SUSTAINABILITY AND ENERGY STATEMENT:

62 Avenue Road, Camden

11th Oct 2016

Leema Technologies Ltd

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1.0 INTRODUCTION

This Sustainability and Energy Statement has been prepared by Leema Technologies Ltd to accompany the Planning application submitted by BB Partnership Ltd to Camden Borough Council for the purpose the demolition of an existing outdated dwelling to create a new family home at 62 Avenue Rd, Camden, London.

The proposed development has been designed to meet and exceed current sustainability and energy efficiency requirements as per Document L1a Part L of the 2012 Building Regulations.

This report should be read alongside other supplemental reports prepared by the design team for the planning application

2.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 The propose development is located at 62 Avenue Road, in the London Borough of Camden. The site falls on the boarder of the Elsworthy Conservation area. However, does not fall within the Conservation area. The area has been developed in stages over a period of seventy years and there have been little subsequent alterations of building frontage. This area has also retained its residential character, and as a result much of its architectural detail and character.

2.2 The proposed development at 62 Avenue Road intends to maintain the surrounding characteristics of the area and will be designed as carefully crafted traditional styled family home that is sympathetic to its surroundings. It will be built with Lower Ground, Ground, First and Second floor. Providing off street parking for 2 cars with cycle stores for 4 bikes. In addition there will be a large forecourt to the front of the building. Currently there is an existing dwelling on site. However, this is a tired and very much outdated property. The client has therefore requested that the existing dwelling is carefully demolished and all useable materials, where viable, shall be used in the construction of the new dwelling.

2.3 Policy CS13 of the Camden Core Strategy seeks to ensure all new developments minimize carbon emissions by following the energy hierarchy, makes use of the decentralised energy networks and generating renewable energy on site. This policy also states new developments should minimize the potential for surface water flooding incorporating efficient water infrastructure.

3.0 POLICY CONTEXT

Camden Planning Guidance (CPG23) on Sustainability provides further guidance on reducing carbon emissions, in line with Policy CS13 and DM22. Within this document it is stated that developments should target a 35% reduction in carbon emissions. Sustainable development is a core principle underpinning planning, and has a key role to play in the creation of sustainable communities. In order to ensure the implementation of sustainable developments and to determine the target of standards to be met by the proposed development, it is necessary to review the relevant national, regional and local planning policies with respect to sustainability

and the site location. A summary of the planning policy context for the site and propose development is provided below.

3.1 Targets:
This Sustainability Statement sets out the targets and commitments of BB Partnership Ltd in relation to the proposed new development at 62 Avenue Road and the measures by which the company will meet these commitments. The BB Partnership Sustainability Statement reflects existing policy frameworks at a number of levels including national, regional and local guidance. The key component that underpins Policy at all levels is the concept of sustainable development. The following provides an overview of the policy documents that form the basis for the principles, targets and measures.

3.2 National Policy:
The Government White Paper of 2003, *'Our Energy Future – Creating a Low Carbon Economy'* marked a change in energy policy in bringing environmental concerns to the fore by defining a long-term strategic vision for energy policy, combining environmental, security of supply, competitiveness and social goals.

One stated aim is for government to 'set an example throughout the public sector by improving energy efficiency in buildings and procurement'. National Energy reduction targets set out in: *The UK Fuel Poverty Strategy, 2001DTI; Energy White Paper 2003, DEFRA: and the Government's Strategy (2004) for combined Heat and Power,* are as follows:

- 2050 60% reduction in CO2
- 2020 To increase renewable generation by 20%
- 2018 Eradicate fuel poverty in vulnerable households
- 2010 Reduce domestic energy consumption by 30%
- 2010 10% of electricity generation from renewables
- 2010 Good quality Combined Heat and Power generation of 10,000 MW

The aforementioned subject areas are embedded in Government Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) which set out national policy on land use planning. These policies complement but do not replace other national planning policies. All PPS's and PPG's are embedded in Regional Spatial Strategies (RSS's), the London Plan and local planning authorities in the preparation of local development documents. They may also be material to decisions on individual planning applications.

- **PPS 1: Delivering Sustainable Development:** (February 2005) sets out the relationship between planning, land use and sustainable development. It places an emphasis on community involvement in the process of building a high quality environment. Inclusive and accessible design, as well as health and safety are also prioritised.
- **PPS 1: A Supplement - Planning and Climate Change:** (December 2007) strengthens the emphasis on sustainable development and sets out guidelines for local planning authorities in relation to regional mitigation and adaptation measures for current and future climate change.
- **PPS 3: Housing:** (June 2010) sets out the Governments strategic housing policy. Objectives aim to ensure that everyone has the opportunity to live in a decent home, which they can afford in a community where they want to live. This policy seeks to improve housing choice, widen access to affordable homes;

develop more opportunities for home ownership and create sustainable and inclusive mixed communities.

- **PPS 10**: **Planning for Sustainable Waste Management:** (May 2006) identifies the production of less waste and its use as a resource wherever possible as the key objective. Disposing of waste is only to be considered as a last resort. The Government seeks to break the link between economic growth and the environmental impact of waste. This policy also specifies the decision making responsibilities, to the extent appropriate, of regional planning bodies and all planning authorities in waste management.
- **PPS 22: Renewable Energy** (August 2004) calls for regional strategies and local authorities to actively encourage renewable energy development through local planning policies. Technologies such as combined heat and power systems (CHP), wind turbines, photo voltaic cells and biomass heating should be considered in all new developments.
- **PPS 25: Development and Flood Risk** (March 2005) aims to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall. It advises that developments on sites in excess of 1 hectare should be accompanied by a Flood Risk Assessment in order to evaluate the risks and order that they are appropriately mitigated or minimised.

3.3 Regional policy

The current London Plan was adopted in February 2008 with an updated Chapter 4A on *Climate Change and London's Metabolism*. Strengthened policies emphasising energy efficient design and decentralised energy supply are introduced promoting adaptation as well as mitigation in sustainable building design.

Policy 4A.1 *Tackling Climate Change* requires developments to minimise CO2 emissions and states that the following hierarchy will be used to assess applications:

- using less energy, in particular by adopting sustainable design and construction measures (Policy 4A.3)
- supplying energy efficiently, in particular by prioritising decentralised energy generation (Policy 4A.6), and
- Using renewable energy (Policy 4A.7)

Policy 4A.3 *Sustainable Design and Construction*, requires future developments to make the most efficient use of land and existing buildings, and to reduce the need to travel. Passive solar design, natural ventilation, heating and cooling are advocated as ways to reduce energy use in policies 4A.3, *Decentralised Heat*, 4A.6 *Cooling and Power*, 4A.9 *Adaptation*, and 4A.10 *Overheating*.

Policy 4A.2 *Mitigating Climate Change* specifies minimum reduction targets for London as a whole from 1990 levels of:

- 15% by 2010
- 20% by 2015
- 25% by 2020
- 30% by 2025.

Policy 4A.7 *Renewable Energy* requires all new developments to reduce CO2 emissions by 20% through the use of on-site renewable energy generation where feasible

3.4 Local Policy
Development Policies – which will support the Core Strategy by setting out additional planning policies that the Council will use when making decisions on applications for planning permission. It goes into more detail on a number of the issues covered in the Core Strategy.

4.0 SUSTAINABILITY PRINCIPLES SUMMARY

The Climate Change Act (November 2008) was the first Bill of its kind to set out a framework for moving the UK to a low-carbon economy. The Act sets legally binding targets for the reduction of targeted greenhouse gas emission for the year 2050 through the following framework:

- The UK net carbon account for the year 2050 will be at least 80% lower than the 1990 baseline with the interim target of 2020 at 34%
- The establishment of a new *Committee on Climate Change*, to provide independent expert advice and guidance to Government on achieving targets and carbon budgets
- Greater energy efficiency, with more consumers becoming "producers" of their own energy at home
- A change in the way energy supply companies operate, so that they focus on reducing demand, rather than just supplying as much energy as possible Investment in low-carbon fuels and technologies, such as wind, wave, solar power and carbon capture and storage.

4.1 Transport (April 2001) establishes the integration of planning and transport at the national, regional, strategic and local level and promotion of more sustainable transport choices both for carrying people and for moving freight as the key objective. This will be achieved through promoting accessibility to jobs, shopping, leisure facilities and services by public transport, walking and cycling, and through reducing the need to travel, especially by car.

4.2 Air Quality, Noise and Pollution
The term “sustainable development” has various definitions which are under constant critical the scale of global to local. As such, the 2005 UK Government publication ‘*Securing the Future: delivering UK sustainable development strategy’* replaced the previous strategy for sustainable development, ‘*A better quality of life: A strategy for sustainable development’* which was published in 1999. *‘Securing the Future’* has agreed four priorities for the UK and its devolved administrations. These priorities are:

1. Sustainable consumption and production,
2. Climate change and energy,
3. Protecting our natural resources and enhancing the environment
4. Creating sustainable communities and a fairer world

All priorities are incorporated into policy at the regional and local level.

4.3 Materials and Waste Management
There is an existing dwelling on site. This property has been deemed unsuitable and inflexible in space arrangement for adaptation for the 21st Century and beyond.

The client has therefore requested that the existing building is carefully deconstructed and all usable materials are either re-used on site as fill material or taken away to be recycled at local recycling facilities.

The contractor will provide a site waste management plan to demonstrate the following:-

a. Target benchmarks for resource efficiency, i.e. m3 of waste per 100 m2 or tonnes of waste per 100m2 set in accordance with best practice
b. Procedures and commitments to minimize non-hazardous construction waste at design stage. Specify waste minimisation actions relating to at least 3 waste groups and support them by appropriate monitoring of waste.
c. Procedures for minimising hazardous waste
d. Monitoring, measuring and reporting of hazardous and non-hazardous site waste production according to the defined waste groups (according to the waste streams generated by the scope of the works)

Where there is a compliant Site Waste Management Plan (SWMP) including procedures and commitments to sort and divert waste from landfill, through either;

a. Re-use on site (In situ of for new applications)
b. Re-use on other sites
c. Salvage/reclaim for re-use
d. Return to supplier via a 'take-back' scheme
e. Recovery and recycling using an approved waste management contractor

Demolition of existing building and Site Waste Management..
There is an existing dwelling on site. This property has been deemed unsuitable and inflexible in space arrangement for adaptation for the 21st Century and beyond.

The client has therefore requested that the existing building is carefully deconstructed and all usable materials are either re-used on site as fill material or taken away to be recycled at local recycling facilities.

4.4 Water Consumption, Surface Water & Water Run-Off and Flood Risk

Full report completed separately.

4.5 Biodiversity and Ecology

Full report completed separately.

5.0 ENERGY STATEMENT

SUMMARY

5.1 The proposed combined development without renewable energy contribution is predicted to generate **89,377 kWh**/annum.

By replacing the gas boilers with Air to Water Source Heat Pumps as a renewable energy to provide space heating and contribute to hot water, the overall energy consumption is predicted to achieve **64,208 kWh**/annum.

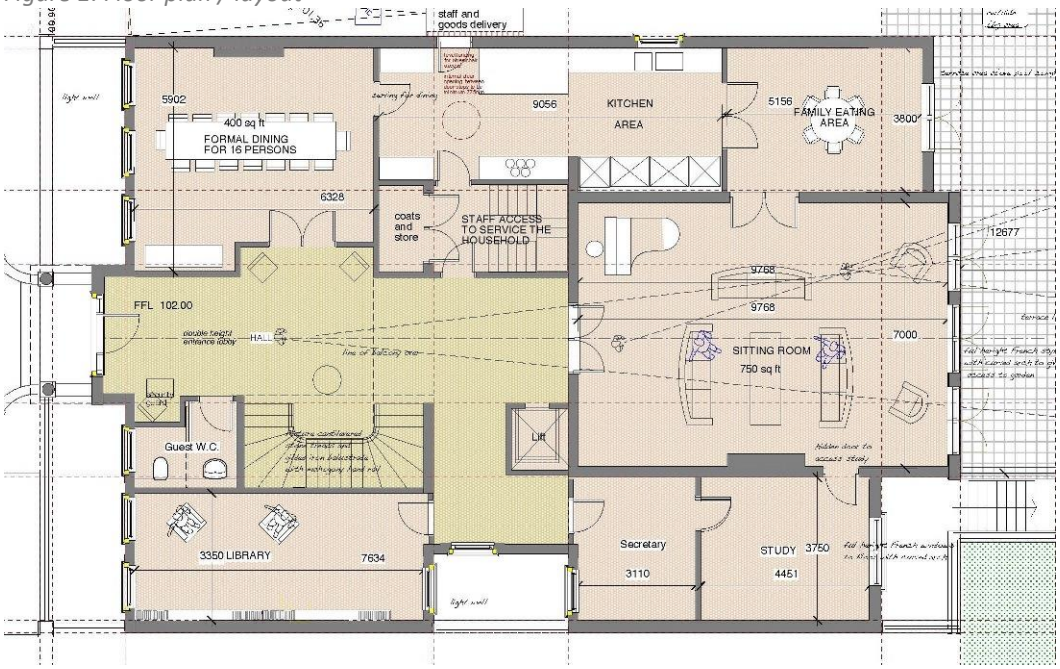
The system should be installed by a specialist contractor and selection of appropriate emitters such as underfloor heating is recommended. This results in a 28% contribution of renewable energy contribution on site.

Layout, Floor Plate and Ceiling Heights

The general footprint of the building is 15 meters wide x 30 meters long. The width of the building allows for perimeter rooms that can take advantage of natural daylight & ventilation and a central circulation core with natural light via a skylight over.

The floor to ceiling heights are generous at 3200mm. Referring to CIBSE Guide AM10 advises that single sided ventilation is effective to 2.5 x ceiling height based a double opening which is made available with sliding sash windows. The high ceilings also offer a suitable 'reservoir' to contain warm air in the summer which can be ventilated out at night time via trickle ventilators.

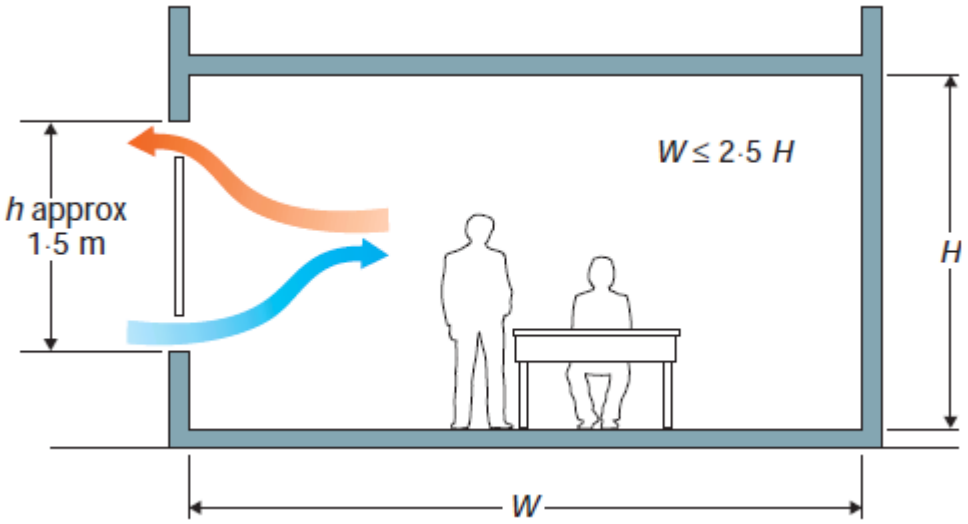
Figure 1: Floor plan / layout



Windows

The windows are sliding sash units which provide effective ventilation. The bottom sash can slide up and the top sash can slide down. This forms two effective ventilation openings. The lower will be the intake of the cooler air. The upper opening will extract the warmer air. See figure 1 below:-

Figure 1: Single Sided Double Opening (Figure 2.19 from CIBSE AM10)



Combined with high ceilings and having two separate ventilation openings, you avoid turbulence that is experience with single opening windows and therefore provides more efficient ventilation which is particularly useful in summertime.

The windows range in size from 1125w x 1725h to 1125w x 2400h. These will allow good levels of daylight and passive solar gains into the internal spaces.

Shading is provides by the glass itself which will be a double glazed unit with low-e coating and multiple glazing bars. The design of the property does not lend itself to contemporary forms of external shading.

Trickle ventilators will be provided to allow for background ventilation as required for secure night-time ventilation.

Impact on Surround Renewable Resources

We have assessed the immediate local environment. Currently, there are no wind turbines, solar thermal or Photovoltaic panels on adjacent properties that will be affected by the proposed development.

Daylight & Reduction of Artificial lighting

To meet the recommendations of Daylight provision we have suggested a daylight factor of 1.5% to living rooms, dining rooms and studies should be implemented.

The main ground floor sitting room to the North-West elevation achieves this if it has a minimum of 7.6m2 of glazing.

The ground floor study to the same elevation achieves >2% daylight factor which exceeds the afore mentioned.

The ground floor dining room to the North-West elevation achieves in excess of 2% daylight factor based on the current window design.

The central circulation stairwell receives natural light from a skylight over.

Generally the rooms are located to the building perimeter and each has a window to provide natural light.

Lighting control will be manual to occupied rooms. The circulation spaces, stores and other ancillary areas will have PIR's to operate lighting and daylight sensors.

Project:	**62 Avenue Road, Camden**
Project Ref:	**L104**
Room:	**Sitting Room**

Input:	Window area (m2)	**12.15**

Input:	Floor Area (m2)	68.4
Input:	Room perimeter (m)	33.54
Select:	Ceiling height (m)	3
	Total Surface Area (m2) =	237.42

Select:	Glazing Type	*Double low-e*
Select:	Visible Sky Angle	*60 degrees*
Select:	Surface Reflectance	*Medium (0.5)*
	RESULT:	**2.39% Daylight Factor**

Green and Brown roof

1) An Intensive Roof

Intensive – intensive living roofs are very much intended for human use and as such take on a more 'landscaped' feel with deeper substrates (at least 150mm up to a meter and beyond) catering for a wide variety of grasses, shrubs and trees. Maintenance is both essential and regular as lawns need mowing and shrubs pruning – an irrigation system should also be installed.

There is NO maintenance - No mowing option – no irrigation system is appropriate at this height.

2) An Extensive Roof

Extensive – an extensive living roof is not normally intended for human use and is unquestionably the most popular form. It's relatively cheap to install, has lower weight loadings and requires minimal maintenance. Usually the plants are set in a light-weight growing medium or substrate of a depth of between 20mm and 150mm. The plants themselves tend to be highly resistant to drought, ground hugging species such as sedum.

The principles behind these types of roof are driven by ecological concerns. Pioneered by the Swiss, the bio-diverse roof is steadily becoming a more common feature as policy makers seek to replace lost habitats for local flora and fauna.

Local Flora and Fauna will not benefit from a roof 12,000mm above the Ground.

The installation of logs, small rocks and sanded areas encourage invertebrates, birds and even lizards to use the roof. Initially the roof will look no better than a rough, stony, weed-infested area but in time will develop; constantly changing as different species come to the fore or take up residence.

During the growing and flowering seasons a mature roof can resemble something akin to an English meadow. Many people think they look messy and unkempt but in fact these roofs do more for the environment than sedum-based and intensive roofs.

A roof 12,000mm above the ground will NOT encourage local invertebrates or lizards to use the roof. It will not look an English meadow when it can't be SEEN

To be able to re-green impermeable surfaces such as roofs gives us the ability to readjust the imbalance – plants store carbon, therefore, if we have more plants we can store more carbon. Living roofs won't save the world but they serve as a fundamental tool with which to address the problem.

The hard surface area of the existing building + terrace + car park is GREATER than the proposed scheme. The rainwater run-off is reduced from 19litres/sec to 17 litres /sec on the proposed scheme. The proposed building is no worse for the environment than the existing building. However, a separate SUDs report will accompany this document.

The only place for a Green roof is the small flat roof over the kitchen extension – otherwise this project is NOT suitable for a Green or Brown roof solution.

5.2 Building Insulation
The proposed U values for the development are identified in table 1 below:-

Table 1: Proposed U values for the building envelope

Element	Building Regs (W/m2.K)	Proposed (W/m2.K)	Improvement
Walls	0.30 W/m^2.K	0.23 W/m^2.K	24%
Roof	0.20 W/m^2.K	0.11 W/m^2.K	45%
Floor	0.25 W/m^2.K	0.12 W/m^2.K	52%
Windows	2.00 W/m^2.K	1.4 W/m^2.K	30%
Doors	2.00 W/m^2.K	1.8 W/m^2.K	10%

The proposed dwelling is to exceed the current building regulations Part L1a between 10-45% of the external insulation values.

The target design air permeability is to be 5m^3/hr/m^2. This is a 50% improvement on current building regulation values.

5.3 Heating

Air Source Heat Pumps
An Air Source Heat Pump (ASHP) system extracts heat from the outside air. It delivers low temperature hot water and would therefore benefit under floor heating or over-sized radiators. Suitable radiators are Purmo Radiators. These would need to be sized by the heating specialist. The ASHP system is potentially more beneficial to this scheme due to the possible lack of deep ground to accommodate a GSHP system. The typical Coefficient of Performance (CoP) is 2.75 (Which equates to 275% efficiency compared with a gas boiler of 90%).

It is recommended to run the ASHP system throughout the winter period. We ran the proposed building through a study to determine the predicted energy required.

One of the downsides of air source heat pumps is the noise. They can provide a consistent background noise. But this occurs more often in winter when the likelihood is that windows will be shut. We recommend providing screening to the ASHP to baffle the noise but allow adequate ventilation. The units can also be unreliable if used intermittently. If the accommodation is to be used as Student Accommodation, this type of heating may not be appropriate and may cause continuous maintenance issues. They are also unsightly and can be expensive to run if not used correctly.

Photovoltaic System

With the significant size of the scheme and resultant high levels of energy demand, Photovoltaic Panels are considered.

To achieve a target of **32,055 kWh/Year** to meet **20%** on-site energy generation, then it is estimated that the scheme requires **47 kWp system**. The estimated of panels orientated and tilted south is **320m^2**. This scheme has a top floor roof area of 342m^2 available. But some areas may be shaded and will need reviewing with firm proposals prior to commencement. Space could be restrictive and recommend a detail review upon detail design. Overshadowing of adjacent buildings also needs to be reviewed.

Other issues to consider are structural loading, access for maintenance, cleaning the panels to maximize efficiency and maintaining the roof finish to prevent leaks.

Systems are available to suit flat roofs such as sit on systems mounted on adjustable angled frameworks as indicated in figures 8 and 9 below. There are also targeted flat roof systems such as the Solyndra (Cylindrical Model) which allow the white roof membrane to reflect daylight onto the underside of the system cylinders.

Figure 8: Tilted frame system

Figure 9: Solyndra Cylindrical PV system

The specification will need to be designed by a specialist (MCS) contractor to meet the required demand and qualify for the feed-in tariff.

2.0 ENERGY CALCULATIONS

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.5.0.69
Printed on 29 April 2014 at 04:47:40

Project Information:

Assessed By: () **Building Type:** Detached House

Dwelling Details:

NEW DWELLING AS BUILT

Site Reference : New Project **Plot Reference:** 7th Amendment

Address : 62, Avenue Road, LONDON, NW8 6HT

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1 TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.47 (electricity)

Target Carbon Dioxide Emission Rate (TER)	22.64 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.86 kg/m²	**OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.20 (max. 0.70)	**OK**
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	**OK**
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	**OK**
Openings	1.45 (max. 2.00)	2.00 (max. 3.30)	**OK**

3 Air permeability

Air permeability at 50 pascals	10.00	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Heat pumps with radiators or underfloor - electric Air-to-water heat pump (electric)	
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Nominal cylinder loss: 1.50 kWh/day Permitted by DBSCG: 2.86 kWh/day	
Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	Cylinderstat	**OK**
	Independent timer for DHW	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South West	20.14m², Overhang twice as wide as window, ratio NaN
Windows facing: South West	20.14m², Overhang twice as wide as window, ratio NaN
Windows facing: South West	20.14m², Overhang twice as wide as window, ratio NaN
Windows facing: South West	16.78m², Overhang twice as wide as window, ratio NaN
Windows facing: North East	4.68m², Overhang twice as wide as window, ratio NaN
Windows facing: North East	10.08m², Overhang twice as wide as window, ratio NaN
Windows facing: North East	2.8m², Overhang twice as wide as window, ratio NaN
Windows facing: North East	3.66m², Overhang twice as wide as window, ratio NaN
Windows facing: North East	2.4m², Overhang twice as wide as window, ratio NaN
Windows facing: North East	4.84m², Overhang twice as wide as window, ratio NaN
Windows facing: North East	1.81m², Overhang twice as wide as window, ratio NaN
Windows facing: South East	2.56m², Overhang twice as wide as window, ratio NaN
Windows facing: North West	2.74m², Overhang twice as wide as window, ratio NaN
Windows facing: South East	4.76m², Overhang twice as wide as window, ratio NaN
Roof windows facing: Unspecified	6.13m²
Ventilation rate:	5.00
Blinds/curtains:	shutter closed 100% of daylight hours

10 Key features

Windows U-value	1.4 W/m²K
Roofs U-value	0.11 W/m²K
External Walls U-value	0.13 W/m²K
Floors U-value	0.12 W/m²K
Floors U-value	0.12 W/m²K

SAP Input

Property Details: 7th Amendment

Address:	62, Avenue Road, LONDON, NW8 6HT
Located in:	England
Region:	Thames valley
UPRN:	1392868468
Date of assessment:	08 December 2011
Date of certificate:	29 April 2014
Assessment type:	New dwelling as built
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Dwelling designed to use less than 125 litres per Person per day:	False

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2011

Floor Location:	Floor area:	Storey height:
Basement floor	382.22 m²	3.2 m
Floor 1	319.56 m²	3.2 m
Floor 2	301.73 m²	3 m
Floor 3	219.26 m²	2.8 m

Living area:	50 m² (fraction 0.041)
Front of dwelling faces:	South West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Access	Manufacturer	Solid			Wood
Lhs	Manufacturer	Solid			Wood
RHS ACCESS	Manufacturer	Solid			Wood
F1	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
F2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
DORMER	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
R1	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
R2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
R3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
DORMER	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
DORMER	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
L1 ACCESS	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
L2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
L3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
DORMER	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
DORMER	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RHS	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
DOME	SAP 2009	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Access	mm	0.7	0	1.8	3.09	1
Lhs	mm	0.7	0	1.8	2.4	1
RHS ACCESS	mm	0.7	0	1.8	2.69	1
F1	16mm or more	0.7	0.63	1.4	3.356	6
F2	16mm or more	0.7	0.63	1.4	3.356	6
DORMER	16mm or more	0.7	0.63	1.4	3.356	6
R1	16mm or more	0.7	0.63	1.4	3.356	5
R2	16mm or more	0.7	0.63	1.4	2.34	2

SAP Input

R3	16mm or more	0.7	0.63	1.4	3.36	3
DORMER	16mm or more	0.7	0.63	1.4	1.4	2
DORMER	16mm or more	0.7	0.63	1.4	1.83	2
L1 ACCESS	16mm or more	0.7	0.63	1.4	2.4	1
L2	16mm or more	0.7	0.63	1.4	2.42	2
L3	16mm or more	0.7	0.63	1.4	1.81	1
DORMER	16mm or more	0.7	0.63	1.4	1.28	2
DORMER	16mm or more	0.7	0.63	1.4	1.37	2
RHS	16mm or more	0.7	0.63	1.4	2.38	2
DOME	16mm or more	0.7	0.63	2	6.13	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Access		All Walls	South West	0	0
Lhs		All Walls	South East	0	0
RHS ACCESS		All Walls	South West	0	0
F1		All Walls	South West	0	0
F2		All Walls	South West	0	0
DORMER		All Walls	South West	0	0
R1		All Walls	South West	0	0
R2		All Walls	North East	0	0
R3		All Walls	North East	0	0
DORMER		Mansard	North East	0	0
DORMER		Mansard	North East	0	0
L1 ACCESS		All Walls	North East	0	0
L2		All Walls	North East	0	0
L3		All Walls	North East	0	0
DORMER		Mansard	South East	0	0
DORMER		Mansard	North West	0	0
RHS		All Walls	South East	0	0
DOME		Ground Floor Deck	Unspecified	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
All Walls	765.4	113.94	651.46	0.2	0	False	N/A
Mansard	213.1	11.76	201.34	0.13	0	False	N/A
Ground Floor Deck	62.66	6.13	56.53	0.11	0		N/A
Top Floor	158.87	0	158.87	0.11	0		N/A
Lower Ground Floor	382.22			0.12			N/A
Ground floor	319.56			0.12			N/A
Internal Elements							
Lower GF	78.836						N/A
GF	77.608						N/A
FF	81.778						N/A
2nd F	59.754						N/A
ground	319.56						N/A
first	301.73						N/A
2nd	219.26						N/A
ground	319.56						N/A
first	301.73						N/A
2nd	219.26						N/A
Party Elements							

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

SAP Input

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	13
Number of sides sheltered:	2
Pressure test:	10 (Assessed dwelling is tested)

Main heating system:

Main heating system:	Central heating systems with radiators or underfloor heating Heat pumps Fuel: Electricity Info Source: SAP Tables SAP Table: 204 Air-to-water heat pump (electric) Systems with radiators Pump in heat space: Yes

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2207 Boiler interlock: Yes

Secondary heating system:

Secondary heating system:	None

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 300 litres Cylinder insulation: Measured loss, 1.5kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2009 **Software Version:** Version: 1.5.0.69

Property Address: 7th Amendment

Address : 62, Avenue Road, LONDON, NW8 6HT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Basement	382.22	(1a) x	3.2	(2a) =	1223.1	(3a)
Ground floor	319.56	(1b) x	3.2	(2b) =	1022.59	(3b)
First floor	301.73	(1c) x	3	(2c) =	905.19	(3c)
Second floor	219.26	(1d) x	2.8	(2d) =	613.93	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	1222.770004272464	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		3764.81	(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							13	x 10 =	130	(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) =	130	÷ (5) =	0.03 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			10 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.53 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides on which sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.45 (21)

Infiltration rate modified for monthly wind speed

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

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Monthly average wind speed from Table 7

(22)m=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.61	0.58	0.58	0.51	0.47	0.44	0.42	0.42	0.48	0.51	0.55	0.58

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.69	0.67	0.67	0.63	0.61	0.6	0.59	0.59	0.61	0.63	0.65	0.67

(24d)

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

(25)m=	0.69	0.67	0.67	0.63	0.61	0.6	0.59	0.59	0.61	0.63	0.65	0.67

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			3.09	x	1.8	=	5.562			(26)
Doors Type 2			2.4	x	1.8	=	4.32			(26)
Doors Type 3			2.69	x	1.8	=	4.842			(26)
Windows Type 1			3.356	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 2			3.356	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 3			3.356	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 4			3.356	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 5			2.34	x1/[1/(1.4)+ 0.04]		=	3.1			(27)
Windows Type 6			3.36	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 7			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 8			1.83	x1/[1/(1.4)+ 0.04]		=	2.43			(27)
Windows Type 9			2.4	x1/[1/(1.4)+ 0.04]		=	3.18			(27)
Windows Type 10			2.42	x1/[1/(1.4)+ 0.04]		=	3.21			(27)
Windows Type 11			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)

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Windows Type 12			1.28	x1/[1/(1.4)+ 0.04]	=	1.7				(27)
Windows Type 13			1.37	x1/[1/(1.4)+ 0.04]	=	1.82				(27)
Windows Type 14			2.38	x1/[1/(1.4)+ 0.04]	=	3.16				(27)
Rooflights			6.13	x 1/[1/(2) + 0.04]	=	12.26				(27b)
Floor Type 1			382.22	x	0.12	=	45.87			(28)
Floor Type 2			319.56	x	0.12	=	38.35			(28)
Walls Type1	765.4	113.94	651.46	x	0.2	=	130.29			(29)
Walls Type2	213.1	11.76	201.34	x	0.13	=	26.17			(29)
Roof Type1	62.66	6.13	56.53	x	0.11	=	6.22			(30)
Roof Type2	158.87	0	158.87	x	0.11	=	17.48			(30)
Total area of elements, m²			1901.81002426147							(31)
Internal wall **			78.84							(32c)
Internal wall **			77.61							(32c)
Internal wall **			81.78							(32c)
Internal wall **			59.75							(32c)
Internal floor			319.56							(32d)
Internal floor			301.73							(32d)
Internal floor			219.26							(32d)
Internal ceiling			319.56							(32e)
Internal ceiling			301.73							(32e)
Internal ceiling			219.26							(32e)

** 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) = 446.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 92835.6484510899 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 285.27 (36)

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

Total fabric heat loss (33) + (36) = 731.52 (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=	854.9	829.66	829.66	783.49	755.92	743.1	730.92	730.92	762.57	783.49	805.85	829.66	(38)

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

(39)m=	1586.43	1561.18	1561.18	1515.01	1487.44	1474.62	1462.44	1462.44	1494.1	1515.01	1537.38	1561.18	

Average = Sum(39)$_{1...12}$ /12= 1518.2 (39)

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

(40)m=	1.3	1.28	1.28	1.24	1.22	1.21	1.2	1.2	1.22	1.24	1.26	1.28	

Average = Sum(40)$_{1...12}$ /12= 1.24 (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)

SAP WorkSheet: New dwelling as built

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N: 4.33 (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: 144.29 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	158.72	152.95	147.17	141.4	135.63	129.86	129.86	135.63	141.4	147.17	152.95	158.72	
Total = Sum(44)$_{1...12}$ =													1731.46 (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=	235.94	206.35	212.94	185.64	178.13	153.71	142.44	163.45	165.4	192.76	210.41	228.49	
Total = Sum(45)$_{1...12}$ =													2275.65 (45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	35.39	30.95	31.94	27.85	26.72	23.06	21.37	24.52	24.81	28.91	31.56	34.27	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.5 (47)

Temperature factor from Table 2b: 0.54 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0.81 (49)

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

Cylinder volume (litres) including any solar storage within same: 0 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

Volume factor from Table 2a: 0 (52)

Temperature factor from Table 2b: 0 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) =): 0 (54)

Enter (49) or (54) in (55): 0.81 (55)

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

(56)m=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(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=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(57)

Primary circuit loss (annual) from Table 3: 360 (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=	30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58	(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=	291.62	256.65	268.62	239.53	233.81	207.6	198.12	219.13	219.29	248.44	264.3	284.18	(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=	291.62	256.65	268.62	239.53	233.81	207.6	198.12	219.13	219.29	248.44	264.3	284.18	
											Output from water heater (annual)$_{1...12}$	2931.3	(64)

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

(65)m=	123	108.85	115.35	104.84	103.78	94.22	91.91	98.89	98.11	108.64	113.07	120.52	(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=	259.89	259.89	259.89	259.89	259.89	259.89	259.89	259.89	259.89	259.89	259.89	259.89	(66)

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

(67)m=	265.31	235.65	191.64	145.08	108.45	91.56	98.93	128.6	172.6	219.16	255.79	272.69	(67)

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

(68)m=	1545.57	1561.6	1521.19	1435.15	1326.54	1224.46	1156.27	1140.23	1180.64	1266.68	1375.29	1477.37	(68)

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

(69)m=	65.32	65.32	65.32	65.32	65.32	65.32	65.32	65.32	65.32	65.32	65.32	65.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	(71)

Water heating gains (Table 5)

(72)m=	165.32	161.98	155.04	145.61	139.48	130.86	123.53	132.92	136.26	146.02	157.05	161.99	(72)

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

(73)m=	2138.15	2121.18	2029.82	1887.79	1736.43	1608.83	1540.68	1563.7	1651.46	1793.82	1950.08	2074	(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	2.34	x	11.51	x	0.63	x	0.7	=	16.46	(75)
Northeast 0.9x	0.77	x	3.36	x	11.51	x	0.63	x	0.7	=	35.46	(75)
Northeast 0.9x	0.77	x	1.4	x	11.51	x	0.63	x	0.7	=	9.85	(75)
Northeast 0.9x	0.77	x	1.83	x	11.51	x	0.63	x	0.7	=	12.87	(75)
Northeast 0.9x	0.77	x	2.4	x	11.51	x	0.63	x	0.7	=	8.44	(75)
Northeast 0.9x	0.77	x	2.42	x	11.51	x	0.63	x	0.7	=	17.02	(75)
Northeast 0.9x	0.77	x	1.81	x	11.51	x	0.63	x	0.7	=	6.37	(75)
Northeast 0.9x	0.77	x	2.34	x	23.55	x	0.63	x	0.7	=	33.69	(75)
Northeast 0.9x	0.77	x	3.36	x	23.55	x	0.63	x	0.7	=	72.56	(75)
Northeast 0.9x	0.77	x	1.4	x	23.55	x	0.63	x	0.7	=	20.16	(75)
Northeast 0.9x	0.77	x	1.83	x	23.55	x	0.63	x	0.7	=	26.35	(75)
Northeast 0.9x	0.77	x	2.4	x	23.55	x	0.63	x	0.7	=	17.28	(75)

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Northeast	0.9x	0.77	x	2.42	x	23.55	x	0.63	x	0.7	=	34.84	(75)
Northeast	0.9x	0.77	x	1.81	x	23.55	x	0.63	x	0.7	=	13.03	(75)
Northeast	0.9x	0.77	x	2.34	x	41.13	x	0.63	x	0.7	=	58.82	(75)
Northeast	0.9x	0.77	x	3.36	x	41.13	x	0.63	x	0.7	=	126.69	(75)
Northeast	0.9x	0.77	x	1.4	x	41.13	x	0.63	x	0.7	=	35.19	(75)
Northeast	0.9x	0.77	x	1.83	x	41.13	x	0.63	x	0.7	=	46	(75)
Northeast	0.9x	0.77	x	2.4	x	41.13	x	0.63	x	0.7	=	30.17	(75)
Northeast	0.9x	0.77	x	2.42	x	41.13	x	0.63	x	0.7	=	60.83	(75)
Northeast	0.9x	0.77	x	1.81	x	41.13	x	0.63	x	0.7	=	22.75	(75)
Northeast	0.9x	0.77	x	2.34	x	67.8	x	0.63	x	0.7	=	96.97	(75)
Northeast	0.9x	0.77	x	3.36	x	67.8	x	0.63	x	0.7	=	208.86	(75)
Northeast	0.9x	0.77	x	1.4	x	67.8	x	0.63	x	0.7	=	58.02	(75)
Northeast	0.9x	0.77	x	1.83	x	67.8	x	0.63	x	0.7	=	75.83	(75)
Northeast	0.9x	0.77	x	2.4	x	67.8	x	0.63	x	0.7	=	49.73	(75)
Northeast	0.9x	0.77	x	2.42	x	67.8	x	0.63	x	0.7	=	100.28	(75)
Northeast	0.9x	0.77	x	1.81	x	67.8	x	0.63	x	0.7	=	37.5	(75)
Northeast	0.9x	0.77	x	2.34	x	89.77	x	0.63	x	0.7	=	128.39	(75)
Northeast	0.9x	0.77	x	3.36	x	89.77	x	0.63	x	0.7	=	276.53	(75)
Northeast	0.9x	0.77	x	1.4	x	89.77	x	0.63	x	0.7	=	76.81	(75)
Northeast	0.9x	0.77	x	1.83	x	89.77	x	0.63	x	0.7	=	100.41	(75)
Northeast	0.9x	0.77	x	2.4	x	89.77	x	0.63	x	0.7	=	65.84	(75)
Northeast	0.9x	0.77	x	2.42	x	89.77	x	0.63	x	0.7	=	132.78	(75)
Northeast	0.9x	0.77	x	1.81	x	89.77	x	0.63	x	0.7	=	49.65	(75)
Northeast	0.9x	0.77	x	2.34	x	97.5	x	0.63	x	0.7	=	139.45	(75)
Northeast	0.9x	0.77	x	3.36	x	97.5	x	0.63	x	0.7	=	300.36	(75)
Northeast	0.9x	0.77	x	1.4	x	97.5	x	0.63	x	0.7	=	83.43	(75)
Northeast	0.9x	0.77	x	1.83	x	97.5	x	0.63	x	0.7	=	109.06	(75)
Northeast	0.9x	0.77	x	2.4	x	97.5	x	0.63	x	0.7	=	71.51	(75)
Northeast	0.9x	0.77	x	2.42	x	97.5	x	0.63	x	0.7	=	144.22	(75)
Northeast	0.9x	0.77	x	1.81	x	97.5	x	0.63	x	0.7	=	53.93	(75)
Northeast	0.9x	0.77	x	2.34	x	92.98	x	0.63	x	0.7	=	132.99	(75)
Northeast	0.9x	0.77	x	3.36	x	92.98	x	0.63	x	0.7	=	286.43	(75)
Northeast	0.9x	0.77	x	1.4	x	92.98	x	0.63	x	0.7	=	79.56	(75)
Northeast	0.9x	0.77	x	1.83	x	92.98	x	0.63	x	0.7	=	104	(75)
Northeast	0.9x	0.77	x	2.4	x	92.98	x	0.63	x	0.7	=	68.2	(75)
Northeast	0.9x	0.77	x	2.42	x	92.98	x	0.63	x	0.7	=	137.53	(75)
Northeast	0.9x	0.77	x	1.81	x	92.98	x	0.63	x	0.7	=	51.43	(75)
Northeast	0.9x	0.77	x	2.34	x	75.42	x	0.63	x	0.7	=	107.87	(75)
Northeast	0.9x	0.77	x	3.36	x	75.42	x	0.63	x	0.7	=	232.33	(75)
Northeast	0.9x	0.77	x	1.4	x	75.42	x	0.63	x	0.7	=	64.54	(75)
Northeast	0.9x	0.77	x	1.83	x	75.42	x	0.63	x	0.7	=	84.36	(75)

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Northeast	0.9x	0.77	x	2.4	x	75.42	x	0.63	x	0.7	=	55.32	(75)
Northeast	0.9x	0.77	x	2.42	x	75.42	x	0.63	x	0.7	=	111.56	(75)
Northeast	0.9x	0.77	x	1.81	x	75.42	x	0.63	x	0.7	=	41.72	(75)
Northeast	0.9x	0.77	x	2.34	x	51.24	x	0.63	x	0.7	=	73.29	(75)
Northeast	0.9x	0.77	x	3.36	x	51.24	x	0.63	x	0.7	=	157.86	(75)
Northeast	0.9x	0.77	x	1.4	x	51.24	x	0.63	x	0.7	=	43.85	(75)
Northeast	0.9x	0.77	x	1.83	x	51.24	x	0.63	x	0.7	=	57.32	(75)
Northeast	0.9x	0.77	x	2.4	x	51.24	x	0.63	x	0.7	=	37.59	(75)
Northeast	0.9x	0.77	x	2.42	x	51.24	x	0.63	x	0.7	=	75.8	(75)
Northeast	0.9x	0.77	x	1.81	x	51.24	x	0.63	x	0.7	=	28.35	(75)
Northeast	0.9x	0.77	x	2.34	x	29.6	x	0.63	x	0.7	=	42.33	(75)
Northeast	0.9x	0.77	x	3.36	x	29.6	x	0.63	x	0.7	=	91.18	(75)
Northeast	0.9x	0.77	x	1.4	x	29.6	x	0.63	x	0.7	=	25.33	(75)
Northeast	0.9x	0.77	x	1.83	x	29.6	x	0.63	x	0.7	=	33.11	(75)
Northeast	0.9x	0.77	x	2.4	x	29.6	x	0.63	x	0.7	=	21.71	(75)
Northeast	0.9x	0.77	x	2.42	x	29.6	x	0.63	x	0.7	=	43.78	(75)
Northeast	0.9x	0.77	x	1.81	x	29.6	x	0.63	x	0.7	=	16.37	(75)
Northeast	0.9x	0.77	x	2.34	x	14.52	x	0.63	x	0.7	=	20.77	(75)
Northeast	0.9x	0.77	x	3.36	x	14.52	x	0.63	x	0.7	=	44.75	(75)
Northeast	0.9x	0.77	x	1.4	x	14.52	x	0.63	x	0.7	=	12.43	(75)
Northeast	0.9x	0.77	x	1.83	x	14.52	x	0.63	x	0.7	=	16.25	(75)
Northeast	0.9x	0.77	x	2.4	x	14.52	x	0.63	x	0.7	=	10.65	(75)
Northeast	0.9x	0.77	x	2.42	x	14.52	x	0.63	x	0.7	=	21.48	(75)
Northeast	0.9x	0.77	x	1.81	x	14.52	x	0.63	x	0.7	=	8.03	(75)
Northeast	0.9x	0.77	x	2.34	x	9.36	x	0.63	x	0.7	=	13.39	(75)
Northeast	0.9x	0.77	x	3.36	x	9.36	x	0.63	x	0.7	=	28.84	(75)
Northeast	0.9x	0.77	x	1.4	x	9.36	x	0.63	x	0.7	=	8.01	(75)
Northeast	0.9x	0.77	x	1.83	x	9.36	x	0.63	x	0.7	=	10.47	(75)
Northeast	0.9x	0.77	x	2.4	x	9.36	x	0.63	x	0.7	=	6.87	(75)
Northeast	0.9x	0.77	x	2.42	x	9.36	x	0.63	x	0.7	=	13.85	(75)
Northeast	0.9x	0.77	x	1.81	x	9.36	x	0.63	x	0.7	=	5.18	(75)
Southeast	0.9x	0.77	x	1.28	x	37.39	x	0.63	x	0.7	=	29.25	(77)
Southeast	0.9x	0.77	x	2.38	x	37.39	x	0.63	x	0.7	=	54.39	(77)
Southeast	0.9x	0.77	x	1.28	x	63.74	x	0.63	x	0.7	=	49.86	(77)
Southeast	0.9x	0.77	x	2.38	x	63.74	x	0.63	x	0.7	=	92.72	(77)
Southeast	0.9x	0.77	x	1.28	x	84.22	x	0.63	x	0.7	=	65.89	(77)
Southeast	0.9x	0.77	x	2.38	x	84.22	x	0.63	x	0.7	=	122.51	(77)
Southeast	0.9x	0.77	x	1.28	x	103.49	x	0.63	x	0.7	=	80.97	(77)
Southeast	0.9x	0.77	x	2.38	x	103.49	x	0.63	x	0.7	=	150.55	(77)
Southeast	0.9x	0.77	x	1.28	x	113.34	x	0.63	x	0.7	=	88.67	(77)
Southeast	0.9x	0.77	x	2.38	x	113.34	x	0.63	x	0.7	=	164.87	(77)

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Southeast	0.9x	0.77	x	1.28	x	115.04	x	0.63	x	0.7	=	90.01	(77)
Southeast	0.9x	0.77	x	2.38	x	115.04	x	0.63	x	0.7	=	167.36	(77)
Southeast	0.9x	0.77	x	1.28	x	112.79	x	0.63	x	0.7	=	88.24	(77)
Southeast	0.9x	0.77	x	2.38	x	112.79	x	0.63	x	0.7	=	164.08	(77)
Southeast	0.9x	0.77	x	1.28	x	105.34	x	0.63	x	0.7	=	82.42	(77)
Southeast	0.9x	0.77	x	2.38	x	105.34	x	0.63	x	0.7	=	153.24	(77)
Southeast	0.9x	0.77	x	1.28	x	92.9	x	0.63	x	0.7	=	72.68	(77)
Southeast	0.9x	0.77	x	2.38	x	92.9	x	0.63	x	0.7	=	135.14	(77)
Southeast	0.9x	0.77	x	1.28	x	72.36	x	0.63	x	0.7	=	56.61	(77)
Southeast	0.9x	0.77	x	2.38	x	72.36	x	0.63	x	0.7	=	105.27	(77)
Southeast	0.9x	0.77	x	1.28	x	44.83	x	0.63	x	0.7	=	35.07	(77)
Southeast	0.9x	0.77	x	2.38	x	44.83	x	0.63	x	0.7	=	65.21	(77)
Southeast	0.9x	0.77	x	1.28	x	31.95	x	0.63	x	0.7	=	25	(77)
Southeast	0.9x	0.77	x	2.38	x	31.95	x	0.63	x	0.7	=	46.48	(77)
Southwest	0.9x	0.77	x	3.36	x	37.39		0.63	x	0.7	=	230.08	(79)
Southwest	0.9x	0.77	x	3.36	x	37.39		0.63	x	0.7	=	230.08	(79)
Southwest	0.9x	0.77	x	3.36	x	37.39		0.63	x	0.7	=	230.08	(79)
Southwest	0.9x	0.77	x	3.36	x	37.39		0.63	x	0.7	=	191.73	(79)
Southwest	0.9x	0.77	x	3.36	x	63.74		0.63	x	0.7	=	392.22	(79)
Southwest	0.9x	0.77	x	3.36	x	63.74		0.63	x	0.7	=	392.22	(79)
Southwest	0.9x	0.77	x	3.36	x	63.74		0.63	x	0.7	=	392.22	(79)
Southwest	0.9x	0.77	x	3.36	x	63.74		0.63	x	0.7	=	326.85	(79)
Southwest	0.9x	0.77	x	3.36	x	84.22		0.63	x	0.7	=	518.25	(79)
Southwest	0.9x	0.77	x	3.36	x	84.22		0.63	x	0.7	=	518.25	(79)
Southwest	0.9x	0.77	x	3.36	x	84.22		0.63	x	0.7	=	518.25	(79)
Southwest	0.9x	0.77	x	3.36	x	84.22		0.63	x	0.7	=	431.87	(79)
Southwest	0.9x	0.77	x	3.36	x	103.49		0.63	x	0.7	=	636.85	(79)
Southwest	0.9x	0.77	x	3.36	x	103.49		0.63	x	0.7	=	636.85	(79)
Southwest	0.9x	0.77	x	3.36	x	103.49		0.63	x	0.7	=	636.85	(79)
Southwest	0.9x	0.77	x	3.36	x	103.49		0.63	x	0.7	=	530.71	(79)
Southwest	0.9x	0.77	x	3.36	x	113.34		0.63	x	0.7	=	697.45	(79)
Southwest	0.9x	0.77	x	3.36	x	113.34		0.63	x	0.7	=	697.45	(79)
Southwest	0.9x	0.77	x	3.36	x	113.34		0.63	x	0.7	=	697.45	(79)
Southwest	0.9x	0.77	x	3.36	x	113.34		0.63	x	0.7	=	581.21	(79)
Southwest	0.9x	0.77	x	3.36	x	115.04		0.63	x	0.7	=	707.96	(79)
Southwest	0.9x	0.77	x	3.36	x	115.04		0.63	x	0.7	=	707.96	(79)
Southwest	0.9x	0.77	x	3.36	x	115.04		0.63	x	0.7	=	707.96	(79)
Southwest	0.9x	0.77	x	3.36	x	115.04		0.63	x	0.7	=	589.97	(79)
Southwest	0.9x	0.77	x	3.36	x	112.79		0.63	x	0.7	=	694.1	(79)
Southwest	0.9x	0.77	x	3.36	x	112.79		0.63	x	0.7	=	694.1	(79)
Southwest	0.9x	0.77	x	3.36	x	112.79		0.63	x	0.7	=	694.1	(79)

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Southwest	0.9x	0.77	x	3.36	x	112.79		0.63	x	0.7	=	578.41	(79)
Southwest	0.9x	0.77	x	3.36	x	105.34		0.63	x	0.7	=	648.25	(79)
Southwest	0.9x	0.77	x	3.36	x	105.34		0.63	x	0.7	=	648.25	(79)
Southwest	0.9x	0.77	x	3.36	x	105.34		0.63	x	0.7	=	648.25	(79)
Southwest	0.9x	0.77	x	3.36	x	105.34		0.63	x	0.7	=	540.21	(79)
Southwest	0.9x	0.77	x	3.36	x	92.9		0.63	x	0.7	=	571.67	(79)
Southwest	0.9x	0.77	x	3.36	x	92.9		0.63	x	0.7	=	571.67	(79)
Southwest	0.9x	0.77	x	3.36	x	92.9		0.63	x	0.7	=	571.67	(79)
Southwest	0.9x	0.77	x	3.36	x	92.9		0.63	x	0.7	=	476.39	(79)
Southwest	0.9x	0.77	x	3.36	x	72.36		0.63	x	0.7	=	445.31	(79)
Southwest	0.9x	0.77	x	3.36	x	72.36		0.63	x	0.7	=	445.31	(79)
Southwest	0.9x	0.77	x	3.36	x	72.36		0.63	x	0.7	=	445.31	(79)
Southwest	0.9x	0.77	x	3.36	x	72.36		0.63	x	0.7	=	371.09	(79)
Southwest	0.9x	0.77	x	3.36	x	44.83		0.63	x	0.7	=	275.85	(79)
Southwest	0.9x	0.77	x	3.36	x	44.83		0.63	x	0.7	=	275.85	(79)
Southwest	0.9x	0.77	x	3.36	x	44.83		0.63	x	0.7	=	275.85	(79)
Southwest	0.9x	0.77	x	3.36	x	44.83		0.63	x	0.7	=	229.87	(79)
Southwest	0.9x	0.77	x	3.36	x	31.95		0.63	x	0.7	=	196.61	(79)
Southwest	0.9x	0.77	x	3.36	x	31.95		0.63	x	0.7	=	196.61	(79)
Southwest	0.9x	0.77	x	3.36	x	31.95		0.63	x	0.7	=	196.61	(79)
Southwest	0.9x	0.77	x	3.36	x	31.95		0.63	x	0.7	=	163.84	(79)
Northwest	0.9x	0.77	x	1.37	x	11.51	x	0.63	x	0.7	=	9.64	(81)
Northwest	0.9x	0.77	x	1.37	x	23.55	x	0.63	x	0.7	=	19.72	(81)
Northwest	0.9x	0.77	x	1.37	x	41.13	x	0.63	x	0.7	=	34.44	(81)
Northwest	0.9x	0.77	x	1.37	x	67.8	x	0.63	x	0.7	=	56.77	(81)
Northwest	0.9x	0.77	x	1.37	x	89.77	x	0.63	x	0.7	=	75.17	(81)
Northwest	0.9x	0.77	x	1.37	x	97.5	x	0.63	x	0.7	=	81.65	(81)
Northwest	0.9x	0.77	x	1.37	x	92.98	x	0.63	x	0.7	=	77.86	(81)
Northwest	0.9x	0.77	x	1.37	x	75.42	x	0.63	x	0.7	=	63.15	(81)
Northwest	0.9x	0.77	x	1.37	x	51.24	x	0.63	x	0.7	=	42.91	(81)
Northwest	0.9x	0.77	x	1.37	x	29.6	x	0.63	x	0.7	=	24.79	(81)
Northwest	0.9x	0.77	x	1.37	x	14.52	x	0.63	x	0.7	=	12.16	(81)
Northwest	0.9x	0.77	x	1.37	x	9.36	x	0.63	x	0.7	=	7.84	(81)
Rooflights	0.9x	1	x	6.13	x	26	x	0.63	x	0.7	=	63.26	(82)
Rooflights	0.9x	1	x	6.13	x	54	x	0.63	x	0.7	=	131.38	(82)
Rooflights	0.9x	1	x	6.13	x	94	x	0.63	x	0.7	=	228.7	(82)
Rooflights	0.9x	1	x	6.13	x	150	x	0.63	x	0.7	=	364.95	(82)
Rooflights	0.9x	1	x	6.13	x	190	x	0.63	x	0.7	=	462.27	(82)
Rooflights	0.9x	1	x	6.13	x	201	x	0.63	x	0.7	=	489.03	(82)
Rooflights	0.9x	1	x	6.13	x	194	x	0.63	x	0.7	=	472	(82)
Rooflights	0.9x	1	x	6.13	x	164	x	0.63	x	0.7	=	399.01	(82)

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Rooflights 0.9x	1	x	6.13	x	116	x	0.63	x	0.7	=	282.23	(82)
Rooflights 0.9x	1	x	6.13	x	68	x	0.63	x	0.7	=	165.44	(82)
Rooflights 0.9x	1	x	6.13	x	33	x	0.63	x	0.7	=	80.29	(82)
Rooflights 0.9x	1	x	6.13	x	21	x	0.63	x	0.7	=	51.09	(82)

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

(83)m=	1144.97	2015.08	2818.62	3721.7	4294.97	4443.87	4323.02	3880.45	3198.43	2332.94	1384.52	970.68	(83)

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

(84)m=	3283.12	4136.26	4848.44	5609.49	6031.4	6052.7	5863.71	5444.15	4849.89	4126.76	3334.6	3044.68	(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=	0.99	0.99	0.98	0.96	0.93	0.85	0.73	0.75	0.91	0.97	0.99	1	(86)

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

(87)m=	17.82	18.08	18.56	19.13	19.82	20.39	20.75	20.73	20.2	19.38	18.43	17.91	(87)

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

(88)m=	19.85	19.86	19.86	19.89	19.91	19.92	19.93	19.93	19.91	19.89	19.88	19.86	(88)

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

(89)m=	0.99	0.99	0.98	0.96	0.91	0.8	0.61	0.64	0.88	0.96	0.99	0.99	(89)

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

(90)m=	15.55	15.94	16.65	17.49	18.5	19.29	19.75	19.73	19.04	17.86	16.47	15.69	(90)

fLA = Living area ÷ (4) = 0.04 (91)

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

(92)m=	15.65	16.03	16.73	17.55	18.55	19.34	19.79	19.77	19.09	17.92	16.55	15.78	(92)

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

(93)m=	15.65	16.03	16.73	17.55	18.55	19.34	19.79	19.77	19.09	17.92	16.55	15.78	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.93	0.87	0.77	0.59	0.62	0.84	0.94	0.98	0.99	(94)

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

(95)m=	3238.09	4040.19	4651.84	5220.07	5253.44	4638.79	3480.68	3374.29	4061.81	3886.6	3268.31	3007.6	(95)

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	17681.61	17220.57	15504.1	13412.12	10193.8	6984.18	4226.26	4195.51	7156.9	10788.18	14687.48	16992.57	(97)

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

(98)m=	10745.98	8857.21	8074.08	5898.27	3675.63	0	0	0	0	5134.78	8221.8	10404.82	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 61012.57 (98)

Space heating requirement in kWh/m²/year 49.9 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		175 (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)	10745.98	8857.21	8074.08	5898.27	3675.63	0	0	0	0	5134.78	8221.8	10404.82	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206) (211)	6140.56	5061.26	4613.76	3370.44	2100.36	0	0	0	0	2934.16	4698.17	5945.61	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 34864.33 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } 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)

	291.62	256.65	268.62	239.53	233.81	207.6	198.12	219.13	219.29	248.44	264.3	284.18	

Efficiency of water heater 175 (216)

(217)m=	175	175	175	175	175	175	175	175	175	175	175	175	(217)

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

(219)m=	166.64	146.66	153.5	136.88	133.61	118.63	113.21	125.22	125.31	141.97	151.03	162.39	

Total = Sum(219a)$_{1...12}$ = 1675.03 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		34864.33
Water heating fuel used		1675.03
Electricity for pumps, fans and electric keep-hot		
central heating pump:	130	(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	130 (231)
Electricity for lighting		1874.19 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	11.46 x 0.01 =	3995.45181860046 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	0 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	11.46 x 0.01 =	191.96 (247)
Pumps, fans and electric keep-hot	(231)	11.46 x 0.01 =	14.9 (249)

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

Energy for lighting	(232)	11.46	x 0.01 =	214.78	(250)
Additional standing charges (Table 12)				0	(251)

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

Total energy cost	(245)...(247) + (250)…(254) =			4417.09059294642	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)				0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =			1.63754669355519	(257)
SAP rating (Section 12)				77.1562236249051	(258)

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

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x		0.517	=	18024.86	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Water heating	(219)	x		0.517	=	865.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =					18890.85	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.517	=	67.21	(267)
Electricity for lighting	(232)	x		0.517	=	968.96	(268)
Total CO2, kg/year	sum of (265)…(271) =					19927.01	(272)
CO2 emissions per m²	(272) ÷ (4) =					16.3	(273)
EI rating (section 14)						79	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x		2.92	=	101803.84	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Energy for water heating	(219)	x		2.92	=	4891.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =					106694.92	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		2.92	=	379.6	(267)
Electricity for lighting	(232)	x		0	=	5472.65	(268)
'Total Primary Energy	sum of (265)…(271) =					112547.16	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =					92.04	(273)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2009 **Software Version:** Version: 1.5.0.69

Property Address: 7th Amendment

Address : 62, Avenue Road, LONDON, NW8 6HT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Basement	382.22	(1a) x	3.2	(2a) =	1223.1	(3a)
Ground floor	319.56	(1b) x	3.2	(2b) =	1022.59	(3b)
First floor	301.73	(1c) x	3	(2c) =	905.19	(3c)
Second floor	219.26	(1d) x	2.8	(2d) =	613.93	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	1222.770004272464	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		3764.81	(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							13	x 10 =	130	(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) = 130	÷ (5) =	0.03 (8)

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

Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		10 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.53 (18)

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

Number of sides on which sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.45 (21)

Infiltration rate modified for monthly wind speed

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

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Monthly average wind speed from Table 7

(22)m=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.61	0.58	0.58	0.51	0.47	0.44	0.42	0.42	0.48	0.51	0.55	0.58

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.69	0.67	0.67	0.63	0.61	0.6	0.59	0.59	0.61	0.63	0.65	0.67

(24d)

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

(25)m=	0.69	0.67	0.67	0.63	0.61	0.6	0.59	0.59	0.61	0.63	0.65	0.67

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			3.09	x	1.8	=	5.562			(26)
Doors Type 2			2.4	x	1.8	=	4.32			(26)
Doors Type 3			2.69	x	1.8	=	4.842			(26)
Windows Type 1			3.356	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 2			3.356	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 3			3.356	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 4			3.356	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 5			2.34	x1/[1/(1.4)+ 0.04]		=	3.1			(27)
Windows Type 6			3.36	x1/[1/(1.4)+ 0.04]		=	4.45			(27)
Windows Type 7			1.4	x1/[1/(1.4)+ 0.04]		=	1.86			(27)
Windows Type 8			1.83	x1/[1/(1.4)+ 0.04]		=	2.43			(27)
Windows Type 9			2.4	x1/[1/(1.4)+ 0.04]		=	3.18			(27)
Windows Type 10			2.42	x1/[1/(1.4)+ 0.04]		=	3.21			(27)
Windows Type 11			1.81	x1/[1/(1.4)+ 0.04]		=	2.4			(27)

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Windows Type 12			1.28	x1/[1/(1.4)+ 0.04]	=	1.7				(27)
Windows Type 13			1.37	x1/[1/(1.4)+ 0.04]	=	1.82				(27)
Windows Type 14			2.38	x1/[1/(1.4)+ 0.04]	=	3.16				(27)
Rooflights			6.13	x 1/[1/(2) + 0.04]	=	12.26				(27b)
Floor Type 1			382.22	x	0.12	=	45.87			(28)
Floor Type 2			319.56	x	0.12	=	38.35			(28)
Walls Type1	765.4	113.94	651.46	x	0.2	=	130.29			(29)
Walls Type2	213.1	11.76	201.34	x	0.13	=	26.17			(29)
Roof Type1	62.66	6.13	56.53	x	0.11	=	6.22			(30)
Roof Type2	158.87	0	158.87	x	0.11	=	17.48			(30)
Total area of elements, m²			1901.81002426147							(31)
Internal wall **			78.84							(32c)
Internal wall **			77.61							(32c)
Internal wall **			81.78							(32c)
Internal wall **			59.75							(32c)
Internal floor			319.56							(32d)
Internal floor			301.73							(32d)
Internal floor			219.26							(32d)
Internal ceiling			319.56							(32e)
Internal ceiling			301.73							(32e)
Internal ceiling			219.26							(32e)

** 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) = 446.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 92835.6484510899 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 285.27 (36)

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

Total fabric heat loss (33) + (36) = 731.52 (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=	854.9	829.66	829.66	783.49	755.92	743.1	730.92	730.92	762.57	783.49	805.85	829.66	(38)

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

(39)m=	1586.43	1561.18	1561.18	1515.01	1487.44	1474.62	1462.44	1462.44	1494.1	1515.01	1537.38	1561.18	

Average = Sum(39)$_{1...12}$ /12= 1518.2 (39)

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

(40)m=	1.3	1.28	1.28	1.24	1.22	1.21	1.2	1.2	1.22	1.24	1.26	1.28	

Average = Sum(40)$_{1...12}$ /12= 1.24 (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 as built

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 4.33 (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) + 36 144.29 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	158.72	152.95	147.17	141.4	135.63	129.86	129.86	135.63	141.4	147.17	152.95	158.72	
Total = Sum(44)$_{1...12}$ =													1731.46 (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=	235.94	206.35	212.94	185.64	178.13	153.71	142.44	163.45	165.4	192.76	210.41	228.49	
Total = Sum(45)$_{1...12}$ =													2275.65 (45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	35.39	30.95	31.94	27.85	26.72	23.06	21.37	24.52	24.81	28.91	31.56	34.27	(46)

Water storage loss:
a) If manufacturer's declared loss factor is known (kWh/day): 1.5 (47)
Temperature factor from Table 2b 0.54 (48)
Energy lost from water storage, kWh/year (47) x (48) = 0.81 (49)
If manufacturer's declared cylinder loss factor is not known:
Cylinder volume (litres) including any solar storage within same 0 (50)
If community heating and no tank in dwelling, enter 110 litres in box (50)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)
Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)
Volume factor from Table 2a 0 (52)
Temperature factor from Table 2b 0 (53)
Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 0 (54)
Enter (49) or (54) in (55) 0.81 (55)
Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(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=	25.11	22.68	25.11	24.3	25.11	24.3	25.11	25.11	24.3	25.11	24.3	25.11	(57)

Primary circuit loss (annual) from Table 3 360 (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=	30.58	27.62	30.58	29.59	30.58	29.59	30.58	30.58	29.59	30.58	29.59	30.58	(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=	291.62	256.65	268.62	239.53	233.81	207.6	198.12	219.13	219.29	248.44	264.3	284.18	(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=	291.62	256.65	268.62	239.53	233.81	207.6	198.12	219.13	219.29	248.44	264.3	284.18	
											Output from water heater (annual)$_{1...12}$	2931.3	(64)

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

(65)m=	123	108.85	115.35	104.84	103.78	94.22	91.91	98.89	98.11	108.64	113.07	120.52	(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=	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	(66)

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

(67)m=	106.12	94.26	76.66	58.03	43.38	36.62	39.57	51.44	69.04	87.66	102.32	109.07	(67)

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

(68)m=	1035.53	1046.28	1019.2	961.55	888.78	820.39	774.7	763.95	791.03	848.68	921.45	989.84	(68)

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

(69)m=	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	(71)

Water heating gains (Table 5)

(72)m=	165.32	161.98	155.04	145.61	139.48	130.86	123.53	132.92	136.26	146.02	157.05	161.99	(72)

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

(73)m=	1404.95	1400.48	1348.87	1263.16	1169.62	1085.85	1035.78	1046.29	1094.31	1180.34	1278.78	1358.88	(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	2.34	x	11.51	x	0.63	x	0.7	=	16.46	(75)
Northeast 0.9x	0.77	x	3.36	x	11.51	x	0.63	x	0.7	=	35.46	(75)
Northeast 0.9x	0.77	x	1.4	x	11.51	x	0.63	x	0.7	=	9.85	(75)
Northeast 0.9x	0.77	x	1.83	x	11.51	x	0.63	x	0.7	=	12.87	(75)
Northeast 0.9x	0.77	x	2.4	x	11.51	x	0.63	x	0.7	=	8.44	(75)
Northeast 0.9x	0.77	x	2.42	x	11.51	x	0.63	x	0.7	=	17.02	(75)
Northeast 0.9x	0.77	x	1.81	x	11.51	x	0.63	x	0.7	=	6.37	(75)
Northeast 0.9x	0.77	x	2.34	x	23.55	x	0.63	x	0.7	=	33.69	(75)
Northeast 0.9x	0.77	x	3.36	x	23.55	x	0.63	x	0.7	=	72.56	(75)
Northeast 0.9x	0.77	x	1.4	x	23.55	x	0.63	x	0.7	=	20.16	(75)
Northeast 0.9x	0.77	x	1.83	x	23.55	x	0.63	x	0.7	=	26.35	(75)
Northeast 0.9x	0.77	x	2.4	x	23.55	x	0.63	x	0.7	=	17.28	(75)

DER WorkSheet: New dwelling as built

Northeast	0.9x	0.77	x	2.42	x	23.55	x	0.63	x	0.7	=	34.84	(75)
Northeast	0.9x	0.77	x	1.81	x	23.55	x	0.63	x	0.7	=	13.03	(75)
Northeast	0.9x	0.77	x	2.34	x	41.13	x	0.63	x	0.7	=	58.82	(75)
Northeast	0.9x	0.77	x	3.36	x	41.13	x	0.63	x	0.7	=	126.69	(75)
Northeast	0.9x	0.77	x	1.4	x	41.13	x	0.63	x	0.7	=	35.19	(75)
Northeast	0.9x	0.77	x	1.83	x	41.13	x	0.63	x	0.7	=	46	(75)
Northeast	0.9x	0.77	x	2.4	x	41.13	x	0.63	x	0.7	=	30.17	(75)
Northeast	0.9x	0.77	x	2.42	x	41.13	x	0.63	x	0.7	=	60.83	(75)
Northeast	0.9x	0.77	x	1.81	x	41.13	x	0.63	x	0.7	=	22.75	(75)
Northeast	0.9x	0.77	x	2.34	x	67.8	x	0.63	x	0.7	=	96.97	(75)
Northeast	0.9x	0.77	x	3.36	x	67.8	x	0.63	x	0.7	=	208.86	(75)
Northeast	0.9x	0.77	x	1.4	x	67.8	x	0.63	x	0.7	=	58.02	(75)
Northeast	0.9x	0.77	x	1.83	x	67.8	x	0.63	x	0.7	=	75.83	(75)
Northeast	0.9x	0.77	x	2.4	x	67.8	x	0.63	x	0.7	=	49.73	(75)
Northeast	0.9x	0.77	x	2.42	x	67.8	x	0.63	x	0.7	=	100.28	(75)
Northeast	0.9x	0.77	x	1.81	x	67.8	x	0.63	x	0.7	=	37.5	(75)
Northeast	0.9x	0.77	x	2.34	x	89.77	x	0.63	x	0.7	=	128.39	(75)
Northeast	0.9x	0.77	x	3.36	x	89.77	x	0.63	x	0.7	=	276.53	(75)
Northeast	0.9x	0.77	x	1.4	x	89.77	x	0.63	x	0.7	=	76.81	(75)
Northeast	0.9x	0.77	x	1.83	x	89.77	x	0.63	x	0.7	=	100.41	(75)
Northeast	0.9x	0.77	x	2.4	x	89.77	x	0.63	x	0.7	=	65.84	(75)
Northeast	0.9x	0.77	x	2.42	x	89.77	x	0.63	x	0.7	=	132.78	(75)
Northeast	0.9x	0.77	x	1.81	x	89.77	x	0.63	x	0.7	=	49.65	(75)
Northeast	0.9x	0.77	x	2.34	x	97.5	x	0.63	x	0.7	=	139.45	(75)
Northeast	0.9x	0.77	x	3.36	x	97.5	x	0.63	x	0.7	=	300.36	(75)
Northeast	0.9x	0.77	x	1.4	x	97.5	x	0.63	x	0.7	=	83.43	(75)
Northeast	0.9x	0.77	x	1.83	x	97.5	x	0.63	x	0.7	=	109.06	(75)
Northeast	0.9x	0.77	x	2.4	x	97.5	x	0.63	x	0.7	=	71.51	(75)
Northeast	0.9x	0.77	x	2.42	x	97.5	x	0.63	x	0.7	=	144.22	(75)
Northeast	0.9x	0.77	x	1.81	x	97.5	x	0.63	x	0.7	=	53.93	(75)
Northeast	0.9x	0.77	x	2.34	x	92.98	x	0.63	x	0.7	=	132.99	(75)
Northeast	0.9x	0.77	x	3.36	x	92.98	x	0.63	x	0.7	=	286.43	(75)
Northeast	0.9x	0.77	x	1.4	x	92.98	x	0.63	x	0.7	=	79.56	(75)
Northeast	0.9x	0.77	x	1.83	x	92.98	x	0.63	x	0.7	=	104	(75)
Northeast	0.9x	0.77	x	2.4	x	92.98	x	0.63	x	0.7	=	68.2	(75)
Northeast	0.9x	0.77	x	2.42	x	92.98	x	0.63	x	0.7	=	137.53	(75)
Northeast	0.9x	0.77	x	1.81	x	92.98	x	0.63	x	0.7	=	51.43	(75)
Northeast	0.9x	0.77	x	2.34	x	75.42	x	0.63	x	0.7	=	107.87	(75)
Northeast	0.9x	0.77	x	3.36	x	75.42	x	0.63	x	0.7	=	232.33	(75)
Northeast	0.9x	0.77	x	1.4	x	75.42	x	0.63	x	0.7	=	64.54	(75)
Northeast	0.9x	0.77	x	1.83	x	75.42	x	0.63	x	0.7	=	84.36	(75)

DER WorkSheet: New dwelling as built

Northeast	0.9x	0.77	x	2.4	x	75.42	x	0.63	x	0.7	=	55.32	(75)
Northeast	0.9x	0.77	x	2.42	x	75.42	x	0.63	x	0.7	=	111.56	(75)
Northeast	0.9x	0.77	x	1.81	x	75.42	x	0.63	x	0.7	=	41.72	(75)
Northeast	0.9x	0.77	x	2.34	x	51.24	x	0.63	x	0.7	=	73.29	(75)
Northeast	0.9x	0.77	x	3.36	x	51.24	x	0.63	x	0.7	=	157.86	(75)
Northeast	0.9x	0.77	x	1.4	x	51.24	x	0.63	x	0.7	=	43.85	(75)
Northeast	0.9x	0.77	x	1.83	x	51.24	x	0.63	x	0.7	=	57.32	(75)
Northeast	0.9x	0.77	x	2.4	x	51.24	x	0.63	x	0.7	=	37.59	(75)
Northeast	0.9x	0.77	x	2.42	x	51.24	x	0.63	x	0.7	=	75.8	(75)
Northeast	0.9x	0.77	x	1.81	x	51.24	x	0.63	x	0.7	=	28.35	(75)
Northeast	0.9x	0.77	x	2.34	x	29.6	x	0.63	x	0.7	=	42.33	(75)
Northeast	0.9x	0.77	x	3.36	x	29.6	x	0.63	x	0.7	=	91.18	(75)
Northeast	0.9x	0.77	x	1.4	x	29.6	x	0.63	x	0.7	=	25.33	(75)
Northeast	0.9x	0.77	x	1.83	x	29.6	x	0.63	x	0.7	=	33.11	(75)
Northeast	0.9x	0.77	x	2.4	x	29.6	x	0.63	x	0.7	=	21.71	(75)
Northeast	0.9x	0.77	x	2.42	x	29.6	x	0.63	x	0.7	=	43.78	(75)
Northeast	0.9x	0.77	x	1.81	x	29.6	x	0.63	x	0.7	=	16.37	(75)
Northeast	0.9x	0.77	x	2.34	x	14.52	x	0.63	x	0.7	=	20.77	(75)
Northeast	0.9x	0.77	x	3.36	x	14.52	x	0.63	x	0.7	=	44.75	(75)
Northeast	0.9x	0.77	x	1.4	x	14.52	x	0.63	x	0.7	=	12.43	(75)
Northeast	0.9x	0.77	x	1.83	x	14.52	x	0.63	x	0.7	=	16.25	(75)
Northeast	0.9x	0.77	x	2.4	x	14.52	x	0.63	x	0.7	=	10.65	(75)
Northeast	0.9x	0.77	x	2.42	x	14.52	x	0.63	x	0.7	=	21.48	(75)
Northeast	0.9x	0.77	x	1.81	x	14.52	x	0.63	x	0.7	=	8.03	(75)
Northeast	0.9x	0.77	x	2.34	x	9.36	x	0.63	x	0.7	=	13.39	(75)
Northeast	0.9x	0.77	x	3.36	x	9.36	x	0.63	x	0.7	=	28.84	(75)
Northeast	0.9x	0.77	x	1.4	x	9.36	x	0.63	x	0.7	=	8.01	(75)
Northeast	0.9x	0.77	x	1.83	x	9.36	x	0.63	x	0.7	=	10.47	(75)
Northeast	0.9x	0.77	x	2.4	x	9.36	x	0.63	x	0.7	=	6.87	(75)
Northeast	0.9x	0.77	x	2.42	x	9.36	x	0.63	x	0.7	=	13.85	(75)
Northeast	0.9x	0.77	x	1.81	x	9.36	x	0.63	x	0.7	=	5.18	(75)
Southeast	0.9x	0.77	x	1.28	x	37.39	x	0.63	x	0.7	=	29.25	(77)
Southeast	0.9x	0.77	x	2.38	x	37.39	x	0.63	x	0.7	=	54.39	(77)
Southeast	0.9x	0.77	x	1.28	x	63.74	x	0.63	x	0.7	=	49.86	(77)
Southeast	0.9x	0.77	x	2.38	x	63.74	x	0.63	x	0.7	=	92.72	(77)
Southeast	0.9x	0.77	x	1.28	x	84.22	x	0.63	x	0.7	=	65.89	(77)
Southeast	0.9x	0.77	x	2.38	x	84.22	x	0.63	x	0.7	=	122.51	(77)
Southeast	0.9x	0.77	x	1.28	x	103.49	x	0.63	x	0.7	=	80.97	(77)
Southeast	0.9x	0.77	x	2.38	x	103.49	x	0.63	x	0.7	=	150.55	(77)
Southeast	0.9x	0.77	x	1.28	x	113.34	x	0.63	x	0.7	=	88.67	(77)
Southeast	0.9x	0.77	x	2.38	x	113.34	x	0.63	x	0.7	=	164.87	(77)

DER WorkSheet: New dwelling as built

Southeast	0.9x	0.77	x	1.28	x	115.04	x	0.63	x	0.7	=	90.01	(77)
Southeast	0.9x	0.77	x	2.38	x	115.04	x	0.63	x	0.7	=	167.36	(77)
Southeast	0.9x	0.77	x	1.28	x	112.79	x	0.63	x	0.7	=	88.24	(77)
Southeast	0.9x	0.77	x	2.38	x	112.79	x	0.63	x	0.7	=	164.08	(77)
Southeast	0.9x	0.77	x	1.28	x	105.34	x	0.63	x	0.7	=	82.42	(77)
Southeast	0.9x	0.77	x	2.38	x	105.34	x	0.63	x	0.7	=	153.24	(77)
Southeast	0.9x	0.77	x	1.28	x	92.9	x	0.63	x	0.7	=	72.68	(77)
Southeast	0.9x	0.77	x	2.38	x	92.9	x	0.63	x	0.7	=	135.14	(77)
Southeast	0.9x	0.77	x	1.28	x	72.36	x	0.63	x	0.7	=	56.61	(77)
Southeast	0.9x	0.77	x	2.38	x	72.36	x	0.63	x	0.7	=	105.27	(77)
Southeast	0.9x	0.77	x	1.28	x	44.83	x	0.63	x	0.7	=	35.07	(77)
Southeast	0.9x	0.77	x	2.38	x	44.83	x	0.63	x	0.7	=	65.21	(77)
Southeast	0.9x	0.77	x	1.28	x	31.95	x	0.63	x	0.7	=	25	(77)
Southeast	0.9x	0.77	x	2.38	x	31.95	x	0.63	x	0.7	=	46.48	(77)
Southwest	0.9x	0.77	x	3.36	x	37.39		0.63	x	0.7	=	230.08	(79)
Southwest	0.9x	0.77	x	3.36	x	37.39		0.63	x	0.7	=	230.08	(79)
Southwest	0.9x	0.77	x	3.36	x	37.39		0.63	x	0.7	=	230.08	(79)
Southwest	0.9x	0.77	x	3.36	x	37.39		0.63	x	0.7	=	191.73	(79)
Southwest	0.9x	0.77	x	3.36	x	63.74		0.63	x	0.7	=	392.22	(79)
Southwest	0.9x	0.77	x	3.36	x	63.74		0.63	x	0.7	=	392.22	(79)
Southwest	0.9x	0.77	x	3.36	x	63.74		0.63	x	0.7	=	392.22	(79)
Southwest	0.9x	0.77	x	3.36	x	63.74		0.63	x	0.7	=	326.85	(79)
Southwest	0.9x	0.77	x	3.36	x	84.22		0.63	x	0.7	=	518.25	(79)
Southwest	0.9x	0.77	x	3.36	x	84.22		0.63	x	0.7	=	518.25	(79)
Southwest	0.9x	0.77	x	3.36	x	84.22		0.63	x	0.7	=	518.25	(79)
Southwest	0.9x	0.77	x	3.36	x	84.22		0.63	x	0.7	=	431.87	(79)
Southwest	0.9x	0.77	x	3.36	x	103.49		0.63	x	0.7	=	636.85	(79)
Southwest	0.9x	0.77	x	3.36	x	103.49		0.63	x	0.7	=	636.85	(79)
Southwest	0.9x	0.77	x	3.36	x	103.49		0.63	x	0.7	=	636.85	(79)
Southwest	0.9x	0.77	x	3.36	x	103.49		0.63	x	0.7	=	530.71	(79)
Southwest	0.9x	0.77	x	3.36	x	113.34		0.63	x	0.7	=	697.45	(79)
Southwest	0.9x	0.77	x	3.36	x	113.34		0.63	x	0.7	=	697.45	(79)
Southwest	0.9x	0.77	x	3.36	x	113.34		0.63	x	0.7	=	697.45	(79)
Southwest	0.9x	0.77	x	3.36	x	113.34		0.63	x	0.7	=	581.21	(79)
Southwest	0.9x	0.77	x	3.36	x	115.04		0.63	x	0.7	=	707.96	(79)
Southwest	0.9x	0.77	x	3.36	x	115.04		0.63	x	0.7	=	707.96	(79)
Southwest	0.9x	0.77	x	3.36	x	115.04		0.63	x	0.7	=	707.96	(79)
Southwest	0.9x	0.77	x	3.36	x	115.04		0.63	x	0.7	=	589.97	(79)
Southwest	0.9x	0.77	x	3.36	x	112.79		0.63	x	0.7	=	694.1	(79)
Southwest	0.9x	0.77	x	3.36	x	112.79		0.63	x	0.7	=	694.1	(79)
Southwest	0.9x	0.77	x	3.36	x	112.79		0.63	x	0.7	=	694.1	(79)

DER WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	3.36	x	112.79		0.63	x	0.7	=	578.41	(79)
Southwest	0.9x	0.77	x	3.36	x	105.34		0.63	x	0.7	=	648.25	(79)
Southwest	0.9x	0.77	x	3.36	x	105.34		0.63	x	0.7	=	648.25	(79)
Southwest	0.9x	0.77	x	3.36	x	105.34		0.63	x	0.7	=	648.25	(79)
Southwest	0.9x	0.77	x	3.36	x	105.34		0.63	x	0.7	=	540.21	(79)
Southwest	0.9x	0.77	x	3.36	x	92.9		0.63	x	0.7	=	571.67	(79)
Southwest	0.9x	0.77	x	3.36	x	92.9		0.63	x	0.7	=	571.67	(79)
Southwest	0.9x	0.77	x	3.36	x	92.9		0.63	x	0.7	=	571.67	(79)
Southwest	0.9x	0.77	x	3.36	x	92.9		0.63	x	0.7	=	476.39	(79)
Southwest	0.9x	0.77	x	3.36	x	72.36		0.63	x	0.7	=	445.31	(79)
Southwest	0.9x	0.77	x	3.36	x	72.36		0.63	x	0.7	=	445.31	(79)
Southwest	0.9x	0.77	x	3.36	x	72.36		0.63	x	0.7	=	445.31	(79)
Southwest	0.9x	0.77	x	3.36	x	72.36		0.63	x	0.7	=	371.09	(79)
Southwest	0.9x	0.77	x	3.36	x	44.83		0.63	x	0.7	=	275.85	(79)
Southwest	0.9x	0.77	x	3.36	x	44.83		0.63	x	0.7	=	275.85	(79)
Southwest	0.9x	0.77	x	3.36	x	44.83		0.63	x	0.7	=	275.85	(79)
Southwest	0.9x	0.77	x	3.36	x	44.83		0.63	x	0.7	=	229.87	(79)
Southwest	0.9x	0.77	x	3.36	x	31.95		0.63	x	0.7	=	196.61	(79)
Southwest	0.9x	0.77	x	3.36	x	31.95		0.63	x	0.7	=	196.61	(79)
Southwest	0.9x	0.77	x	3.36	x	31.95		0.63	x	0.7	=	196.61	(79)
Southwest	0.9x	0.77	x	3.36	x	31.95		0.63	x	0.7	=	163.84	(79)
Northwest	0.9x	0.77	x	1.37	x	11.51	x	0.63	x	0.7	=	9.64	(81)
Northwest	0.9x	0.77	x	1.37	x	23.55	x	0.63	x	0.7	=	19.72	(81)
Northwest	0.9x	0.77	x	1.37	x	41.13	x	0.63	x	0.7	=	34.44	(81)
Northwest	0.9x	0.77	x	1.37	x	67.8	x	0.63	x	0.7	=	56.77	(81)
Northwest	0.9x	0.77	x	1.37	x	89.77	x	0.63	x	0.7	=	75.17	(81)
Northwest	0.9x	0.77	x	1.37	x	97.5	x	0.63	x	0.7	=	81.65	(81)
Northwest	0.9x	0.77	x	1.37	x	92.98	x	0.63	x	0.7	=	77.86	(81)
Northwest	0.9x	0.77	x	1.37	x	75.42	x	0.63	x	0.7	=	63.15	(81)
Northwest	0.9x	0.77	x	1.37	x	51.24	x	0.63	x	0.7	=	42.91	(81)
Northwest	0.9x	0.77	x	1.37	x	29.6	x	0.63	x	0.7	=	24.79	(81)
Northwest	0.9x	0.77	x	1.37	x	14.52	x	0.63	x	0.7	=	12.16	(81)
Northwest	0.9x	0.77	x	1.37	x	9.36	x	0.63	x	0.7	=	7.84	(81)
Rooflights	0.9x	1	x	6.13	x	26	x	0.63	x	0.7	=	63.26	(82)
Rooflights	0.9x	1	x	6.13	x	54	x	0.63	x	0.7	=	131.38	(82)
Rooflights	0.9x	1	x	6.13	x	94	x	0.63	x	0.7	=	228.7	(82)
Rooflights	0.9x	1	x	6.13	x	150	x	0.63	x	0.7	=	364.95	(82)
Rooflights	0.9x	1	x	6.13	x	190	x	0.63	x	0.7	=	462.27	(82)
Rooflights	0.9x	1	x	6.13	x	201	x	0.63	x	0.7	=	489.03	(82)
Rooflights	0.9x	1	x	6.13	x	194	x	0.63	x	0.7	=	472	(82)
Rooflights	0.9x	1	x	6.13	x	164	x	0.63	x	0.7	=	399.01	(82)

DER WorkSheet: New dwelling as built

Rooflights 0.9x	1	x	6.13	x	116	x	0.63	x	0.7	=	282.23	(82)
Rooflights 0.9x	1	x	6.13	x	68	x	0.63	x	0.7	=	165.44	(82)
Rooflights 0.9x	1	x	6.13	x	33	x	0.63	x	0.7	=	80.29	(82)
Rooflights 0.9x	1	x	6.13	x	21	x	0.63	x	0.7	=	51.09	(82)

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

(83)m=	1144.97	2015.08	2818.62	3721.7	4294.97	4443.87	4323.02	3880.45	3198.43	2332.94	1384.52	970.68	(83)

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

(84)m=	2549.92	3415.57	4167.49	4984.86	5464.59	5529.72	5358.8	4926.74	4292.74	3513.28	2663.3	2329.56	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.97	0.94	0.87	0.76	0.78	0.93	0.98	1	1	(86)

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

(87)m=	17.71	17.98	18.47	19.05	19.76	20.34	20.72	20.69	20.14	19.3	18.34	17.81	(87)

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

(88)m=	19.85	19.86	19.86	19.89	19.91	19.92	19.93	19.93	19.91	19.89	19.88	19.86	(88)

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

(89)m=	1	0.99	0.98	0.97	0.92	0.83	0.65	0.68	0.9	0.98	0.99	1	(89)

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

(90)m=	15.41	15.8	16.52	17.37	18.41	19.23	19.72	19.7	18.96	17.74	16.34	15.55	(90)

fLA = Living area ÷ (4) = 0.04 (91)

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

(92)m=	15.5	15.89	16.6	17.44	18.46	19.28	19.76	19.74	19.01	17.81	16.42	15.64	(92)

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

(93)m=	15.5	15.89	16.6	17.44	18.46	19.28	19.76	19.74	19.01	17.81	16.42	15.64	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.97	0.94	0.89	0.79	0.63	0.65	0.86	0.96	0.99	0.99	(94)

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

(95)m=	2529.46	3361.88	4040.87	4703.9	4858.72	4375.5	3351.01	3223.86	3707.06	3361.09	2630.21	2313.63	(95)

Monthly average external temperature from Table 8

(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	17451.8	17000.19	15302.26	13241.22	10062.46	6899.11	4188.72	4151.17	7038.74	10615.55	14482.85	16770.01	(97)

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

(98)m=	11102.23	9164.94	8378.47	6146.86	3871.58	0	0	0	0	5397.32	8533.9	10755.54	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 63350.85 (98)

Space heating requirement in kWh/m²/year 51.81 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		175 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)													kWh/year
	11102.23	9164.94	8378.47	6146.86	3871.58	0	0	0	0	5397.32	8533.9	10755.54	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	6344.13	5237.11	4787.7	3512.49	2212.33	0	0	0	0	3084.18	4876.51	6146.02	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 36200.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } 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)

	291.62	256.65	268.62	239.53	233.81	207.6	198.12	219.13	219.29	248.44	264.3	284.18	

Efficiency of water heater 175 (216)

(217)m=	175	175	175	175	175	175	175	175	175	175	175	175	(217)

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

(219)m=	166.64	146.66	153.5	136.88	133.61	118.63	113.21	125.22	125.31	141.97	151.03	162.39	

Total = Sum(219a)$_{1...12}$ = 1675.03 (219)

Annual totals **kWh/year** **kWh/year**

Space heating fuel used, main system 1		36200.49
Water heating fuel used		1675.03
Electricity for pumps, fans and electric keep-hot		
central heating pump:	130	(230c)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	130 (231)
Electricity for lighting		1874.19 (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		0.517	=	18715.65	(261)
Space heating (secondary)	(215) x		0	=	0	(263)
Water heating	(219) x		0.517	=	865.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				19581.64	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.517	=	67.21	(267)

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Electricity for lighting	(232) x	0.517	=	968.96	(268)
Total CO2, kg/year		sum of (265)…(271) =		20617.81	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		16.86	(273)
EI rating (section 14)				78	(274)

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User Details:

Assessor Name: **Stroma Number:**

Software Name: Stroma FSAP 2009 **Software Version:** Version: 1.5.0.69

Property Address: 7th Amendment

Address : 62, Avenue Road, LONDON, NW8 6HT

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Basement	382.22	(1a) x	3.2	(2a) =	1223.1	(3a)
Ground floor	319.56	(1b) x	3.2	(2b) =	1022.59	(3b)
First floor	301.73	(1c) x	3	(2c) =	905.19	(3c)
Second floor	219.26	(1d) x	2.8	(2d) =	613.93	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	1222.77	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		3764.81	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.01 (8)

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

Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		10 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.51 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used		
Number of sides on which sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.43 (21)

Infiltration rate modified for monthly wind speed

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

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Monthly average wind speed from Table 7

(22)m=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.58	0.55	0.55	0.49	0.44	0.42	0.4	0.4	0.45	0.49	0.52	0.55

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=	0.67	0.65	0.65	0.62	0.6	0.59	0.58	0.58	0.6	0.62	0.63	0.65

(24d)

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

(25)m=	0.67	0.65	0.65	0.62	0.6	0.59	0.58	0.58	0.6	0.62	0.63	0.65

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.85	x	2	=	3.7			(26)
Windows			303.8425	x	1/[1/(2)+ 0.04]	=	562.67			(27)
Floor Type 1			382.22	x	0.25	=	95.56			(28)
Floor Type 2			319.56	x	0.25	=	79.89			(28)
Walls	978.5	305.69	672.81	x	0.35	=	235.48			(29)
Roof Type1	62.66	0	62.66	x	0.16	=	10.03			(30)
Roof Type2	158.87	0	158.87	x	0.16	=	25.42			(30)
Total area of elements, m²			1901.81							(31)
Internal wall **			78.84							(32c)
Internal wall **			77.61							(32c)
Internal wall **			81.78							(32c)
Internal wall **			59.75							(32c)
Internal floor			319.56							(32d)
Internal floor			301.73							(32d)

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Internal floor	219.26			(32d)
Internal ceiling	319.56			(32e)
Internal ceiling	301.73			(32e)
Internal ceiling	219.26			(32e)

** 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) = 1012.74 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 80003.904 (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 209.2 (36)

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

Total fabric heat loss (33) + (36) = 1221.94 (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=	832.25	809.45	809.45	767.76	742.87	731.28	720.28	720.28	748.87	767.76	787.96	809.45	(38)

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

(39)m=	2054.2	2031.4	2031.4	1989.71	1964.81	1953.23	1942.23	1942.23	1970.82	1989.71	2009.9	2031.4	

Average = Sum(39)$_{1...12}$ /12= 1992.58 (39)

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

(40)m=	1.68	1.66	1.66	1.63	1.61	1.6	1.59	1.59	1.61	1.63	1.64	1.66	

Average = Sum(40)$_{1...12}$ /12= 1.63 (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 4.33 (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) + 36 144.29 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	158.72	152.95	147.17	141.4	135.63	129.86	129.86	135.63	141.4	147.17	152.95	158.72	

Total = Sum(44)$_{1...12}$ = 1731.46 (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=	235.94	206.35	212.94	185.64	178.13	153.71	142.44	163.45	165.4	192.76	210.41	228.49	

Total = Sum(45)$_{1...12}$ = 2275.65 (45)

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

(46)m=	35.39	30.95	31.94	27.85	26.72	23.06	21.37	24.52	24.81	28.91	31.56	34.27	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

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Temperature factor from Table 2b		0	(48)
Energy lost from water storage, kWh/year	(47) x (48) =	0	(49)
If manufacturer's declared cylinder loss factor is not known:			
Cylinder volume (litres) including any solar storage within same		150	(50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

Hot water storage loss factor from Table 2 (kWh/litre/day)		0.02	(51)
Volume factor from Table 2a		0.93	(52)
Temperature factor from Table 2b		0.54	(53)
Energy lost from water storage, kWh/year	((50) x (51) x (52) x (53) =	1.44	(54)
Enter (49) or (54) in (55)		1.44	(55)

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

(56)m=	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(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=	44.53	40.22	44.53	43.09	44.53	43.09	44.53	44.53	43.09	44.53	43.09	44.53	(57)

Primary circuit loss (annual) from Table 3 610 (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=	51.81	46.79	51.81	50.14	51.81	50.14	51.81	51.81	50.14	51.81	50.14	51.81	(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=	332.27	293.36	309.27	278.87	274.46	246.94	238.77	259.78	258.63	289.09	303.64	324.83	(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=	332.27	293.36	309.27	278.87	274.46	246.94	238.77	259.78	258.63	289.09	303.64	324.83	

Output from water heater (annual)$_{1...12}$ 3409.93 (64)

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

(65)m=	155.52	138.22	147.87	136.31	136.3	125.69	124.43	131.42	129.58	141.16	144.54	153.04	(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=	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	216.58	(66)

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

(67)m=	156.94	139.39	113.36	85.82	64.15	54.16	58.52	76.07	102.1	129.64	151.31	161.3	(67)

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

(68)m=	1035.53	1046.28	1019.2	961.55	888.78	820.39	774.7	763.95	791.03	848.68	921.45	989.84	(68)

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

(69)m=	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	44.66	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	-173.26	(71)

Water heating gains (Table 5)

(72)m=	209.03	205.69	198.75	189.32	183.19	174.57	167.24	176.63	179.97	189.73	200.76	205.7	(72)

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

(73)m=	1499.47	1489.33	1429.28	1334.66	1234.1	1147.1	1098.44	1114.63	1171.08	1266.02	1371.49	1454.82	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x 303.84	x	19.87	x	0.72	x	0.7	=	2108.95	(76)
East	0.9x	1	x 303.84	x	38.52	x	0.72	x	0.7	=	4087.74	(76)
East	0.9x	1	x 303.84	x	61.57	x	0.72	x	0.7	=	6533.53	(76)
East	0.9x	1	x 303.84	x	91.41	x	0.72	x	0.7	=	9700.74	(76)
East	0.9x	1	x 303.84	x	111.22	x	0.72	x	0.7	=	11803.04	(76)
East	0.9x	1	x 303.84	x	116.05	x	0.72	x	0.7	=	12315.87	(76)
East	0.9x	1	x 303.84	x	112.64	x	0.72	x	0.7	=	11953.95	(76)
East	0.9x	1	x 303.84	x	98.03	x	0.72	x	0.7	=	10403.79	(76)
East	0.9x	1	x 303.84	x	73.6	x	0.72	x	0.7	=	7811.1	(76)
East	0.9x	1	x 303.84	x	46.91	x	0.72	x	0.7	=	4978.1	(76)
East	0.9x	1	x 303.84	x	24.71	x	0.72	x	0.7	=	2621.97	(76)
East	0.9x	1	x 303.84	x	16.39	x	0.72	x	0.7	=	1739.68	(76)

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

(83)m=	2108.95	4087.74	6533.53	9700.74	11803.04	12315.87	11953.95	10403.79	7811.1	4978.1	2621.97	1739.68	(83)

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

(84)m=	3608.42	5577.07	7962.81	11035.41	13037.14	13462.97	13052.39	11518.42	8982.18	6244.13	3993.46	3194.49	(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=	1	1	0.99	0.97	0.9	0.77	0.57	0.63	0.92	0.99	1	1	(86)

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

(87)m=	18.88	19.11	19.53	20.03	20.54	20.84	20.96	20.95	20.65	20	19.3	18.93	(87)

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

(88)m=	19.56	19.57	19.57	19.6	19.61	19.62	19.63	19.63	19.61	19.6	19.59	19.57	(88)

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

(89)m=	1	1	0.99	0.96	0.86	0.66	0.4	0.45	0.85	0.99	1	1	(89)

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

(90)m=	17.65	17.88	18.31	18.82	19.3	19.55	19.62	19.62	19.41	18.8	18.08	17.7	(90)

fLA = Living area ÷ (4) = 0.04 (91)

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

(92)m=	17.7	17.93	18.36	18.87	19.35	19.6	19.67	19.67	19.46	18.85	18.13	17.75	(92)

TER WorkSheet: New dwelling as built

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

(93)m=	17.7	17.93	18.36	18.87	19.35	19.6	19.67	19.67	19.46	18.85	18.13	17.75	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.95	0.85	0.65	0.41	0.45	0.84	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	3606.82	5564.66	7874.57	10519.98	11051.81	8801.43	5288.22	5232.05	7553.31	6141.07	3988.89	3193.51	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	27107.43	26275.18	23473.32	20226.2	15039.69	9771.44	5388.64	5381.36	10168.74	16009.26	22378.56	26110.32	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	17484.46	13917.47	11605.47	6988.48	2966.98	0	0	0	0	7341.93	13240.56	17050.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 90595.46 (98)

Space heating requirement in kWh/m²/year 74.09 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0.1 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 0.9 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 0.9 (204)

Efficiency of main space heating system 1 78.9 (206)

Efficiency of secondary/supplementary heating system, % 100 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	17484.46	13917.47	11605.47	6988.48	2966.98	0	0	0	0	7341.93	13240.56	17050.11	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	19944.25	15875.45	13238.18	7971.65	3384.39	0	0	0	0	8374.82	15103.3	19448.79	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 103340.83 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	1748.45	1391.75	1160.55	698.85	296.7	0	0	0	0	734.19	1324.06	1705.01	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 9059.55 (215)

Water heating

Output from water heater (calculated above)

	332.27	293.36	309.27	278.87	274.46	246.94	238.77	259.78	258.63	289.09	303.64	324.83	

Efficiency of water heater 68.8 (216)

(217)m=	78.66	78.64	78.57	78.41	77.83	68.8	68.8	68.8	68.8	78.42	78.61	78.66	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	422.41	373.07	393.63	355.65	352.62	358.92	347.05	377.59	375.91	368.66	386.24	412.95	

Total = Sum(219a)$_{1...12}$ = 4524.72 (219)

TER WorkSheet: New dwelling as built

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		103340.83	
Space heating fuel used, secondary		9059.55	
Water heating fuel used		4524.72	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	130		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	175	(231)
Electricity for lighting		2771.63	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.194	=	20048.12	(261)
Space heating (secondary)	(215)	x	0.422	=	3823.13	(263)
Water heating	(219)	x	0.194	=	877.8	(264)
Space and water heating	(261) + (262) + (263) + (264) =				24749.05	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.422	=	73.85	(267)
Electricity for lighting	(232)	x	0.422	=	1169.63	(268)
Total CO2, kg/year	sum of (265)…(271) =				25992.52	(272)
TER =					22.64	(273)

Predicted Energy Assessment

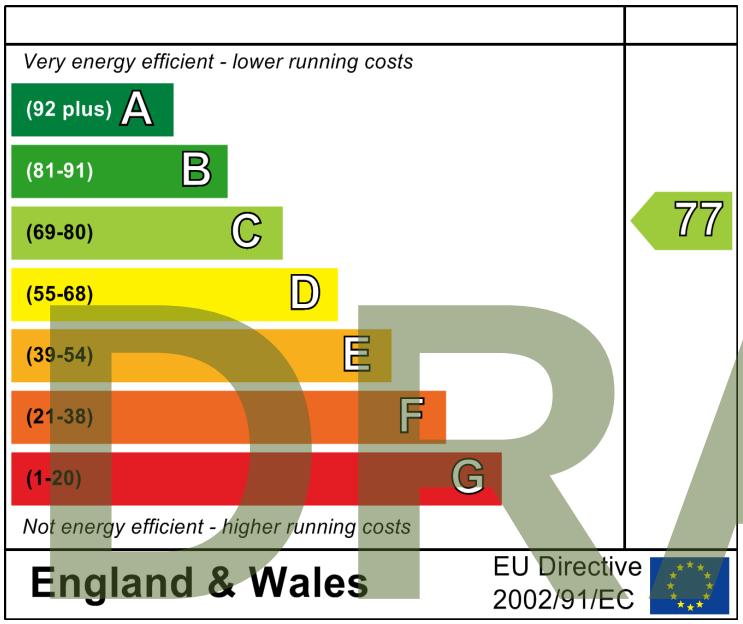
62, Avenue Road
LONDON
NW8 6HT

Dwelling type: Detached House
Date of assessment: 08 December 2011
Produced by: Stroma Certification
Total floor area: 1222.77 m²

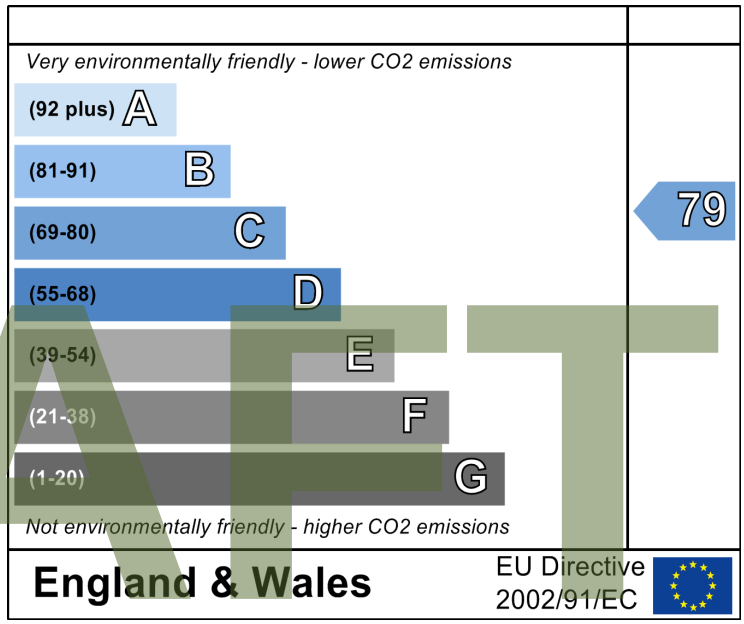
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2009 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.