	19.56	19.56	(88)

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

(89)m=	0.99	0.97	0.91	0.77	0.56	0.37	0.23	0.28	0.55	0.88	0.98	0.99	(89)

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

(90)m=	19.55	19.55	19.55	19.57	19.57	19.58	19.58	19.58	19.57	19.57	19.56	19.56	(90)

fLA = Living area ÷ (4) = | 0.33 | (91)

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

(92)m=	20.03	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.04	20.04	20.04	20.03	(92)

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

(93)m=	20.03	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.04	20.04	20.04	20.03	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.27	0.32	0.59	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	898.01	1228.26	1536.38	1677.3	1460.55	1001.84	643.34	676.97	1036.38	1172.72	945.98	817.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	3018.09	2897.59	2586.5	2109.92	1577.12	1021.77	646.59	683.32	1118.55	1785.12	2454.88	3015.41	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1577.34	1121.79	781.28	311.49	86.73	0	0	0	0	455.63	1086.41	1635.1	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	7055.77	(98)
Space heating requirement in kWh/m²/year	62.05	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		229.4	(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)	1577.34	1121.79	781.28	311.49	86.73	0	0	0	0	455.63	1086.41	1635.1		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	687.6	489.01	340.58	135.78	37.81	0	0	0	0	198.62	473.59	712.78		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3075.76	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	194.84	171.25	178.7	158.59	154.26	136.17	129.2	143.95	144.38	164.53	175.98	189.62		
Efficiency of water heater													100	(216)
(217)m=	100	100	100	100	100	100	100	100	100	100	100	100		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	194.84	171.25	178.7	158.59	154.26	136.17	129.2	143.95	144.38	164.53	175.98	189.62		
Total = Sum(219a)$_{1...12}$ =													1941.46	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3075.76	
Water heating fuel used			1941.46	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			435.8	(232)
Electricity generated by PVs			-778.07	(233)

12a. CO_2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO_2/kWh		**Emissions** kg CO_2/year	
Space heating (main system 1)	(211)	x	0.519	=	1596.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)

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Water heating	(219) x	0.519	=	1007.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2603.94	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	226.18	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-403.82	(269)
Total CO2, kg/year	sum of (265)…(271) =			2426.3	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			21.34	(273)
EI rating (section 14)				80	(274)

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User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 02

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	39.95	(1a)	x	2.7	(2a)	=	107.87	(3a)
Ground floor	35.19	(1b)	x	3.2	(2b)	=	112.61	(3b)
First floor	32.26	(1c)	x	4.65	(2c)	=	150.01	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	107.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	370.48	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(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

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

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.21	x1/[1/(1.4)+ 0.04]		=	6.91			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 7			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]		=	4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]		=	1.372			(27b)
Floor			39.95	x	0.13	=	5.1935			(28)
Walls Type1	10.29	0	10.29	x	0.15	=	1.54			(29)
Walls Type2	5.1	4.86	0.24	x	0.15	=	0.04			(29)
Walls Type3	1.35	1.4	-0.05	x	0.15	=	-0.01			(29)
Walls Type4	5.21	5.21	0	x	0.15	=	0			(29)
Walls Type5	6.27	5.29	0.98	x	0.15	=	0.15			(29)

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Walls Type6	0.8	0	0.8	x	0.15	=	0.12			(29)
Walls Type7	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type8	5.63	0	5.63	x	0.15	=	0.84			(29)
Walls Type9	4.96	0	4.96	x	0.15	=	0.74			(29)
Walls Type10	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type11	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type12	6.4	0	6.4	x	0.15	=	0.96			(29)
Walls Type13	9.11	5.29	3.82	x	0.15	=	0.57			(29)
Walls Type14	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type15	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type16	9.3	0	9.3	x	0.15	=	1.4			(29)
Walls Type17	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type18	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.76	4.5	27.26	x	0.13	=	3.54			(30)
Roof Type2	3.02	0.98	2.04	x	0.13	=	0.27			(30)
Total area of elements, m²			165.72							(31)
Party wall			28.78	x	0	=	0			(32)
Party wall			27.84	x	0	=	0			(32)
Party wall			32.1	x	0	=	0			(32)
Party wall			32.96	x	0	=	0			(32)
Party wall			38.6	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	70.34	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		15.84	(36)

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

Total fabric heat loss	(33) + (36) =	86.18	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	69.19	68.87	68.57	67.13	66.86	65.6	65.6	65.37	66.08	66.86	67.4	67.97		(38)

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

(39)m=	155.37	155.06	154.75	153.31	153.04	151.79	151.79	151.55	152.27	153.04	153.58	154.15		
										Average = Sum(39)$_{1…12}$ /12=			153.31	(39)

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

(40)m=	1.45	1.44	1.44	1.43	1.42	1.41	1.41	1.41	1.42	1.42	1.43	1.44		
										Average = Sum(40)$_{1…12}$ /12=			1.43	(40)

Number of days in month (Table 1a)

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

DER WorkSheet: New dwelling design stage

(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 — 2.8 (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 — 100.66 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	110.73	106.7	102.67	98.65	94.62	90.59	90.59	94.62	98.65	102.67	106.7	110.73		
										Total = Sum(44)$_{1...12}$ =			1207.91	(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=	164.2	143.61	148.2	129.2	123.97	106.98	99.13	113.75	115.11	134.15	146.44	159.02		
										Total = Sum(45)$_{1...12}$ =			1583.76	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	24.63	21.54	22.23	19.38	18.6	16.05	14.87	17.06	17.27	20.12	21.97	23.85		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 210 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.57 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.94 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.94 (55)

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

(56)m=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	193.4	169.99	177.4	157.46	153.17	135.24	128.33	142.96	143.37	163.35	174.7	188.22	(62)

DER WorkSheet: New dwelling design stage

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

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

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

Output from water heater

(64)m=	193.4	169.99	177.4	157.46	153.17	135.24	128.33	142.96	143.37	163.35	174.7	188.22	

Output from water heater (annual)$_{1...12}$ 1927.59 (64)

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

(65)m=	77.96	68.85	72.64	65.57	64.58	58.18	56.32	61.18	60.88	67.97	71.3	76.24	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	139.91	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.87	21.2	17.24	13.05	9.76	8.24	8.9	11.57	15.53	19.72	23.02	24.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	267.77	270.54	263.54	248.64	229.82	212.14	200.32	197.54	204.54	219.45	238.27	255.95	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	36.99	(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=	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	-111.93	(71)
Water heating gains (Table 5)													
(72)m=	104.78	102.46	97.63	91.07	86.8	80.8	75.7	82.24	84.56	91.35	99.03	102.47	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	461.4	459.18	443.39	417.73	391.36	366.15	349.9	356.32	369.61	395.5	425.28	447.93	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)

Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.21	x	36.79		0.76	x	0.7	=	70.67	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.21	x	62.67		0.76	x	0.7	=	120.38	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.21	x	85.75		0.76	x	0.7	=	164.71	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.21	x	106.25		0.76	x	0.7	=	204.09	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.21	x	119.01		0.76	x	0.7	=	228.6	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.21	x	118.15		0.76	x	0.7	=	226.94	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.21	x	113.91		0.76	x	0.7	=	218.8	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)

Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.21	x	104.39		0.76	x	0.7	=	200.51	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.21	x	92.85		0.76	x	0.7	=	178.35	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.21	x	69.27		0.76	x	0.7	=	133.05	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.21	x	44.07		0.76	x	0.7	=	84.65	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.21	x	31.49		0.76	x	0.7	=	60.48	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)

Rooflights 0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights 0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)
Rooflights 0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights 0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights 0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights 0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights 0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights 0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights 0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights 0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights 0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights 0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights 0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights 0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights 0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights 0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights 0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights 0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights 0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights 0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights 0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights 0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights 0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

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

(83)m=	386.5	700.4	1060.31	1468.94	1775.54	1816.92	1729.37	1494.36	1201.89	802.52	470.83	325.54	(83)

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

(84)m=	847.9	1159.58	1503.7	1886.67	2166.89	2183.07	2079.26	1850.68	1571.5	1198.02	896.11	773.46	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.8	0.61	0.44	0.32	0.37	0.62	0.9	0.99	1	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.73	19.73	19.73	19.74	19.74	19.75	19.75	19.75	19.75	19.74	19.74	19.74	(88)

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

(89)m=	0.99	0.97	0.91	0.75	0.54	0.36	0.23	0.27	0.53	0.87	0.98	0.99	(89)

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

(90)m=	19.73	19.73	19.73	19.74	19.74	19.75	19.75	19.75	19.75	19.74	19.74	19.74	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	20.14	20.15	20.15	20.15	20.16	20.16	20.16	20.16	20.16	20.16	20.15	20.15	(92)

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

(93)m=	20.14	20.15	20.15	20.15	20.16	20.16	20.16	20.16	20.16	20.16	20.15	20.15	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.77	0.57	0.38	0.26	0.31	0.56	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	841.56	1129.32	1378.95	1455.57	1231.61	835.27	539.4	567.76	880.87	1054.99	879.53	769.46	(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=	2461.81	2364.05	2112.01	1725.46	1294.11	844.24	540.67	570.32	922.71	1462.46	2004.81	2458.88	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1205.47	829.74	545.39	194.32	46.5	0	0	0	0	303.16	810.2	1256.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5191.72 (98)

Space heating requirement in kWh/m²/year 48.34 (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		205.31	(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)													
	1205.47	829.74	545.39	194.32	46.5	0	0	0	0	303.16	810.2	1256.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	587.15	404.15	265.65	94.65	22.65	0	0	0	0	147.66	394.63	612.22	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2528.75 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

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Water heating

Output from water heater (calculated above)

	193.4	169.99	177.4	157.46	153.17	135.24	128.33	142.96	143.37	163.35	174.7	188.22	
Efficiency of water heater													100 (216)
(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

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

(219)m=	193.4	169.99	177.4	157.46	153.17	135.24	128.33	142.96	143.37	163.35	174.7	188.22	

Total = Sum(219a)$_{1...12}$ = 1927.59 (219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			2528.75	
Water heating fuel used			1927.59	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			421.58	(232)
Electricity generated by PVs			-778.07	(233)

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	0.519	=	1312.42	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	1000.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2312.84	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	218.8	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-403.82	(269)
Total CO2, kg/year		sum of (265)…(271) =		2127.83	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.81	(273)
EI rating (section 14)				81	(274)

DER WorkSheet: New dwelling design stage

User Details:			
Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 03

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	40.51	(1a)	x	2.7	(2a)	=	109.38	(3a)
Ground floor	35.41	(1b)	x	3.2	(2b)	=	113.31	(3b)
First floor	32.25	(1c)	x	4.65	(2c)	=	149.96	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	108.17	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	372.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(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

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

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.28	0.31	0.32	0.33

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x 1.4	= 3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]	= 6.44			(27)
Windows Type 2			5.21	x1/[1/(1.4)+ 0.04]	= 6.91			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]	= 1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]	= 6.44			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]	= 7.01			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]	= 6.44			(27)
Windows Type 7			5.29	x1/[1/(1.4)+ 0.04]	= 7.01			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]	= 4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]	= 1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]	= 1.372			(27b)
Floor			40.51	x 0.13	= 5.2663			(28)
Walls Type1	10.29	0	10.29	x 0.15	= 1.54			(29)
Walls Type2	5.08	4.86	0.22	x 0.15	= 0.03			(29)
Walls Type3	1.35	1.4	-0.05	x 0.15	= -0.01			(29)
Walls Type4	5.21	5.21	0	x 0.15	= 0			(29)
Walls Type5	6.27	5.29	0.98	x 0.15	= 0.15			(29)

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Walls Type6	0.8	0	0.8	x	0.15	=	0.12			(29)
Walls Type7	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type8	6.02	0	6.02	x	0.15	=	0.9			(29)
Walls Type9	4.96	0	4.96	x	0.15	=	0.74			(29)
Walls Type10	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type11	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type12	6.4	0	6.4	x	0.15	=	0.96			(29)
Walls Type13	9.11	5.29	3.82	x	0.15	=	0.57			(29)
Walls Type14	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type15	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type16	9.3	0	9.3	x	0.15	=	1.4			(29)
Walls Type17	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type18	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.76	4.5	27.26	x	0.13	=	3.54			(30)
Roof Type2	3.31	0.98	2.33	x	0.13	=	0.3			(30)
Total area of elements, m²			166.94							(31)
Party wall			29.24	x	0	=	0			(32)
Party wall			28.24	x	0	=	0			(32)
Party wall			32.58	x	0	=	0			(32)
Party wall			33.47	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 70.51 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 15.9 (36)

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

Total fabric heat loss (33) + (36) = 86.41 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	69.55	69.24	68.93	67.49	67.22	65.96	65.96	65.73	66.45	67.22	67.77	68.34	(38)

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

(39)m=	155.96	155.65	155.34	153.9	153.63	152.37	152.37	152.14	152.86	153.63	154.17	154.74

Average = Sum(39)$_{1…12}$ /12= 153.9 (39)

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

(40)m=	1.44	1.44	1.44	1.42	1.42	1.41	1.41	1.41	1.41	1.42	1.43	1.43

Average = Sum(40)$_{1…12}$ /12= 1.42 (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 — 2.8 (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 — 100.78 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	110.86	106.83	102.8	98.76	94.73	90.7	90.7	94.73	98.76	102.8	106.83	110.86		
										Total = Sum(44)$_{1...12}$ =			1209.36	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	164.4	143.79	148.37	129.36	124.12	107.11	99.25	113.89	115.25	134.31	146.61	159.21		
										Total = Sum(45)$_{1...12}$ =			1585.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	24.66	21.57	22.26	19.4	18.62	16.07	14.89	17.08	17.29	20.15	21.99	23.88		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 210 (47)

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): — 1.57 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.94 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0.94 (55)

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

(56)m=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

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

(62)m=	193.6	170.16	177.58	157.62	153.32	135.37	128.45	143.09	143.51	163.52	174.87	188.41	(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=	193.6	170.16	177.58	157.62	153.32	135.37	128.45	143.09	143.51	163.52	174.87	188.41	

Output from water heater (annual)$_{1...12}$ 1929.5 (64)

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

(65)m=	78.02	68.91	72.7	65.62	64.63	58.22	56.36	61.23	60.93	68.02	71.36	76.3	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	140.17	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.97	21.29	17.32	13.11	9.8	8.27	8.94	11.62	15.6	19.8	23.11	24.64	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	268.9	271.69	264.66	249.69	230.79	213.03	201.17	198.38	205.41	220.38	239.28	257.04	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	37.02	(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=	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	-112.14	(71)
Water heating gains (Table 5)													
(72)m=	104.87	102.54	97.71	91.14	86.87	80.86	75.76	82.3	84.62	91.43	99.11	102.55	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	462.8	460.58	444.74	418.99	392.51	367.22	350.91	357.35	370.68	396.66	426.55	449.28	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)

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Northeast 0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast 0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast 0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast 0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast 0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast 0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast 0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast 0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast 0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast 0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast 0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast 0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast 0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Northeast 0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Southwest 0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest 0.9x	0.77	x	5.21	x	36.79		0.76	x	0.7	=	70.67	(79)
Southwest 0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest 0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest 0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest 0.9x	0.77	x	5.21	x	62.67		0.76	x	0.7	=	120.38	(79)
Southwest 0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest 0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest 0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest 0.9x	0.77	x	5.21	x	85.75		0.76	x	0.7	=	164.71	(79)
Southwest 0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest 0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest 0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest 0.9x	0.77	x	5.21	x	106.25		0.76	x	0.7	=	204.09	(79)
Southwest 0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest 0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest 0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest 0.9x	0.77	x	5.21	x	119.01		0.76	x	0.7	=	228.6	(79)
Southwest 0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest 0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest 0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest 0.9x	0.77	x	5.21	x	118.15		0.76	x	0.7	=	226.94	(79)
Southwest 0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest 0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest 0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest 0.9x	0.77	x	5.21	x	113.91		0.76	x	0.7	=	218.8	(79)
Southwest 0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)

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Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.21	x	104.39		0.76	x	0.7	=	200.51	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.21	x	92.85		0.76	x	0.7	=	178.35	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.21	x	69.27		0.76	x	0.7	=	133.05	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.21	x	44.07		0.76	x	0.7	=	84.65	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.21	x	31.49		0.76	x	0.7	=	60.48	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)

Rooflights 0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights 0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)
Rooflights 0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights 0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights 0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights 0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights 0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights 0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights 0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights 0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights 0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights 0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights 0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights 0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights 0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights 0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights 0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights 0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights 0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights 0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights 0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights 0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights 0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

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

(83)m=	386.5	700.4	1060.31	1468.94	1775.54	1816.92	1729.37	1494.36	1201.89	802.52	470.83	325.54	(83)

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

(84)m=	849.3	1160.97	1505.04	1887.93	2168.05	2184.14	2080.28	1851.7	1572.57	1199.18	897.38	774.81	(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=	0.99	0.98	0.93	0.8	0.62	0.44	0.32	0.37	0.63	0.91	0.99	1	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	19.73	19.73	19.74	19.75	19.75	19.76	19.76	19.76	19.75	19.75	19.74	19.74	(88)

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

(89)m=	0.99	0.97	0.91	0.76	0.55	0.36	0.23	0.28	0.53	0.87	0.98	0.99	(89)

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

(90)m=	19.73	19.73	19.74	19.75	19.75	19.76	19.76	19.76	19.75	19.75	19.74	19.74	(90)

fLA = Living area ÷ (4) = 0.33 (91)

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

(92)m=	20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.16	20.16	20.16	20.15	(92)

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

(93)m=	20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.16	20.16	20.16	20.15	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.77	0.57	0.38	0.26	0.31	0.56	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	843.07	1131.2	1381.83	1460.1	1236.47	838.95	541.98	570.44	884.5	1057.65	881.07	770.88	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2471.69	2373.57	2120.57	1732.59	1299.59	848	543.25	573.02	926.77	1468.58	2013.01	2468.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1211.69	834.87	549.62	196.19	46.96	0	0	0	0	305.73	814.99	1263.25	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5223.31 (98)

Space heating requirement in kWh/m²/year 48.29 (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		205.74	(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)													
	1211.69	834.87	549.62	196.19	46.96	0	0	0	0	305.73	814.99	1263.25	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	588.94	405.79	267.14	95.36	22.83	0	0	0	0	148.6	396.13	614	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2538.78 (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	0

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

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Water heating

Output from water heater (calculated above)

193.6	170.16	177.58	157.62	153.32	135.37	128.45	143.09	143.51	163.52	174.87	188.41

Efficiency of water heater — 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	193.6	170.16	177.58	157.62	153.32	135.37	128.45	143.09	143.51	163.52	174.87	188.41

Total = $Sum(219a)_{1...12}$ = 1929.5 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2538.78	
Water heating fuel used			1929.5	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			423.36	(232)
Electricity generated by PVs			-778.07	(233)

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	0.519	=	1317.63	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	1001.41	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2319.04	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	219.73	(268)
Energy saving/generation technologies Item 1		0.519	=	-403.82	(269)
Total CO2, kg/year		sum of (265)…(271) =		2134.95	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.74	(273)
EI rating (section 14)				81	(274)

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User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 04

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	41.19	(1a)	x	2.7	(2a)	=	111.21	(3a)
Ground floor	35.68	(1b)	x	3.2	(2b)	=	114.18	(3b)
First floor	32.25	(1c)	x	4.65	(2c)	=	149.96	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	109.12	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	375.35	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13	(8)

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

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

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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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

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.36	0.35	0.35	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.21	x1/[1/(1.4)+ 0.04]		=	6.91			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 7			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]		=	4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]		=	1.372			(27b)
Floor			41.19	x	0.13	=	5.3547			(28)
Walls Type1	10.29	0	10.29	x	0.15	=	1.54			(29)
Walls Type2	5.08	4.86	0.22	x	0.15	=	0.03			(29)
Walls Type3	1.35	1.4	-0.05	x	0.15	=	-0.01			(29)
Walls Type4	5.21	5.21	0	x	0.15	=	0			(29)
Walls Type5	6.27	5.29	0.98	x	0.15	=	0.15			(29)

Walls Type6	0.8	0	0.8	x	0.15	=	0.12			(29)
Walls Type7	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type8	6.62	0	6.62	x	0.15	=	0.99			(29)
Walls Type9	4.96	0	4.96	x	0.15	=	0.74			(29)
Walls Type10	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type11	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type12	6.4	0	6.4	x	0.15	=	0.96			(29)
Walls Type13	9.11	5.29	3.82	x	0.15	=	0.57			(29)
Walls Type14	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type15	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type16	9.3	0	9.3	x	0.15	=	1.4			(29)
Walls Type17	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type18	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.76	4.5	27.26	x	0.13	=	3.54			(30)
Roof Type2	3.67	0.98	2.69	x	0.13	=	0.35			(30)
Total area of elements, m²			168.58							(31)
Party wall			29.65	x	0	=	0			(32)
Party wall			28.67	x	0	=	0			(32)
Party wall			33.12	x	0	=	0			(32)
Party wall			34.08	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	70.74	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		15.97	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	86.7	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	70.01	69.7	69.39	67.94	67.67	66.42	66.42	66.18	66.9	67.67	68.22	68.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	156.71	156.4	156.09	154.65	154.38	153.12	153.12	152.89	153.6	154.38	154.92	155.5

Average = $Sum(39)_{1…12}$ /12= 154.65 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.44	1.43	1.43	1.42	1.41	1.4	1.4	1.4	1.41	1.41	1.42	1.42

Average = $Sum(40)_{1…12}$ /12= 1.42 (40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(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 — 2.81 (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 — 100.92 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	111.02	106.98	102.94	98.91	94.87	90.83	90.83	94.87	98.91	102.94	106.98	111.02		
Total = Sum(44)1…12 =													1211.09	(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=	164.63	143.99	148.59	129.54	124.3	107.26	99.39	114.05	115.41	134.5	146.82	159.44		
Total = Sum(45)1…12 =													1587.93	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	24.7	21.6	22.29	19.43	18.64	16.09	14.91	17.11	17.31	20.18	22.02	23.92		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		210	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)			
Water storage loss:			
a) If manufacturer's declared loss factor is known (kWh/day):		1.57	(48)
Temperature factor from Table 2b		0.6	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.94	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.94	(55)
Water storage loss calculated for each month	((56)m = (55) × (41)m		

(56)m=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m													
(62)m=	193.84	170.37	177.79	157.8	153.5	135.52	128.59	143.25	143.67	163.71	175.08	188.64	(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=	193.84	170.37	177.79	157.8	153.5	135.52	128.59	143.25	143.67	163.71	175.08	188.64	

Output from water heater (annual)1…12 | 1931.76 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.1	68.98	72.77	65.68	64.69	58.27	56.41	61.28	60.98	68.08	71.43	76.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	140.47	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	24.1	21.4	17.41	13.18	9.85	8.32	8.99	11.68	15.68	19.9	23.23	24.77	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	270.29	273.09	266.02	250.98	231.98	214.13	202.21	199.4	206.47	221.52	240.51	258.36	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	(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=	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	-112.38	(71)
Water heating gains (Table 5)													
(72)m=	104.98	102.65	97.8	91.22	86.95	80.93	75.82	82.37	84.7	91.51	99.2	102.65	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	464.5	462.28	446.37	420.52	393.92	368.52	352.15	358.59	371.99	398.07	428.09	450.92	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)

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Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.21	x	36.79		0.76	x	0.7	=	70.67	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.21	x	62.67		0.76	x	0.7	=	120.38	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.21	x	85.75		0.76	x	0.7	=	164.71	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.21	x	106.25		0.76	x	0.7	=	204.09	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.21	x	119.01		0.76	x	0.7	=	228.6	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.21	x	118.15		0.76	x	0.7	=	226.94	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.21	x	113.91		0.76	x	0.7	=	218.8	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)

Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.21	x	104.39		0.76	x	0.7	=	200.51	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.21	x	92.85		0.76	x	0.7	=	178.35	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.21	x	69.27		0.76	x	0.7	=	133.05	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.21	x	44.07		0.76	x	0.7	=	84.65	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.21	x	31.49		0.76	x	0.7	=	60.48	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)

Rooflights	0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights	0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)
Rooflights	0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights	0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights	0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights	0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights	0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights	0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights	0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights	0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights	0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights	0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights	0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights	0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights	0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights	0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights	0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights	0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights	0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights	0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights	0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights	0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights	0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights	0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights	0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights	0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights	0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights	0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	386.5	700.4	1060.31	1468.94	1775.54	1816.92	1729.37	1494.36	1201.89	802.52	470.83	325.54	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	851	1162.68	1506.68	1889.46	2169.46	2185.44	2081.52	1852.95	1573.88	1200.59	898.92	776.46	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.81	0.62	0.44	0.32	0.38	0.63	0.91	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.74	19.74	19.74	19.75	19.75	19.76	19.76	19.76	19.76	19.75	19.75	19.74	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.76	0.55	0.36	0.23	0.28	0.53	0.87	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.74	19.74	19.74	19.75	19.75	19.76	19.76	19.76	19.76	19.75	19.75	19.74	(90)

fLA = Living area ÷ (4) = 0.33 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.15	20.15	20.16	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.16	20.16	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.15	20.15	20.16	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.16	20.16	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.78	0.57	0.39	0.26	0.31	0.56	0.88	0.98	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	844.92	1133.5	1385.37	1465.73	1242.56	843.57	545.2	573.78	889.04	1060.93	882.95	772.62	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2484.22	2385.64	2131.43	1741.61	1306.51	852.72	546.48	576.4	931.87	1476.32	2023.38	2481.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1219.64	841.44	555.07	198.63	47.58	0	0	0	0	309.05	821.11	1271.31	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5263.83 (98)

Space heating requirement in kWh/m²/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) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		206.29	(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)													
	1219.64	841.44	555.07	198.63	47.58	0	0	0	0	309.05	821.11	1271.31	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	591.22	407.89	269.07	96.29	23.06	0	0	0	0	149.81	398.04	616.27	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2551.66 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

	193.84	170.37	177.79	157.8	153.5	135.52	128.59	143.25	143.67	163.71	175.08	188.64	
Efficiency of water heater												100	(216)
(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	193.84	170.37	177.79	157.8	153.5	135.52	128.59	143.25	143.67	163.71	175.08	188.64

Total = $Sum(219a)_{1...12}$ = 1931.76 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2551.66	
Water heating fuel used			1931.76	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			425.55	(232)
Electricity generated by PVs			-778.07	(233)

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	0.519	=	1324.31	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	1002.58	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2326.89	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	220.86	(268)
Energy saving/generation technologies Item 1		0.519	=	-403.82	(269)
Total CO2, kg/year		sum of (265)…(271) =		2143.94	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.65	(273)
EI rating (section 14)				81	(274)

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User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 05

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	41.06	(1a)	x	2.7	(2a)	=	110.86	(3a)
Ground floor	35.9	(1b)	x	3.2	(2b)	=	114.88	(3b)
First floor	32.25	(1c)	x	4.65	(2c)	=	149.96	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	109.21	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	375.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.33	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(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

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.36	0.35	0.35	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.21	x1/[1/(1.4)+ 0.04]		=	6.91			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 7			5.29	x1/[1/(1.4)+ 0.04]		=	7.01			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]		=	4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]		=	1.372			(27b)
Floor			41.06	x	0.13	=	5.3378			(28)
Walls Type1	10.31	0	10.31	x	0.15	=	1.55			(29)
Walls Type2	5.08	4.86	0.22	x	0.15	=	0.03			(29)
Walls Type3	1.35	1.4	-0.05	x	0.15	=	-0.01			(29)
Walls Type4	5.21	5.21	0	x	0.15	=	0			(29)
Walls Type5	6.27	5.29	0.98	x	0.15	=	0.15			(29)

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Walls Type6	0.8	0	0.8	x	0.15	=	0.12			(29)
Walls Type7	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type8	6.75	0	6.75	x	0.15	=	1.01			(29)
Walls Type9	5	0	5	x	0.15	=	0.75			(29)
Walls Type10	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type11	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type12	6.4	0	6.4	x	0.15	=	0.96			(29)
Walls Type13	9.11	5.29	3.82	x	0.15	=	0.57			(29)
Walls Type14	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type15	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type16	9.3	0	9.3	x	0.15	=	1.4			(29)
Walls Type17	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type18	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.76	4.5	27.26	x	0.13	=	3.54			(30)
Roof Type2	3.34	0.98	2.36	x	0.13	=	0.31			(30)
Total area of elements, m²			168.31							(31)
Party wall			30.19	x	0	=	0			(32)
Party wall			27.95	x	0	=	0			(32)
Party wall			33.7	x	0	=	0			(32)
Party wall			33.09	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)
Party wall			40	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 70.7 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 15.95 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 86.65 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	70.07	69.76	69.45	68	67.73	66.48	66.48	66.24	66.96	67.73	68.28	68.85	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	156.72	156.41	156.1	154.66	154.39	153.13	153.13	152.9	153.61	154.39	154.93	155.5

Average = $Sum(39)_{1…12}$ /12= 154.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.44	1.43	1.43	1.42	1.41	1.4	1.4	1.4	1.41	1.41	1.42	1.42

Average = $Sum(40)_{1…12}$ /12= 1.42 (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 — 2.81 (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 — 100.94 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	111.03	106.99	102.96	98.92	94.88	90.84	90.84	94.88	98.92	102.96	106.99	111.03	
										Total = Sum(44)1…12 =		1211.25	(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=	164.66	144.01	148.6	129.56	124.31	107.27	99.4	114.07	115.43	134.52	146.84	159.46	
										Total = Sum(45)1…12 =		1588.14	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	24.7	21.6	22.29	19.43	18.65	16.09	14.91	17.11	17.31	20.18	22.03	23.92	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 210 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.57 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0.94 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 0 (54)

Enter (50) or (54) in (55) — 0.94 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(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=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	193.86	170.39	177.81	157.82	153.52	135.53	128.61	143.27	143.69	163.72	175.1	188.66	(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=	193.86	170.39	177.81	157.82	153.52	135.53	128.61	143.27	143.69	163.72	175.1	188.66	

Output from water heater (annual)$_{1...12}$ 1931.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.11	68.98	72.77	65.69	64.7	58.28	56.41	61.29	60.99	68.09	71.43	76.38	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	140.5	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	24.11	21.41	17.41	13.18	9.85	8.32	8.99	11.69	15.68	19.91	23.24	24.78	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	270.42	273.22	266.15	251.1	232.09	214.23	202.3	199.5	206.57	221.62	240.62	258.48	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	37.05	(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=	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	-112.4	(71)
Water heating gains (Table 5)													
(72)m=	104.99	102.65	97.81	91.23	86.96	80.94	75.82	82.38	84.71	91.52	99.21	102.66	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	464.66	462.44	446.53	420.66	394.06	368.64	352.27	358.71	372.11	398.21	428.23	451.08	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	11.28	x	0.76	x	0.7	=	22.01	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	22.97	x	0.76	x	0.7	=	44.79	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	41.38	x	0.76	x	0.7	=	80.7	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	67.96	x	0.76	x	0.7	=	132.53	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)
Northeast 0.9x	0.77	x	5.29	x	91.35	x	0.76	x	0.7	=	178.15	(75)

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Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	97.38	x	0.76	x	0.7	=	189.93	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	91.1	x	0.76	x	0.7	=	177.67	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	72.63	x	0.76	x	0.7	=	141.64	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	50.42	x	0.76	x	0.7	=	98.34	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	28.07	x	0.76	x	0.7	=	54.74	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	14.2	x	0.76	x	0.7	=	27.69	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Northeast	0.9x	0.77	x	5.29	x	9.21	x	0.76	x	0.7	=	17.97	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.21	x	36.79		0.76	x	0.7	=	70.67	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.21	x	62.67		0.76	x	0.7	=	120.38	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.21	x	85.75		0.76	x	0.7	=	164.71	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.21	x	106.25		0.76	x	0.7	=	204.09	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.21	x	119.01		0.76	x	0.7	=	228.6	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.21	x	118.15		0.76	x	0.7	=	226.94	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.21	x	113.91		0.76	x	0.7	=	218.8	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)

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Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	5.21	x	104.39		0.76	x	0.7	=	200.51	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.21	x	92.85		0.76	x	0.7	=	178.35	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.21	x	69.27		0.76	x	0.7	=	133.05	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.21	x	44.07		0.76	x	0.7	=	84.65	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.21	x	31.49		0.76	x	0.7	=	60.48	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)

Rooflights 0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights 0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)
Rooflights 0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights 0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights 0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights 0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights 0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights 0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights 0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights 0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights 0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights 0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights 0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights 0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights 0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights 0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights 0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights 0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights 0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights 0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights 0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights 0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights 0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	386.5	700.4	1060.31	1468.94	1775.54	1816.92	1729.37	1494.36	1201.89	802.52	470.83	325.54	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	851.16	1162.84	1506.83	1889.6	2169.59	2185.56	2081.63	1853.07	1574	1200.73	899.06	776.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.81	0.62	0.44	0.32	0.38	0.63	0.91	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.74	19.74	19.74	19.75	19.75	19.76	19.76	19.76	19.76	19.75	19.75	19.75	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.76	0.55	0.36	0.23	0.28	0.53	0.87	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.74	19.74	19.74	19.75	19.75	19.76	19.76	19.76	19.76	19.75	19.75	19.75	(90)

fLA = Living area ÷ (4) = 0.33 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.16	20.16	20.16	20.15	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.17	20.16	20.16	20.16	20.15	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.78	0.57	0.39	0.26	0.31	0.56	0.88	0.98	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	845.09	1133.67	1385.53	1465.72	1242.27	843.11	544.68	573.28	888.7	1061	883.1	772.78	(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=	2483.79	2385.2	2130.98	1741.14	1306.02	852.21	545.96	575.87	931.36	1475.84	2022.93	2480.94	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1219.2	841.03	554.62	198.3	47.43	0	0	0	0	308.64	820.68	1270.87	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5260.76 (98)

Space heating requirement in kWh/m²/year 48.17 (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		206.3	(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)													
	1219.2	841.03	554.62	198.3	47.43	0	0	0	0	308.64	820.68	1270.87	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	590.99	407.68	268.84	96.13	22.99	0	0	0	0	149.61	397.81	616.04	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2550.09 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

	193.86	170.39	177.81	157.82	153.52	135.53	128.61	143.27	143.69	163.72	175.1	188.66

Efficiency of water heater: 100 (216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	193.86	170.39	177.81	157.82	153.52	135.53	128.61	143.27	143.69	163.72	175.1	188.66

Total = Sum(219a)$_{1...12}$ = 1931.97 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2550.09	
Water heating fuel used			1931.97	
Electricity for pumps, fans and electric keep-hot				
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		0	(231)
Electricity for lighting			425.75	(232)
Electricity generated by PVs			-778.07	(233)

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	0.519	=	1323.49	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	1002.69	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2326.19	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	220.96	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-403.82	(269)
Total CO2, kg/year		sum of (265)…(271) =		2143.34	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.63	(273)
EI rating (section 14)				81	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Su Lee	**Stroma Number:**	STRO031315
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Unit 06

Address : 138-140 Highgate Road, Highgate, Highgate, NW5 1PB

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Basement	38.62	(1a)	x	2.7	(2a)	=	104.27	(3a)
Ground floor	34.58	(1b)	x	3.2	(2b)	=	110.66	(3b)
First floor	31.61	(1c)	x	4.65	(2c)	=	146.99	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	104.81	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	361.92	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	50	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(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) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.46	x	1.4	=	3.444			(26)
Windows Type 1			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 2			5.01	x1/[1/(1.4)+ 0.04]		=	6.64			(27)
Windows Type 3			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 4			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 5			5.09	x1/[1/(1.4)+ 0.04]		=	6.75			(27)
Windows Type 6			4.86	x1/[1/(1.4)+ 0.04]		=	6.44			(27)
Windows Type 7			5.09	x1/[1/(1.4)+ 0.04]		=	6.75			(27)
Rooflights Type 1			3.37	x1/[1/(1.4) + 0.04]		=	4.718			(27b)
Rooflights Type 2			1.13	x1/[1/(1.4) + 0.04]		=	1.582			(27b)
Rooflights Type 3			0.98	x1/[1/(1.4) + 0.04]		=	1.372			(27b)
Floor			38.62	x	0.13	=	5.0206			(28)
Walls Type1	10.15	0	10.15	x	0.15	=	1.52			(29)
Walls Type2	26.7	0	26.7	x	0.15	=	4.01			(29)
Walls Type3	5.08	4.86	0.22	x	0.15	=	0.03			(29)
Walls Type4	1.35	0	1.35	x	0.15	=	0.2			(29)
Walls Type5	5	5.01	-0.01	x	0.15	=	0			(29)

DER WorkSheet: New dwelling design stage

Walls Type6	6.02	5.09	0.93	x	0.15	=	0.14			(29)
Walls Type7	0.8	0	0.8	x	0.15	=	0.12			(29)
Walls Type8	0.96	0	0.96	x	0.15	=	0.14			(29)
Walls Type9	5.28	0	5.28	x	0.15	=	0.79			(29)
Walls Type10	5	0	5	x	0.15	=	0.75			(29)
Walls Type11	5.76	4.86	0.9	x	0.15	=	0.14			(29)
Walls Type12	0.42	0	0.42	x	0.15	=	0.06			(29)
Walls Type13	6.18	0	6.18	x	0.15	=	0.93			(29)
Walls Type14	8.74	5.09	3.65	x	0.15	=	0.55			(29)
Walls Type15	1.86	0	1.86	x	0.15	=	0.28			(29)
Walls Type16	8.6	2.46	6.14	x	0.15	=	0.92			(29)
Walls Type17	40	0	40	x	0.15	=	6			(29)
Walls Type18	8.97	0	8.97	x	0.15	=	1.35			(29)
Walls Type19	0.6	0	0.6	x	0.15	=	0.09			(29)
Walls Type20	8.37	4.86	3.51	x	0.15	=	0.53			(29)
Roof Type1	31.14	4.5	26.64	x	0.13	=	3.46			(30)
Roof Type2	2.38	0.98	1.4	x	0.13	=	0.18			(30)
Total area of elements, m²			229.38							(31)
Party wall			29.19	x	0	=	0			(32)
Party wall			32.58	x	0	=	0			(32)
Party wall			38.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 79.24 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: 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 15.38 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 94.62 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	69.21	68.85	68.48	66.79	66.47	64.99	64.99	64.72	65.56	66.47	67.11	67.78	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	163.83	163.46	163.1	161.4	161.08	159.6	159.6	159.33	160.17	161.08	161.73	162.4	

Average = Sum(39)$_{1…12}$ /12= 161.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.56	1.56	1.56	1.54	1.54	1.52	1.52	1.52	1.53	1.54	1.54	1.55	

Average = Sum(40)$_{1…12}$ /12= 1.54 (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)

DER WorkSheet: New dwelling design stage

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.78 | (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 | 100.22 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	110.24	106.23	102.23	98.22	94.21	90.2	90.2	94.21	98.22	102.23	106.23	110.24		
										Total = Sum(44)1...12 =			1202.65	(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=	163.49	142.99	147.55	128.64	123.43	106.51	98.7	113.26	114.61	133.57	145.8	158.33		
										Total = Sum(45)1...12 =			1576.86	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	24.52	21.45	22.13	19.3	18.51	15.98	14.8	16.99	17.19	20.04	21.87	23.75		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 210 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 1.57 | (48)

Temperature factor from Table 2b | 0.6 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0.94 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = | 0 | (54)

Enter (50) or (54) in (55) | 0.94 | (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	29.2	26.38	29.2	28.26	29.2	28.26	29.2	29.2	28.26	29.2	28.26	29.2	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(62)m=	192.69	169.36	176.75	156.9	152.63	134.77	127.9	142.46	142.87	162.77	174.06	187.53	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

DER WorkSheet: New dwelling design stage

Output from water heater

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(64)m=	192.69	169.36	176.75	156.9	152.63	134.77	127.9	142.46	142.87	162.77	174.06	187.53	

Output from water heater (annual)$_{1...12}$ 1920.69 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.72	68.64	72.42	65.38	64.4	58.02	56.18	61.02	60.72	67.77	71.09	76.01	(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=	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	138.99	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.52	20.89	16.99	12.86	9.62	8.12	8.77	11.4	15.3	19.43	22.68	24.18	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	263.88	266.62	259.72	245.03	226.48	209.05	197.41	194.67	201.57	216.26	234.81	252.23	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	(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=	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	-111.19	(71)

Water heating gains (Table 5)

(72)m=	104.46	102.15	97.34	90.81	86.56	80.59	75.51	82.02	84.33	91.09	98.73	102.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	456.56	454.36	438.75	413.39	387.36	362.46	346.39	352.79	365.9	391.49	420.92	443.27	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.09	x	11.28	x	0.76	x	0.7	=	21.17	(75)
Northeast 0.9x	0.77	x	5.09	x	11.28	x	0.76	x	0.7	=	21.17	(75)
Northeast 0.9x	0.77	x	5.09	x	22.97	x	0.76	x	0.7	=	43.1	(75)
Northeast 0.9x	0.77	x	5.09	x	22.97	x	0.76	x	0.7	=	43.1	(75)
Northeast 0.9x	0.77	x	5.09	x	41.38	x	0.76	x	0.7	=	77.65	(75)
Northeast 0.9x	0.77	x	5.09	x	41.38	x	0.76	x	0.7	=	77.65	(75)
Northeast 0.9x	0.77	x	5.09	x	67.96	x	0.76	x	0.7	=	127.52	(75)
Northeast 0.9x	0.77	x	5.09	x	67.96	x	0.76	x	0.7	=	127.52	(75)
Northeast 0.9x	0.77	x	5.09	x	91.35	x	0.76	x	0.7	=	171.42	(75)
Northeast 0.9x	0.77	x	5.09	x	91.35	x	0.76	x	0.7	=	171.42	(75)
Northeast 0.9x	0.77	x	5.09	x	97.38	x	0.76	x	0.7	=	182.75	(75)
Northeast 0.9x	0.77	x	5.09	x	97.38	x	0.76	x	0.7	=	182.75	(75)

DER WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	5.09	x	91.1	x	0.76	x	0.7	=	170.96	(75)
Northeast	0.9x	0.77	x	5.09	x	91.1	x	0.76	x	0.7	=	170.96	(75)
Northeast	0.9x	0.77	x	5.09	x	72.63	x	0.76	x	0.7	=	136.29	(75)
Northeast	0.9x	0.77	x	5.09	x	72.63	x	0.76	x	0.7	=	136.29	(75)
Northeast	0.9x	0.77	x	5.09	x	50.42	x	0.76	x	0.7	=	94.62	(75)
Northeast	0.9x	0.77	x	5.09	x	50.42	x	0.76	x	0.7	=	94.62	(75)
Northeast	0.9x	0.77	x	5.09	x	28.07	x	0.76	x	0.7	=	52.67	(75)
Northeast	0.9x	0.77	x	5.09	x	28.07	x	0.76	x	0.7	=	52.67	(75)
Northeast	0.9x	0.77	x	5.09	x	14.2	x	0.76	x	0.7	=	26.64	(75)
Northeast	0.9x	0.77	x	5.09	x	14.2	x	0.76	x	0.7	=	26.64	(75)
Northeast	0.9x	0.77	x	5.09	x	9.21	x	0.76	x	0.7	=	17.29	(75)
Northeast	0.9x	0.77	x	5.09	x	9.21	x	0.76	x	0.7	=	17.29	(75)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	5.01	x	36.79		0.76	x	0.7	=	67.96	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	36.79		0.76	x	0.7	=	65.93	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	5.01	x	62.67		0.76	x	0.7	=	115.76	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	62.67		0.76	x	0.7	=	112.3	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	5.01	x	85.75		0.76	x	0.7	=	158.39	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	85.75		0.76	x	0.7	=	153.65	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	5.01	x	106.25		0.76	x	0.7	=	196.25	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	106.25		0.76	x	0.7	=	190.38	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	5.01	x	119.01		0.76	x	0.7	=	219.82	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	119.01		0.76	x	0.7	=	213.24	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	5.01	x	118.15		0.76	x	0.7	=	218.23	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	118.15		0.76	x	0.7	=	211.7	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	5.01	x	113.91		0.76	x	0.7	=	210.4	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	113.91		0.76	x	0.7	=	204.1	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)

Southwest	0.9x	0.77	x	5.01	x	104.39		0.76	x	0.7	=	192.82	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	104.39		0.76	x	0.7	=	187.04	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	5.01	x	92.85		0.76	x	0.7	=	171.5	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	92.85		0.76	x	0.7	=	166.37	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	5.01	x	69.27		0.76	x	0.7	=	127.94	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	69.27		0.76	x	0.7	=	124.11	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	5.01	x	44.07		0.76	x	0.7	=	81.4	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	44.07		0.76	x	0.7	=	78.96	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	5.01	x	31.49		0.76	x	0.7	=	58.16	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Southwest	0.9x	0.77	x	4.86	x	31.49		0.76	x	0.7	=	56.42	(79)
Northwest	0.9x	0.77	x	1.4	x	11.28	x	0.76	x	0.7	=	5.82	(81)
Northwest	0.9x	0.77	x	1.4	x	22.97	x	0.76	x	0.7	=	11.85	(81)
Northwest	0.9x	0.77	x	1.4	x	41.38	x	0.76	x	0.7	=	21.36	(81)
Northwest	0.9x	0.77	x	1.4	x	67.96	x	0.76	x	0.7	=	35.08	(81)
Northwest	0.9x	0.77	x	1.4	x	91.35	x	0.76	x	0.7	=	47.15	(81)
Northwest	0.9x	0.77	x	1.4	x	97.38	x	0.76	x	0.7	=	50.26	(81)
Northwest	0.9x	0.77	x	1.4	x	91.1	x	0.76	x	0.7	=	47.02	(81)
Northwest	0.9x	0.77	x	1.4	x	72.63	x	0.76	x	0.7	=	37.49	(81)
Northwest	0.9x	0.77	x	1.4	x	50.42	x	0.76	x	0.7	=	26.02	(81)
Northwest	0.9x	0.77	x	1.4	x	28.07	x	0.76	x	0.7	=	14.49	(81)
Northwest	0.9x	0.77	x	1.4	x	14.2	x	0.76	x	0.7	=	7.33	(81)
Northwest	0.9x	0.77	x	1.4	x	9.21	x	0.76	x	0.7	=	4.76	(81)
Rooflights	0.9x	1	x	3.37	x	26	x	0.76	x	0.7	=	41.95	(82)
Rooflights	0.9x	1	x	1.13	x	26	x	0.76	x	0.7	=	14.07	(82)
Rooflights	0.9x	1	x	0.98	x	26	x	0.76	x	0.7	=	12.2	(82)
Rooflights	0.9x	1	x	3.37	x	54	x	0.76	x	0.7	=	87.13	(82)
Rooflights	0.9x	1	x	1.13	x	54	x	0.76	x	0.7	=	29.22	(82)
Rooflights	0.9x	1	x	0.98	x	54	x	0.76	x	0.7	=	25.34	(82)
Rooflights	0.9x	1	x	3.37	x	96	x	0.76	x	0.7	=	154.9	(82)
Rooflights	0.9x	1	x	1.13	x	96	x	0.76	x	0.7	=	51.94	(82)
Rooflights	0.9x	1	x	0.98	x	96	x	0.76	x	0.7	=	45.05	(82)
Rooflights	0.9x	1	x	3.37	x	150	x	0.76	x	0.7	=	242.03	(82)

Rooflights 0.9x	1	x	1.13	x	150	x	0.76	x	0.7	=	81.16	(82)
Rooflights 0.9x	1	x	0.98	x	150	x	0.76	x	0.7	=	70.38	(82)
Rooflights 0.9x	1	x	3.37	x	192	x	0.76	x	0.7	=	309.8	(82)
Rooflights 0.9x	1	x	1.13	x	192	x	0.76	x	0.7	=	103.88	(82)
Rooflights 0.9x	1	x	0.98	x	192	x	0.76	x	0.7	=	90.09	(82)
Rooflights 0.9x	1	x	3.37	x	200	x	0.76	x	0.7	=	322.71	(82)
Rooflights 0.9x	1	x	1.13	x	200	x	0.76	x	0.7	=	108.21	(82)
Rooflights 0.9x	1	x	0.98	x	200	x	0.76	x	0.7	=	93.84	(82)
Rooflights 0.9x	1	x	3.37	x	189	x	0.76	x	0.7	=	304.96	(82)
Rooflights 0.9x	1	x	1.13	x	189	x	0.76	x	0.7	=	102.26	(82)
Rooflights 0.9x	1	x	0.98	x	189	x	0.76	x	0.7	=	88.68	(82)
Rooflights 0.9x	1	x	3.37	x	157	x	0.76	x	0.7	=	253.33	(82)
Rooflights 0.9x	1	x	1.13	x	157	x	0.76	x	0.7	=	84.94	(82)
Rooflights 0.9x	1	x	0.98	x	157	x	0.76	x	0.7	=	73.67	(82)
Rooflights 0.9x	1	x	3.37	x	115	x	0.76	x	0.7	=	185.56	(82)
Rooflights 0.9x	1	x	1.13	x	115	x	0.76	x	0.7	=	62.22	(82)
Rooflights 0.9x	1	x	0.98	x	115	x	0.76	x	0.7	=	53.96	(82)
Rooflights 0.9x	1	x	3.37	x	66	x	0.76	x	0.7	=	106.49	(82)
Rooflights 0.9x	1	x	1.13	x	66	x	0.76	x	0.7	=	35.71	(82)
Rooflights 0.9x	1	x	0.98	x	66	x	0.76	x	0.7	=	30.97	(82)
Rooflights 0.9x	1	x	3.37	x	33	x	0.76	x	0.7	=	53.25	(82)
Rooflights 0.9x	1	x	1.13	x	33	x	0.76	x	0.7	=	17.85	(82)
Rooflights 0.9x	1	x	0.98	x	33	x	0.76	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	3.37	x	21	x	0.76	x	0.7	=	33.88	(82)
Rooflights 0.9x	1	x	1.13	x	21	x	0.76	x	0.7	=	11.36	(82)
Rooflights 0.9x	1	x	0.98	x	21	x	0.76	x	0.7	=	9.85	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	382.13	692.39	1047.88	1451.08	1753.29	1793.85	1707.53	1475.95	1187.61	793.27	465.49	321.85	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	838.69	1146.74	1486.63	1864.48	2140.65	2156.31	2053.92	1828.74	1553.51	1184.76	886.41	765.12	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.93	0.82	0.64	0.46	0.34	0.39	0.65	0.91	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.64	19.64	19.65	19.66	19.66	19.67	19.67	19.67	19.67	19.66	19.66	19.65	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.77	0.57	0.37	0.24	0.28	0.55	0.87	0.98	0.99	(89)

DER WorkSheet: New dwelling design stage

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.64	19.64	19.65	19.66	19.66	19.67	19.67	19.67	19.67	19.66	19.66	19.65		(90)
										fLA = Living area ÷ (4) =			0.32	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.08	20.08	20.08	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.09	20.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.08	20.08	20.08	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.09	20.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.97	0.92	0.79	0.59	0.4	0.27	0.32	0.58	0.89	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	832.11	1117.29	1370.52	1468.04	1264.42	863.9	556.52	585.63	902.6	1051.95	869.95	760.89		(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=	2585.2	2481.59	2215.43	1806.31	1351.97	877.84	558.63	589.75	960.62	1529.16	2100.81	2579.96		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	1304.3	916.81	628.61	243.55	65.14	0	0	0	0	355.05	886.22	1353.39		
									Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ =				5753.07	(98)
Space heating requirement in kWh/m²/year													54.89	(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		211.14	(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)														
	1304.3	916.81	628.61	243.55	65.14	0	0	0	0	355.05	886.22	1353.39		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	617.74	434.22	297.72	115.35	30.85	0	0	0	0	168.16	419.73	640.99		
									Total (kWh/year) = $Sum(211)_{1...5,10....12}$ =				2724.77	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) = $Sum(215)_{1...5,10....12}$ =				0	(215)

Water heating

Output from water heater (calculated above)														
	192.69	169.36	176.75	156.9	152.63	134.77	127.9	142.46	142.87	162.77	174.06	187.53		
Efficiency of water heater													100	(216)

(217)m=	100	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	192.69	169.36	176.75	156.9	152.63	134.77	127.9	142.46	142.87	162.77	174.06	187.53

Total = Sum(219a)$_{1...12}$ = 1920.69 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2724.77	
Water heating fuel used		1920.69	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	0	(231)
Electricity for lighting		415.46	(232)
Electricity generated by PVs		-778.07	(233)

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	0.519	=	1414.16	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	996.84	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2411	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	215.62	(268)
Energy saving/generation technologies Item 1		0.519	=	-403.82	(269)
Total CO2, kg/year		sum of (265)…(271) =		2222.8	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		21.21	(273)
EI rating (section 14)				80	(274)

12. Appendix B – Overheating report

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 14 December 2018

Property Details: Unit 01

Dwelling type:	End-terrace House
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	3
Front of dwelling faces:	North East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	519.13	**(P1)**
Transmission heat loss coefficient:	117.3	
Summer heat loss coefficient:	636.46	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South West (Window 1)	0	1
South West (Window 2)	0	1
North West (Window 3)	0	1
South West (Window 4)	0	1
North East (Terrace window)	0	1
South West (Window 5)	0	1
North West (Window 6)	0	1
North East (Entrance window)	0	1
Horizontal (Skylight 1)	0	1
Horizontal (Skylight 2)	0	1
Horizontal (Kitchen walk skylight)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (Window 1)	1	0.9	1	0.9	**(P8)**
South West (Window 2)	1	0.9	1	0.9	**(P8)**
North West (Window 3)	1	0.9	1	0.9	**(P8)**
South West (Window 4)	1	0.9	1	0.9	**(P8)**
North East (Terrace window)	1	0.9	1	0.9	**(P8)**
South West (Window 5)	1	0.9	1	0.9	**(P8)**
North West (Window 6)	1	0.9	1	0.9	**(P8)**
North East (Entrance window)	1	0.9	1	0.9	**(P8)**
Horizontal (Skylight 1)	1	1	1	1	**(P8)**
Horizontal (Skylight 2)	1	1	1	1	**(P8)**
Horizontal (Kitchen walk skylight)	1	1	1	1	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
South West (Window 1)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15
South West (Window 2)	0.9 x	5.19	119.92	0.76	0.7	0.9	268.2

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North West (Window 3)	0.9 x	1.4	98.85	0.76	0.7	0.9	59.63	
South West (Window 4)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15	
North East (Terrace window)	0.9 x	7.38	98.85	0.76	0.7	0.9	314.35	
South West (Window 5)	0.9 x	5.83	119.92	0.76	0.7	0.9	301.28	
North West (Window 6)	0.9 x	3.36	98.85	0.76	0.7	0.9	143.12	
North East (Entrance window)	0.9 x	6.71	98.85	0.76	0.7	0.9	285.81	
	1 x	3.35	203	0.76	0.7	1	325.61	
	1 x	1.13	203	0.76	0.7	1	109.83	
	1 x	1.37	203	0.76	0.7	1	133.16	
						Total	2443.28	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	541.38	519.72	528.92	
Total summer gains	3141.07	2963	2670.2	**(P5)**
Summer gain/loss ratio	4.94	4.66	4.2	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	21.19	22.81	22.25	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 14 December 2018

Property Details: Unit 02

Dwelling type:	Mid-terrace House
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	3
Front of dwelling faces:	North East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	489.04	**(P1)**
Transmission heat loss coefficient:	86.2	
Summer heat loss coefficient:	575.22	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (Window 1)	0	1
South West (Window 2)	0	1
North West (Window 3)	0	1
South West (Window 4)	0	1
North East (Terrace window)	0	1
South West (Window 5)	0	1
North East (Entrance window)	0	1
Horizontal (Skylight 1)	0	1
Horizontal (Skylight 2)	0	1
Horizontal (Kitchen walk skylight)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (Window 1)	1	0.9	1	0.9	**(P8)**
South West (Window 2)	1	0.9	1	0.9	**(P8)**
North West (Window 3)	1	0.9	1	0.9	**(P8)**
South West (Window 4)	1	0.9	1	0.9	**(P8)**
North East (Terrace window)	1	0.9	1	0.9	**(P8)**
South West (Window 5)	1	0.9	1	0.9	**(P8)**
North East (Entrance window)	1	0.9	1	0.9	**(P8)**
Horizontal (Skylight 1)	1	1	1	1	**(P8)**
Horizontal (Skylight 2)	1	1	1	1	**(P8)**
Horizontal (Kitchen walk skylight)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**
South West (Window 1)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15
South West (Window 2)	0.9 x	5.21	119.92	0.76	0.7	0.9	269.24
North West (Window 3)	0.9 x	1.4	98.85	0.76	0.7	0.9	59.63
South West (Window 4)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15

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North East (Terrace window)	0.9 x	5.29	98.85	0.76	0.7	0.9	225.32	
South West (Window 5)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15	
North East (Entrance window)	0.9 x	5.29	98.85	0.76	0.7	0.9	225.32	
	1 x	3.37	203	0.76	0.7	1	327.55	
	1 x	1.13	203	0.76	0.7	1	109.83	
	1 x	0.98	203	0.76	0.7	1	95.25	
						Total	2065.6	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	528.57	507.5	516.56	
Total summer gains	2722.39	2573.1	2341.99	**(P5)**
Summer gain/loss ratio	4.73	4.47	4.07	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	20.98	22.62	22.12	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 14 December 2018

Property Details: Unit 03

Dwelling type:	Mid-terrace House
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	3
Front of dwelling faces:	North East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	491.9	**(P1)**
Transmission heat loss coefficient:	86.4	
Summer heat loss coefficient:	578.31	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (Window 1)	0	1
South West (Window 2)	0	1
North West (Window 3)	0	1
South West (Window 4)	0	1
North East (Terrace window)	0	1
South West (Window 5)	0	1
North East (Entrance window)	0	1
Horizontal (Skylight 1)	0	1
Horizontal (Skylight 2)	0	1
Horizontal (Kitchen walk skylight)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (Window 1)	1	0.9	1	0.9	**(P8)**
South West (Window 2)	1	0.9	1	0.9	**(P8)**
North West (Window 3)	1	0.9	1	0.9	**(P8)**
South West (Window 4)	1	0.9	1	0.9	**(P8)**
North East (Terrace window)	1	0.9	1	0.9	**(P8)**
South West (Window 5)	1	0.9	1	0.9	**(P8)**
North East (Entrance window)	1	0.9	1	0.9	**(P8)**
Horizontal (Skylight 1)	1	1	1	1	**(P8)**
Horizontal (Skylight 2)	1	1	1	1	**(P8)**
Horizontal (Kitchen walk skylight)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**
South West (Window 1)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15
South West (Window 2)	0.9 x	5.21	119.92	0.76	0.7	0.9	269.24
North West (Window 3)	0.9 x	1.4	98.85	0.76	0.7	0.9	59.63
South West (Window 4)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15

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North East (Terrace window)	0.9 x	5.29	98.85	0.76	0.7	0.9	225.32	
South West (Window 5)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15	
North East (Entrance window)	0.9 x	5.29	98.85	0.76	0.7	0.9	225.32	
	1 x	3.37	203	0.76	0.7	1	327.55	
	1 x	1.13	203	0.76	0.7	1	109.83	
	1 x	0.98	203	0.76	0.7	1	95.25	
						Total	2065.6	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	530.2	509.05	518.13	
Total summer gains	2724.01	2574.65	2343.56	**(P5)**
Summer gain/loss ratio	4.71	4.45	4.05	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	20.96	22.6	22.1	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 14 December 2018

Property Details: Unit 04

Dwelling type:	Mid-terrace House
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	3
Front of dwelling faces:	North East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	495.46	**(P1)**
Transmission heat loss coefficient:	86.7	
Summer heat loss coefficient:	582.17	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South West (Window 1)	0	1
South West (Window 2)	0	1
North West (Window 3)	0	1
South West (Window 4)	0	1
North East (Terrace window)	0	1
South West (Window 5)	0	1
North East (Entrance window)	0	1
Horizontal (Skylight 1)	0	1
Horizontal (Skylight 2)	0	1
Horizontal (Kitchen walk skylight)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (Window 1)	1	0.9	1	0.9	**(P8)**
South West (Window 2)	1	0.9	1	0.9	**(P8)**
North West (Window 3)	1	0.9	1	0.9	**(P8)**
South West (Window 4)	1	0.9	1	0.9	**(P8)**
North East (Terrace window)	1	0.9	1	0.9	**(P8)**
South West (Window 5)	1	0.9	1	0.9	**(P8)**
North East (Entrance window)	1	0.9	1	0.9	**(P8)**
Horizontal (Skylight 1)	1	1	1	1	**(P8)**
Horizontal (Skylight 2)	1	1	1	1	**(P8)**
Horizontal (Kitchen walk skylight)	1	1	1	1	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
South West (Window 1)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15
South West (Window 2)	0.9 x	5.21	119.92	0.76	0.7	0.9	269.24
North West (Window 3)	0.9 x	1.4	98.85	0.76	0.7	0.9	59.63
South West (Window 4)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15

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North East (Terrace window)	0.9 x	5.29	98.85	0.76	0.7	0.9	225.32	
South West (Window 5)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15	
North East (Entrance window)	0.9 x	5.29	98.85	0.76	0.7	0.9	225.32	
	1 x	3.37	203	0.76	0.7	1	327.55	
	1 x	1.13	203	0.76	0.7	1	109.83	
	1 x	0.98	203	0.76	0.7	1	95.25	
						Total	2065.6	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	532.18	510.94	520.04	
Total summer gains	2725.99	2576.54	2345.47	**(P5)**
Summer gain/loss ratio	4.68	4.43	4.03	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	20.93	22.58	22.08	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 14 December 2018

Property Details: Unit 05

Dwelling type:	Mid-terrace House
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	3
Front of dwelling faces:	North East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	495.93	**(P1)**
Transmission heat loss coefficient:	86.7	
Summer heat loss coefficient:	582.58	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (Window 1)	0	1
South West (Window 2)	0	1
North West (Window 3)	0	1
South West (Window 4)	0	1
North East (Terrace window)	0	1
South West (Window 5)	0	1
North East (Entrance window)	0	1
Horizontal (Skylight 1)	0	1
Horizontal (Skylight 2)	0	1
Horizontal (Kitchen walk skylight)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (Window 1)	1	0.9	1	0.9	**(P8)**
South West (Window 2)	1	0.9	1	0.9	**(P8)**
North West (Window 3)	1	0.9	1	0.9	**(P8)**
South West (Window 4)	1	0.9	1	0.9	**(P8)**
North East (Terrace window)	1	0.9	1	0.9	**(P8)**
South West (Window 5)	1	0.9	1	0.9	**(P8)**
North East (Entrance window)	1	0.9	1	0.9	**(P8)**
Horizontal (Skylight 1)	1	1	1	1	**(P8)**
Horizontal (Skylight 2)	1	1	1	1	**(P8)**
Horizontal (Kitchen walk skylight)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**
South West (Window 1)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15
South West (Window 2)	0.9 x	5.21	119.92	0.76	0.7	0.9	269.24
North West (Window 3)	0.9 x	1.4	98.85	0.76	0.7	0.9	59.63
South West (Window 4)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15

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North East (Terrace window)	0.9 x	5.29	98.85	0.76	0.7	0.9	225.32	
South West (Window 5)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15	
North East (Entrance window)	0.9 x	5.29	98.85	0.76	0.7	0.9	225.32	
	1 x	3.37	203	0.76	0.7	1	327.55	
	1 x	1.13	203	0.76	0.7	1	109.83	
	1 x	0.98	203	0.76	0.7	1	95.25	
						Total	2065.6	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	532.36	511.11	520.22	
Total summer gains	2726.18	2576.72	2345.65	**(P5)**
Summer gain/loss ratio	4.68	4.42	4.03	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	20.93	22.57	22.08	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 14 December 2018

Property Details: Unit 06

Dwelling type:	End-terrace House
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	3
Front of dwelling faces:	North East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	477.73	**(P1)**
Transmission heat loss coefficient:	94.6	
Summer heat loss coefficient:	572.35	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South West (Window 1)	0	1
South West (Window 2)	0	1
North West (Window 3)	0	1
South West (Window 4)	0	1
North East (Terrace window)	0	1
South West (Window 5)	0	1
North East (Entrance window)	0	1
Horizontal (Skylight 1)	0	1
Horizontal (Skylight 2)	0	1
Horizontal (Kitchen walk skylight)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (Window 1)	1	0.9	1	0.9	**(P8)**
South West (Window 2)	1	0.9	1	0.9	**(P8)**
North West (Window 3)	1	0.9	1	0.9	**(P8)**
South West (Window 4)	1	0.9	1	0.9	**(P8)**
North East (Terrace window)	1	0.9	1	0.9	**(P8)**
South West (Window 5)	1	0.9	1	0.9	**(P8)**
North East (Entrance window)	1	0.9	1	0.9	**(P8)**
Horizontal (Skylight 1)	1	1	1	1	**(P8)**
Horizontal (Skylight 2)	1	1	1	1	**(P8)**
Horizontal (Kitchen walk skylight)	1	1	1	1	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
South West (Window 1)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15
South West (Window 2)	0.9 x	5.01	119.92	0.76	0.7	0.9	258.9
North West (Window 3)	0.9 x	1.4	98.85	0.76	0.7	0.9	59.63
South West (Window 4)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15

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North East (Terrace window)	0.9 x	5.09	98.85	0.76	0.7	0.9	216.81	
South West (Window 5)	0.9 x	4.86	119.92	0.76	0.7	0.9	251.15	
North East (Entrance window)	0.9 x	5.09	98.85	0.76	0.7	0.9	216.81	
	1 x	3.37	203	0.76	0.7	1	327.55	
	1 x	1.13	203	0.76	0.7	1	109.83	
	1 x	0.98	203	0.76	0.7	1	95.25	
						Total	2038.23	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	522.96	502.14	511.13	
Total summer gains	2687.53	2540.37	2312.98	**(P5)**
Summer gain/loss ratio	4.7	4.44	4.04	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	20.95	22.59	22.09	**(P7)**
Likelihood of high internal temperature	**Slight**	**Medium**	**Medium**	

Assessment of likelihood of high internal temperature: Medium