

Energy Strategy Report

151-153
Camden High
Street,
London,
NW1 7JY

October 2019

Ref: 19-5251

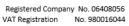




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Quality Standards Control

The signatories below verify that this document has been prepared in accordance with our quality control requirements. These procedures do not affect the content and views expressed by the originator.

Revision	Initial	Rev A	Rev B	Rev C
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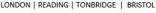
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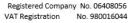
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1. Executive Summary

This Energy Statement demonstrates the predicted energy performance and carbon dioxide emissions of the proposed development at **151-153 Camden High Street, London, NW1 7JY,** based on the information provided by the design team. The development will comprise of a refurbishment a **2-storey apartment and erection of 2nd floor rear extension and roof extension residential building.**

Policy Requirements

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

Policies	Requirements	Compliance Check	
Local Plan Policy CC1	All new residential development will also be required to demonstrate a 19% CO2 reduction below Part L 2013 Building Regulations and 20% carbon reduction via on-site renewable technologies	The development achieved a carbon reduction of 75.43% over Part L 2013 baseline via energy efficient measures. The development achieved an overall carbon reduction of 21.39% via PV.	
Local Plan Policy CC2	BREEAM domestic refurbishment 'Excellent' for conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings.	Since the development consists of 2 dwellings of a total of 193.09 sqm, BREEAM 'Excellent' was not targeted.	

Table 1 Policy Requirements

Methodology and Strategies

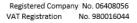
The methodology used to determine the CO_2 emissions is in accordance with the London Plan's threestep Energy Hierarchy (Policy 5.2). The below table shows the Energy Hierarchy and suggested strategies for the proposed development.

Stages	Strategies	
BE LEAN Energy efficient design	 U-values better and air permeability better than Building Regulations Part L; High efficiency electric boiler for heating and hot water. Low energy (LED) type lighting; Natural ventilation 	
BE CLEAN District heat networks or communal heating systems	As there are no current or proposed district heat networks and the size of the development is not suitable for CHP this stage of the hierarchy is not feasible for this scheme. Details can be found in section 8.1.	
BE GREEN On-site renewable technologies	 PV panels of 4.725 kWp on the roof (approximate 15 panels with 315 w/p are required). Details are in Section Error! R eference source not found. 	

Table 2 Energy Hierarchy and suggested strategies



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Assessment Results

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

	Energy Hierarchy	Regulated Carbon Emissions (Tonnes CO ₂ /yr)
BASELINE	TER set by Building Regulations 2013 Part L	27.90
BE LEAN	After energy demand reduction	8.72
BE CLEAN	After CHP/ Communal Heating	8.72
BE GREEN	After renewable energy	6.85

Table 3 Carbon Emissions after each stage of the proposed strategy

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

	Energy Hierarchy		Regulated Carbon Savings		
	,	Tonnes CO₂/yr	%		
BE LEAN	BE LEAN After energy demand reduction		68.75 %		
BE CLEAN	BE CLEAN After heat network/ CHP		0		
BE GREEN	After renewable energy	1.87	21.39%		
Total Cumul	ative Savings	21.05	75.43%		
Total Target	Savings	5.30	19 %		

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

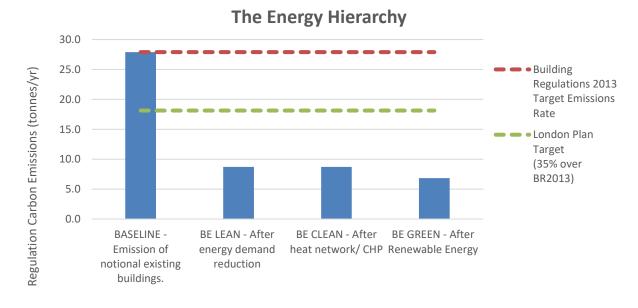
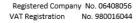


Figure 1 The Energy Hierarchy



























2. Introduction

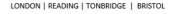
This Energy Statement will be included as part of the planning application that addresses the environmental impact of the development. This report focuses on the energy strategy for the proposed scheme and how energy consumption and carbon emissions will be minimised and to meet the targeted carbon emissions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

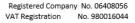
The development is to be located in the **London Borough of Camden** and it is in close proximity to Camden town underground Station (approximately 150 meters to the North) and Camden road station (approximately 500 meters to the North East). The proposal is a **refurbishment a 2-storey apartment** and erection of 2nd floor rear extension and roof extension residential building at 151-153 Camden High Street, London, NW1 7JY.



Figure 2 Site Location



























3. Planning Policy

National Planning Policy Framework (February 2019)

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

The London Plan (March 2016)

MAYOR OF LONDON



Policy 5.2, 5.4, 5.5, 5.6, & 5.7

According to Policy 5.2 all major new developments should show carbon emissions reduction through the Mayor's energy hierarchy (Be Lean, Be Clean and Be Green), unless it can be demonstrated that such provision is not feasible. From October 2016 Zero Carbon Standard apply to all new major residential development (10 or more units). This means that at least 35% of carbon reductions against a Building Regulations Part L 2013 must be achieved on-site, with the remaining emissions, up to 100%, to be offset through a contribution to the Council's Carbon Offset Fund. For the non-residential development, must achieve a 35% reduction in CO₂ emissions against a Building Regulations Part L 2013 baseline.

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

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





















London Borough of Camden



Core Strategy (Adopted in 2010)

Policy CS13 - Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change

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

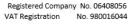
- a) Ensuring patterns of land use that minimize the need to travel by car and hep support local energy networks;
- b) Promoting the efficient use of land and buildings;
- c) Minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all the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

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



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Local Plan (Adopted July 2017)

Policy CC1 - Climate change mitigation

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.

We will:

- a. Promote zero development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
- b. Require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;
- c. Ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
- d. Support and encourage sensitive energy efficiency improvements to existing building;
- e. Require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
- Expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

- g. Working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
- h. Protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and
- Requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

The energy hierarchy

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

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

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





















addition to any requirements for renewable energy). This can be demonstrated through an energy statement or sustainability statement.

Policy CC2 – Adapting to climate change

The Council will require development to be resilient to climate change.

All development should adopt appropriate climate change adaptation.

- a. The protection of existing green spaces and promoting new appropriate green infrastructure;
- b. Not increasing, and wherever possible reducing, surface water run-off through increasing permeable surfaces and use of Sustainable Drainage Systems;
- c. Incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and
- d. Measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainable Statement.

Sustainable design and constructions measures

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

- e. Ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;
- Encourage new build residential development to use the Home Quality Mark and Passivhaus design standards:
- Encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM Domestic refurbishment; and
- Expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.

Policy CC3 – Water and flooding

The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to:

- a. Incorporate water efficiency measures;
- b. Avoid harm to the water environment and improve water quality;
- c. Consider the impact of development in areas at risk of flooding (including drainage);
- d. Incorporate flood resilient measures in areas prone to flooding;
- e. Utilize Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and
- Not locate vulnerable development in flood-prone areas.

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore.

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4. Assessment Methodology

Mayor's Energy Hierarchy

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

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

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

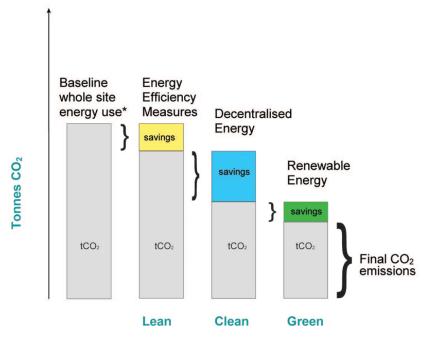


Figure 3 The Energy Hierarchy

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Software and Input data

The Government approved software, i.e. FSAP 2012, have been utilised to carry out Standard **Assessment Procedure (SAP)** calculations.

Syntegra received the architectural drawings and relevant documents, and they were used to undertake the energy assessments. The document reference is listed in table below.

No.	Document Name	Format	Received Date
1	PLANNING	dwg	08-04-2019

Table 5 The document list



















5. **Baseline – Target Emission Rate**

In regard to the conversion/ refurbishment area, the CO₂ emissions for the development are calculated based on the notional existing building conditions in accordance with GLA Guidance on preparing energy assessments (March 2016). The inputs were gathered during the site survey or assumed by the Reduced Data SAP (RdSAP) when the data was not available. To make a parallel comparison with the proposed building, the existing building was assumed as if it has same functions and geometry with the proposed building. The existing building conditions are summarised in the table below.

		Existing Specifications (Age band A set by RdSAP 2012)
	Wall	2.1 (solid brick as built)
	Window	4.8 (single glazing before 2002)
U-value (W/m² K)	Floor	1.2 (as built/ insulation unknown)
, ,	Roof	2.3 (Pitched, slates or tiles, insulation at rafters)
	Door	3.0
Air Permeability (m³/h.m² at 50 Pa)		35
Heating System		Direct acting electric boiler for radiator heating (SAP default efficiency - 100%)
Hot Wate	er System	From main heating system boiler 110 litres, 12 mm loose jacket
Lighting		0% Low Energy Lights
Ventilation		Natural ventilation with no extract fans in wet rooms

Table 6 Existing Specifications used for energy assessment

The baseline regulated energy demand for the development is presented in the table below:

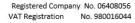


BASELINE	Regulated CO ₂ Emissions (Tonnes CO ₂ /yr)
151-153 Camden High Street	27.90

Table 7 Regulated Carbon Emissions at Baseline



























6. BE LEAN – Energy Efficient Design

This section outlines the energy efficient measures taken in order to minimise the building's energy demand and therefore reduce energy use and CO₂ emissions further than the Baseline requirements (Building Regulations 2013 Part L compliance).

Passive Design Measures

Enhanced Building Elements

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

		Part L2b min. required values	Proposed building values
	Wall	New element - 0.28 Upgrade element – 0.3-0.55	New wall – 0.28
U-value	Window unit	1.6	New window - 1.6 Replaced window – 1.6
(W/m ² K)	Floor	New element - 0.22 Upgrade element –0.25	New floor - 0.15 Retained ground floor – 0.25
	Roof	0.16 - 0.18	New roof - 0.18
	Door	1.8 - 3.5	New door – 1.2
Air Permeability (m³/h.m² at 50 Pa)		-	4.5

Table 8 Proposed Building Elements

Orientation & Natural Daylighting

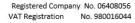
Passive solar gain reduces the amount of energy required for space heating during the winter months. The building is typically positioned to have South-West outdoor area with North-East aspects which align with the roads and also maximise the passive solar gains into the building throughout the day.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

Natural Ventilation

A natural ventilation strategy will be adopted with extract fans in wet rooms; toilets, bathrooms, kitchens and utility rooms. Therefore, higher energy consumption and CO₂ emissions due to mechanical ventilation is avoided.



























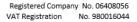
Water Efficiency

In accordance with London Plan policy 5.15, the development will be based upon the specification of water efficient fittings including low volume dual flush WCs, and low flow taps/ showers/ bath. These measures will result in the internal water consumption rate of **105 litres/person/day** or less, excluding an allowance 5 litres per person per day for external water consumption. The design stage water use calculations is below.

Installation Type	Unit of Measure	Capacity/ flow rate (1)	Use factor (2)	Fixed use (litres/head/ day) (3)	Total Consumption Litres/head/day (1)x(2)+(3) =(4)
wc	Full Flush Volume (litres)	6	1.46	0	8.76
(dual flush)	Part flush Volume (litres)	4	2.96	0	11.85
Taps (excluding kitchen/ utility room taps)	Flow rate (litres/minute)	6.5	1.58	1.58	11.85
Bath (where shower also present)	Capacity to overflow (litres)	120	0.11	0	13.20
Shower (where bath also present)	Flow rate (litres/minute)	7.5	4.37	0	32.78
Kitchen / utility room sink taps	Flow rate (litres/minute)	6.5	0.44	10.36	13.22
Washing machine	Litres/kg dry load	9	2.1	0	18.90
Dishwasher	Litres/place setting	1.2	3.6	0	4.32
Waste disposal unit	Litres/use	If present = 1 If absent = 0	3.08	0.00	0
Water Softener	Litres/person/d ay	-	1.00	0.00	-
(5)	Total calculated use (litres/person/day) = Sum column 4			114.9	
(6)	Contribution from greywater (litres/person/day)			0	
(7)	Contribution from rainwater (litres/person/day)			0	
(8) Normalisation Factor			0.91		
То	Total water consumption (litres/person/day)				104.5
	External water use				5

Table 9 Design stage water use calculations

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Solar Shading

Each dwelling will incorporate internal blinds or curtains to reduce the solar heat coming into the dwelling, and thus can avoid installing cooling systems for summer.

Active Design Measures

Heating, Cooling and Hot Water System

The space heating and hot water are provided by energy efficient systems as summarised in the table below. At Be Lean stage, direct acting electric boiler (100% efficiency) have been examined for radiator heating and hot water. Detailed specifications are in the table below:

Systems	General Specification	Controls/ Other inputs		
Heating	Direct acting electric boiler for radiator heating (efficiency of 100%)	 Controls – Time and temperature zone control by suitable arrangement of plumbing and electrical services Pump is in heated space Boiler interlock – Yes 		
Hot water	From main heating system	Flat 1	 Cylinder in heated space Cylinderstat Water heating timed separately 	

Table 10 Heating, cooling and Hot water systems

All suggested specifications above are provisional at this early design stage, and therefore have to be reviewed with mechanical engineers and contractors in the course of design development.

The following table demonstrates the reduction in CO2 emissions from the energy efficiency measures mentioned above. It can be seen that the carbon reduction of 68.75% can be achieved against the existing building conditions.



Regulated CO ₂ Emission	Carbon Reduction		
BASELINE	BE LEAN	(%)	
27.90	8.72	68.75%	

Table 11 Regulated Carbon Emissions



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7. BE CLEAN – CHP & Decentralised Energy Networks

The Energy Hierarchy encourages the use of a CHP system and the connection to District Heating system to reduce CO₂ emissions further.

Decentralised Energy Network

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

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

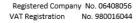
The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed alongside the **London Heat Map Study for the London Borough of Camden** as part of this assessment. The study identifies that the site is located near the existing district heating networks. This is demonstrated clearly from the London Heat Map (http://www.londonheatmap.org.uk) snapshot below.



Figure 4 London Heat Map near the site



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Moreover, the London heat map below identifies existing and potential DH networks in more broaden area, and it could not find any existing (in red) and potential (in yellow) DH networks within 500m radius from the property. The costs involved in extending the DH networks would outweigh the advantages in this development. Therefore, utilisation of the DH network has not been a feasible option for this development.

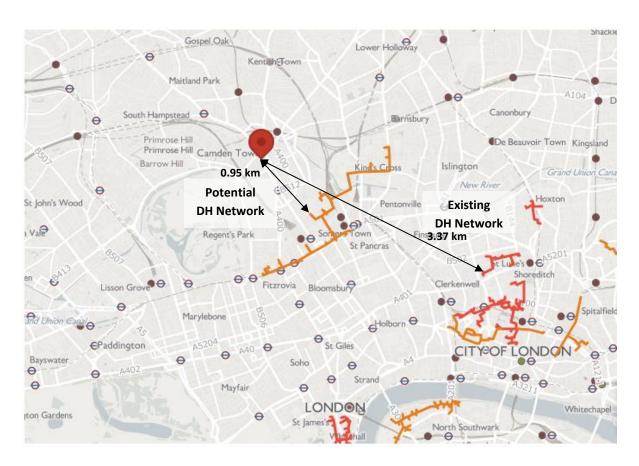
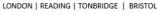
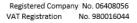


Figure 5 Existing and Potential DH Network near the site























CHP

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

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

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

The feasibility of installing CHP has been assessed for this development. Since this development has only two residential units that would not require high hot water loads, installing the CHP system would not be beneficial given the cost. Hence the CHP system has not been considered for this small development at Be Clean stage.



Regulated CO ₂ Emissions (Tonnes CO ₂ /yr)	BE LEAN	BE CLEAN	CARBON REDUCTION (%)
151-153 Camden High Street	8.72	8.72	0

Table 12 Regulated Carbon Emissions at Be Clean Stage



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Wind Power

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

Estimated average windspeeds around NW1 7..

Wind speed at 10m above ground level (m/s)						
5 4.9 4.8						
4.9	4.9 4.8 4.8					
5	4.9	4.8				

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

Wind speed at 45m above ground level (m/s)				
6.3	6.3 6.1			
6.2	6.1	6.1		
6.2	6.2	6.1		

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

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



















8. BE GREEN – Renewable Energy

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

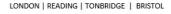
- Renewable energy resource or fuel availability of the LZC technology on the site.
- Space limitations due to building design and urban location of the site.
- Capital, operating and maintenance cost.
- Planning Permission
- Implementation with regards the overall M&E design strategy for building type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

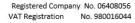
The table below summarises the various low zero carbon technologies considered for the projects, and we have identified that **Air Source Heat Pumps (ASHP)** would be the most appropriate option in this development.

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

Table 13 Feasibility Study of LZC Technologies



























Non-feasible Technology

Air Source Heat Pumps (ASHP)

ASHP can meet the space heating demands on site efficiently in comparison with gas boilers. Although this low carbon technology consumes electricity to operate due to higher efficiency the heat output is much greater. However, the efficiency of heat pumps is very much dependent on the temperature difference between the heat source and the space required to be heated. As a result, ASHPs tend to have a lower COP than GSHPs. This is due to the varying levels of air temperature throughout the year when compared to the relatively stable ground temperature. Moreover, any noise associated with the external units could potentially be an issue at night due to the proximity of the neighbouring residential buildings. Therefore, the use of ASHP is not a suitable option for this development.

• Ground Source Heat Pumps (GSHP)

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

Solar Thermal

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

Hydro power

There is no river or lake within the development site boundaries. Therefore, small scale hydro-electric will not be studied any further because of the location and the spatial limitations of the development.

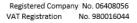
Biomass

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

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



















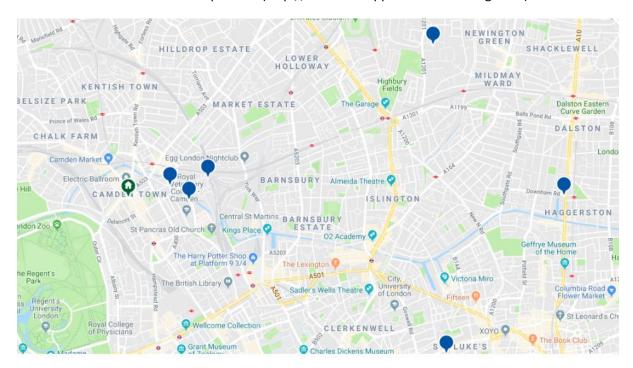








However, if the biomass system is considered at detailed design stage, local suppliers can be found near the site as shown in the map below (http://biomass-suppliers-list.service.gov.uk).



Company name	Postcode	Contact	Fuel Supplied
Wolseley UK Ltd	NW1 0BY	www.plumbcenter.co.uk FFP.Camden@wolseley.co.uk	Pellets
Travis Perkins Trading Co. Ltd	NW1 OPT	www.travisperkins.co.uk sean.mahon@travisperkins.co.uk	Pellets
Wolseley UK Ltd	N1C 4PD	www.pipecenter.co.uk k94.kingscross@wolseley.co.uk	Pellets
Travis Perkins Trading Co. Ltd	N19 5UN	www.travisperkins.co.uk toby.duncan@travisperkins.co.uk	Pellets
Travis Perkins Trading Co. Ltd	W2 6NA	www.travisperkins.co.uk liam.clancy@travisperkins.co.uk	Pellets
Travis Perkins Trading Co. Ltd	NW61SD	www.travisperkins.co.uk johnny.farmer@travisperkins.co.uk	Pellets
Wolseley UK Ltd	N5 2PW	www.plumbcenter.co.uk YM.Highbury@wolseley.co.uk	Pellets
Travis Perkins Trading Co. Ltd	EC1Y 0TY	www.travisperkins.co.uk keith.gittins@travisperkins.co.uk	Pellets
Travis Perkins Trading Co. Ltd	EC1Y 0TY	www.travisperkins.co.uk kenneth.walker@travisperkins.co.uk	Pellets
Travis Perkins Trading Co. Ltd	E8 4DL	www.travisperkins.co.uk	Pellets





















Proposed Technology

• Photovoltaic (PV)

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

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

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

Direct acting electric Boilers + 4.725 kWp

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

Orientation	South - West	Overshading	Less than 20 percent	
Panel Tilt	0-10°	Power Output	315 W per panel	
Annual Output	Approximately 1796.7 kWh	PV Area	1.65 m² per panel	
Numbers of Panels	15 panels in total			

Table 14 Suggested PV details

The proposed PV panels are subject to further consideration at detailed design stage. In order to qualify both the installer and the equipment, the system must be certified under the Microgeneration Certification Scheme (MCS).

Given the proposed LZC technologies on the site (**PVs**), the overall CO2 reduction at BE GREEN stage can be calculated as shown below. And, it can be seen that the development can achieve the CO_2 emissions reduction of <u>21.39%</u> in the residential units over Building Regulations Part L 2013

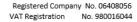
♣ BE GREEN stage

Regulated CO ₂ Emissions (Tonnes CO ₂ /yr)	BE LEAN	BE CLEAN	CARBON REDUCTION (%)
2-6 Camden High Street	8.72	6.85	21.39

Table 15 Regulated Carbon Reduction at Be Green Stage



LONDON | READING | TONBRIDGE | BRISTOL























Conclusion 9.

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at 151-153 Camden High Street, London, NW1 7JY, based on the information provided by the design team.

In line with the London Plan's three step energy hierarchy the regulated CO2 emissions for this development have been reduced by 73.96% over Building Regulation 2013 with 23.10% from renewable energy, once all measures in the table below are taken into account.

Stages	Strategies
BE LEAN Energy efficient design	 U-values better and air permeability better than Building Regulations Part L; High efficiency electric boiler for heating and hot water. Low energy (LED) type lighting; Natural ventilation
BE CLEAN District heat networks or communal heating systems	As there are no current or proposed district heat networks and the size of the development is not suitable for CHP this stage of the hierarchy is not feasible for this scheme. Details can be found in section 8.1.
BE GREEN On-site renewable technologies	 PV panels of 4.725 kWp on the roof (approximate 15 panels with 315 w/p are required). Details are in Section Error! R eference source not found

Table 16 Energy Hierarchy and suggested strategies

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

Energy Hierarchy		Regulated Carbon Savings		
			%	
BE LEAN	After energy demand reduction	19.18	68.75%	
BE CLEAN	BE CLEAN After heat network/ CHP		0	
BE GREEN	After renewable energy	1.87	21.39%	
Total Cumulative Savings		21.05	75.43%	
Total Target	Savings	5.30	19 %	

Table 17 Carbon dioxide Emissions after each stage of the Energy Hierarchy



Tel: 0330 053 6774

mail@syntegragroup.com

















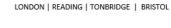


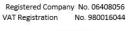




10. Appendix A – Sap Reports SAP Existing























			User I	Details:						
Assessor Name: Software Name:	Su Lee Stroma FSAP 20	012		Strom Softwa					0031315 on: 1.0.4.18	
				Address		Existing				
Address :	151-153, Camder	n High Stre	et, LON	IDON, N	W1 7JY					
1. Overall dwelling dime	ensions:		۸ro	a(m²)		۸۷ ۵۰	ight(m)		Volume(m ³	R \
Ground floor					(1a) x		2.75	(2a) =	205.34	(3a)
Total floor area TFA = (1	(a)+(1b)+(1c)+(1d)+(1e)+(1r	n)	74.67	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	205.34	(5)
2. Ventilation rate:										
Number of chimneys	main heating	secondar heating	ry □ + □	other 0	7 = [total 0	x	40 =	m³ per hou	(6a)
Number of open flues	0 +	0	┪╻┝	0	」	0	x	20 =	0	(6b)
Number of intermittent fa	U		J L		J			10 =		╡`′
					Ļ	2			20	(7a)
Number of passive vents						0	x	10 =	0	(7b)
Number of flueless gas f	ires					0	X	40 =	0	(7c)
								Air ch	nanges per ho	our
Infiltration due to chimne	evs flues and fans =	(6a)+(6b)+(7	7a)+(7b)+	(7c) =	Г	20		÷ (5) =	0.1	(8)
If a pressurisation test has					continue fr	_		÷ (3) =	0.1	(0)
Number of storeys in t		.,	, ,,			, ,	, ,		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: (•	uction			0	(11)
if both types of wall are p deducting areas of open	present, use the value corr ings): if equal user 0.35	responding to	the grea	ter wall are	a (after					
If suspended wooden	• / .	ealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, er	nter 0.05, else enter ()							0	(13)
Percentage of window	s and doors draught	stripped							0	(14)
Window infiltration				0.25 - [0.2	2 x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)
Air permeability value	•		•	•	•	etre of e	envelope	area	35	(17)
If based on air permeabi	•								1.85	(18)
Air permeability value applie Number of sides sheltere		nas been dor	ne or a de	gree aır pe	rmeability	is being u	sed			(19)
Shelter factor	5u			(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor			(21) = (18) x (20) =				1.57	(21)
Infiltration rate modified	-	ed								` ′
Jan Feb	Mar Apr Ma	1	Jul	Aug	Sep	Oct	Nov	Dec	1	
Monthly average wind sp	- · · · ·		•			•	•	•	_	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
		•	•	•	•	•	•	•	_	
Wind Factor $(22a)m = (2a)m =$	'				· .				1	
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	

2	1.96 1	1.92	1.73	1.69	1.49	1.49	1.45	1.57	1.69	1.77	1.85]		
alculate effec		-	te for t	he appli	cable ca	se	!	!	!			-		— ,,
If mechanical If exhaust air he			div N. (2	2h) _ (22	a) × Emy (auation (VEVV otho	nuico (22h	n) = (22a)				0	(2
If balanced with) – (23a)				0	=
			-	_					2h\m . (1	22h) v [1 (226)	. 100	0	(2
a) If balance		0	0	0	0	o (IVIVI	0	0	0	23D) X [$\frac{1-(230)}{0}$) - 100]	']	(2
b) If balance												_		(-
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1		(2
c) If whole h	ouse extraction < 0.5 × (2			•	•				.5 × (23b)		J		
lc)m= 0	0	0	0	0	0	0	0	0	0	0	0	1		(:
d) If natural	ventilation on the state of the			•					0.51		1	_		
ld)m= 2		1.92	1.73	1.69	1.49	1.49	1.45	1.57	1.69	1.77	1.85	1		(2
Effective air	<u> </u>				ļ							J		•
5)m= 2		1.92	1.73	1.69	1.49	1.49	1.45	1.57	1.69	1.77	1.85	1		(:
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(0
8)m= 135.67	133.01	130.35	117.05	114.39	101.09	101.09	98.43	106.41	114.39	119.71	125.03		(3
eat transfer	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
9)m= 444.4	441.74	439.08	425.78	423.12	409.82	409.82	407.16	415.14	423.12	428.44	433.76		
			/ 01.6						Average =		12 /12=	425.12	(3
eat loss para	- `			5.07	5.40	- 10	- 4-	` ′	= (39)m ÷	<u>` </u>	5.04		
0)m= 5.95	5.92	5.88	5.7	5.67	5.49	5.49	5.45	5.56	5.67	5.74	5.81		$\neg \alpha$
umber of day	vs in mor	nth (Tabl	le 1a)					,	Average =	Sum(40) ₁	12 /12=	5.69	(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
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r. vvalei nea	ung ener	gy requi	rement.								KVVII/ye	;ai.	
ssumed occ											35		(4
if TFA > 13.		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13.	9)			
if TFA £ 13.	•	tor usos	no in litro	o por de	v Vd ov	orogo –	(25 v NI)	. 26					,
าnual avera(educe the annu									se target o		.85		(4
t more that 125	_				_	_			J				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t water usage				,				ООР		1.101			
4)m= 104.33	100.54	96.75	92.95	89.16	85.36	85.36	89.16	92.95	96.75	100.54	104.33		
									Total = Su		l .	1138.19	(<u>4</u>
104.55						_				. ,			
nergy content of	f hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x L	0Tm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, ra)		
nergy content o	f hot water	used - cal	121.74	onthly = 4.	190 x Vd,r	93.41	0Tm / 3600 107.19) kWh/mor 108.47	126.41	137.98	149.84		
ergy content o						1		108.47	126.41	137.98	149.84	1492.35	\(<u>4</u>
ergy content of	135.32	139.64	121.74	116.81	100.8	93.41	107.19	108.47	,	137.98	149.84	1492.35	(4
ergy content of 154.72 nstantaneous v	135.32	139.64	121.74	116.81	100.8	93.41	107.19	108.47	126.41	137.98	149.84	1492.35	
ergy content of 154.72 Instantaneous v S)m= 23.21	135.32 water heatin	139.64	121.74 of use (no	116.81 hot water	100.8	93.41 enter 0 in	107.19 boxes (46)	108.47) to (61)	126.41 Total = Su	137.98 m(45) ₁₁₂ =	149.84	1492.35	
ergy content of 154.72 nstantaneous v s)m= 23.21 ater storage	135.32 water heatin 20.3 closs:	139.64 ng at point 20.95	121.74 of use (no	116.81 hot water 17.52	100.8 storage),	93.41 enter 0 in 14.01	107.19 boxes (46) 16.08	108.47) to (61) 16.27	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7	149.84	1492.35	(4
nstantaneous v some 23.21 ater storage orage volum	vater heatin 20.3 loss: ne (litres)	139.64 ng at point 20.95 includin	121.74 of use (no 18.26 ag any so	116.81 2 hot water 17.52 Dlar or W	100.8 r storage), 15.12 /WHRS	93.41 enter 0 in 14.01 storage	107.19 boxes (46) 16.08 within sa	108.47) to (61) 16.27	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7	149.84	1492.35	(4
nstantaneous voices storage orage volum community h	vater heating 20.3 Ploss: ne (litres) neating a	139.64 ng at point 20.95 includin	of use (not 18.26 ag any so nk in dw	116.81 2 hot water 17.52 Dlar or W relling, e	100.8 * storage), 15.12 /WHRS nter 110	93.41 enter 0 in 14.01 storage litres in	107.19 boxes (46, 16.08 within sa (47)	108.47) to (61) 16.27	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7	149.84	1492.35	(4
nstantaneous values orage volum community is therwise if natural orage.	vater heating a constored eloss:	139.64 ng at point 20.95 includin nd no ta hot wate	of use (no 18.26 ag any so nk in dw er (this in	116.81 to hot water 17.52 Dlar or Welling, e	100.8 r storage), 15.12 /WHRS nter 110 nstantar	93.41 enter 0 in 14.01 storage litres in neous co	107.19 boxes (46, 16.08 within sa (47)	108.47) to (61) 16.27	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7	149.84	1492.35	(4
ergy content of the standard of the storage of the	vater heating a stored e loss:	139.64 ng at point 20.95 includin nd no ta hot wate	of use (not) 18.26 18 any so ank in dwer (this in oss factors)	116.81 2 hot water 17.52 Dlar or Welling, eacludes i	100.8 r storage), 15.12 /WHRS nter 110 nstantar	93.41 enter 0 in 14.01 storage litres in neous co	107.19 boxes (46, 16.08 within sa (47)	108.47) to (61) 16.27	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7	149.84	1492.35	(4
ergy content of the standard of the storage of the	vater heating a stored e loss:	139.64 ng at point 20.95 includin nd no ta hot wate	of use (not) 18.26 18 any so ank in dwer (this in oss factors)	116.81 2 hot water 17.52 Dlar or Welling, eacludes i	100.8 r storage), 15.12 /WHRS nter 110 nstantar	93.41 enter 0 in 14.01 storage litres in neous co	107.19 boxes (46, 16.08 within sa (47)	108.47) to (61) 16.27	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7	149.84	1492.35	(4
instantaneous visualistantaneous	vater heating 20.3 neating a stored e loss: turer's defactor from water	139.64 ng at point 20.95 includin nd no ta hot wate eclared le m Table	of use (not 18.26 and any sounk in dwarf (this in coss factor 2b , kWh/ye	116.81 17.52 Dlar or Water relling, eacludes it	100.8 r storage), 15.12 /WHRS nter 110 nstantar wn (kWh	93.41 enter 0 in 14.01 storage litres in neous co	107.19 boxes (46, 16.08 within sa (47)	108.47) to (61) 16.27 ame vess	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7	149.84 = 22.48	1492.35	(4 (4 (4
instantaneous violater storage community in therwise if nurater storage in the st	vater heating a constored eloss: turer's defactor from water turer's defactor's defactor	139.64 ng at point 20.95 includin nd no ta hot wate eclared le m Table storage eclared of	of use (not) 18.26 ag any so onk in dwer (this in oss factor 2b by kWh/ye cylinder l	116.81 17.52 Dlar or Welling, encludes in the control of the con	100.8 r storage), 15.12 /WHRS nter 110 nstantar wn (kWh	93.41 enter 0 in 14.01 storage litres in neous con/day):	107.19 boxes (46, 16.08 within sa (47) mbi boil	108.47) to (61) 16.27 ame vess	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7 47)	149.84 = 22.48 110 0	1492.35	(4)
instantaneous visuality visuality instantaneous visuality visual	vater heating a construction of turer's desage loss.	139.64 ng at point 20.95 includin and no ta hot wate eclared le m Table storage eclared of	of use (not) 18.26 Ing any so ank in dwer (this in oss factors) 2b kWh/ye cylinder loom Table	116.81 17.52 Dlar or Welling, encludes in the control of the con	100.8 r storage), 15.12 /WHRS nter 110 nstantar wn (kWh	93.41 enter 0 in 14.01 storage litres in neous con/day):	107.19 boxes (46, 16.08 within sa (47) mbi boil	108.47) to (61) 16.27 ame vess	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7 47)	149.84 = 22.48 110	1492.35	(4)
nstantaneous v nater storage orage volum community h therwise if n nater storage of manufac nergy lost fro of manufac of water stor community h	vater heating a construction of turer's defactor from water turer's defactor some and turer's defactor from water from	139.64 ng at point 20.95 includin nd no ta hot wate eclared le m Table storage eclared of	of use (not) 18.26 Ing any so ank in dwer (this in oss factors) 2b kWh/ye cylinder loom Table	116.81 17.52 Dlar or Welling, encludes in the control of the con	100.8 r storage), 15.12 /WHRS nter 110 nstantar wn (kWh	93.41 enter 0 in 14.01 storage litres in neous con/day):	107.19 boxes (46, 16.08 within sa (47) mbi boil	108.47) to (61) 16.27 ame vess	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7 47)	149.84 = 22.48 110 0 0	1492.35	(4)
ergy content of the standard of the storage of the	vater heating a constored stored factor from water turer's desage loss meating stored factor from mater turer's desage loss meating stored from Tal	139.64 ng at point 20.95 includin nd no ta hot wate eclared le storage eclared of factor fr ee sectio	of use (not) 18.26 ag any so ank in dwer (this in coss factor 2b , kWh/ye cylinder I com Tablon 4.3	116.81 hot water 17.52 plar or W velling, e acludes i or is known	100.8 r storage), 15.12 /WHRS nter 110 nstantar wn (kWh	93.41 enter 0 in 14.01 storage litres in neous con/day):	107.19 boxes (46, 16.08 within sa (47) mbi boil	108.47) to (61) 16.27 ame vess	126.41 Total = Su 18.96	137.98 m(45) ₁₁₂ = 20.7 47)	149.84 = 22.48	1492.35	
instantaneous visible	vater heating 20.3 ne (litres) neating a constored a loss: turer's defactor from water turer's defactor from Eagle loss neating seriom Talifactor from the factor from the factor from the factor from the factor from Talifactor from Talifac	139.64 ang at point 20.95 includin and no ta hot wate eclared le m Table storage eclared of factor fr ee section ble 2a m Table	of use (not) 18.26 18.26 ag any so onk in dwer (this in oss factors) 2b kWh/ye cylinder I om Table on 4.3	116.81 2 hot water 17.52 Dlar or Water velling, encludes in the control of the	100.8 r storage), 15.12 /WHRS nter 110 nstantar wn (kWh	93.41 enter 0 in 14.01 storage litres in neous con/day): known:	107.19 boxes (46, 16.08 within sa (47) mbi boil	108.47 108.47 16.27 ame vest ers) ente	126.41 Total = Sul 18.96 sel er '0' in (137.98 m(45) ₁₁₂ = 20.7 47) 1 0.	149.84 = 22.48 110 0 0	1492.35	(4) (4) (4) (4) (5) (5) (5) (5) (5) (6) (6) (6) (6) (6) (6) (6) (6) (6) (6

Water storage loss calculated for each month $((56)m = (55) \times (41)m$	
(56)m= 208.01 187.88 208.01 201.3 208.01 201.3 208.01 208.01 201.3 208.01 201.3 208.01	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H	,
(57)m= 208.01 187.88 208.01 201.3 208.01 201.3 208.01 208.01 208.01 201.3 208.01 201.3 208.01	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 0 0 0 0 0 0 0 0 0 0 0	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)$	n
(62)m= 362.73 323.2 347.65 323.04 324.82 302.1 301.41 315.19 309.76 334.41 339.28 357.85	(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	(63)
Output from water heater	
(64)m= 362.73 323.2 347.65 323.04 324.82 302.1 301.41 315.19 309.76 334.41 339.28 357.85	
Output from water heater (annual) ₁₁₂ 3941.44	(64)
Heat gains from water heating, kWh/month 0.25 $'$ [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]	
(65)m= 217.85 195.3 212.83 201.52 205.25 194.55 197.46 202.04 197.1 208.44 206.92 216.23	(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	
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
	(66)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(66) (67)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 117.7 117	, ,
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 117.7 117	, ,
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 117.7 117	(67)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 117.7 117	(67)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 117.7 117	(67) (68)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 117.7 117	(67) (68)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 117.7 117	(67) (68) (69)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 117.7 117	(67) (68) (69)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(67) (68) (69) (70)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(67) (68) (69) (70)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(67) (68) (69) (70)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	(67) (68) (69) (70)

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.01	x	11.28	x	0.76	x	0.7	=	33.36	(75)
Northeast 0.9x	0.77	x	4.01	x	22.97	x	0.76	x	0.7	=	67.91	(75)
Northeast 0.9x	0.77	x	4.01	x	41.38	x	0.76	x	0.7	=	122.35	(75)
Northeast 0.9x	0.77	x	4.01	x	67.96	x	0.76	x	0.7	=	200.93	(75)
Northeast 0.9x	0.77	x	4.01	x	91.35	x	0.76	x	0.7	=	270.09	(75)
Northeast 0.9x	0.77	x	4.01	x	97.38	x	0.76	x	0.7	=	287.94	(75)
Northeast 0.9x	0.77	x	4.01	x	91.1	x	0.76	x	0.7	=	269.37	(75)
Northeast 0.9x	0.77	x	4.01	x	72.63	x	0.76	x	0.7	=	214.74	(75)
Northeast 0.9x	0.77	x	4.01	x	50.42	x	0.76	x	0.7	=	149.08	(75)
Northeast 0.9x	0.77	x	4.01	x	28.07	x	0.76	x	0.7	=	82.99	(75)
Northeast 0.9x	0.77	X	4.01	x	14.2	x	0.76	X	0.7	=	41.98	(75)
Northeast 0.9x	0.77	x	4.01	x	9.21	x	0.76	x	0.7	=	27.24	(75)
Southwest _{0.9x}	0.77	x	0.91	x	36.79]	0.76	x	0.7	=	12.34	(79)
Southwest _{0.9x}	0.77	x	1.53	x	36.79]	0.76	x	0.7	=	20.75	(79)
Southwest _{0.9x}	0.77	x	4.42	x	36.79]	0.76	x	0.7	=	59.96	(79)
Southwest _{0.9x}	0.77	x	0.91	x	62.67]	0.76	x	0.7	=	21.03	(79)
Southwest _{0.9x}	0.77	x	1.53	x	62.67]	0.76	x	0.7	=	35.35	(79)
Southwest _{0.9x}	0.77	x	4.42	x	62.67]	0.76	x	0.7	=	102.13	(79)
Southwest _{0.9x}	0.77	x	0.91	x	85.75]	0.76	x	0.7	=	28.77	(79)
Southwest _{0.9x}	0.77	x	1.53	x	85.75]	0.76	x	0.7	=	48.37	(79)
Southwest _{0.9x}	0.77	x	4.42	x	85.75]	0.76	x	0.7	=	139.74	(79)
Southwest _{0.9x}	0.77	x	0.91	x	106.25]	0.76	x	0.7	=	35.65	(79)
Southwest _{0.9x}	0.77	x	1.53	x	106.25]	0.76	x	0.7	=	59.93	(79)
Southwest _{0.9x}	0.77	x	4.42	x	106.25]	0.76	x	0.7	=	173.14	(79)
Southwest _{0.9x}	0.77	x	0.91	x	119.01]	0.76	x	0.7	=	39.93	(79)
Southwest _{0.9x}	0.77	X	1.53	x	119.01]	0.76	x	0.7	=	67.13	(79)
Southwest _{0.9x}	0.77	x	4.42	x	119.01]	0.76	x	0.7	=	193.93	(79)
Southwest _{0.9x}	0.77	x	0.91	x	118.15]	0.76	x	0.7	=	39.64	(79)
Southwest _{0.9x}	0.77	X	1.53	x	118.15]	0.76	x	0.7	=	66.65	(79)
Southwest _{0.9x}	0.77	x	4.42	x	118.15]	0.76	x	0.7	=	192.53	(79)
Southwest _{0.9x}	0.77	x	0.91	x	113.91]	0.76	x	0.7	=	38.22	(79)
Southwest _{0.9x}	0.77	x	1.53	x	113.91]	0.76	x	0.7	=	64.25	(79)
Southwest _{0.9x}	0.77	x	4.42	x	113.91]	0.76	x	0.7	=	185.62	(79)
Southwest _{0.9x}	0.77	x	0.91	x	104.39]	0.76	x	0.7	=	35.02	(79)
Southwest _{0.9x}	0.77	x	1.53	x	104.39]	0.76	x	0.7	=	58.88	(79)
Southwest _{0.9x}	0.77	X	4.42	x	104.39]	0.76	x	0.7	=	170.11	(79)
Southwest _{0.9x}	0.77	X	0.91	x	92.85]	0.76	x	0.7] =	31.15	(79)
Southwest _{0.9x}	0.77	X	1.53	x	92.85]	0.76	x	0.7] =	52.38	(79)
Southwest _{0.9x}	0.77	X	4.42	x	92.85]	0.76	x	0.7	j =	151.31	(79)

	_															
Southw	est _{0.9x}	0.77	×	0.9	91	X	6	9.27			0.76	X	0.7	=	23.24	(79)
Southw	est _{0.9x}	0.77	x	1.5	53	X	6	9.27] [0.76	X	0.7	=	39.07	(79)
Southw	est _{0.9x}	0.77	X	4.4	12	X	6	9.27			0.76	x	0.7	=	112.87	(79)
Southw	est _{0.9x}	0.77	X	0.9	91	x	4	4.07			0.76	x	0.7	=	14.79	(79)
Southw	est _{0.9x}	0.77	X	1.5	53	x	4	4.07] [0.76	x	0.7	=	24.86	(79)
Southw	est _{0.9x}	0.77	X	4.4	12	x	4	4.07] [0.76	x	0.7	=	71.82	(79)
Southw	est _{0.9x}	0.77	X	0.9	91	x	3	1.49] [0.76	x	0.7	=	10.56	(79)
Southw	est _{0.9x}	0.77	X	1.5	53	x	3	1.49] [0.76	x	0.7	=	17.76	(79)
Southw	est _{0.9x}	0.77	X	4.4	12	x	3	1.49			0.76	x	0.7	=	51.31	(79)
Solar g	gains in	watts, ca	alculated	for eac	h month				(83)m	= Su	um(74)m .	(82)m			_	
(83)m=	126.42	226.42	339.23	469.65	571.08	58	86.76	557.46	478.	.76	383.92	258.17	153.44	106.88		(83)
Total g	ains – ii	nternal a	nd solar	(84)m =	= (73)m	+ (8	83)m	, watts							_	
(84)m=	727.23	823.64	921.2	1028.29	1106.71	11	00.98	1058.58	987.	.43	905.48	803.29	724.77	697.22		(84)
7. Me	an inter	nal temp	erature	(heating	season)										
				eriods ir		<i>′</i>	area f	rom Tab	ole 9.	.Th1	1 (°C)				21	(85)
•		_	٠.	living are		_			,		. (-)					`` ′
	Jan	Feb	Mar	Apr	May	Ė	Jun	Jul	Αι	ua	Sep	Oct	Nov	Dec	7	
(86)m=	0.99	0.98	0.97	0.96	0.93	_	0.87	0.8	0.8	Ť	0.91	0.96	0.98	0.99	┪	(86)
Moon	intorno	Ltompor	atura in	living are	no T1 /f/	مالد	w cto	nc 2 to 7	l 7 in T	able.	. 00)		1	I	_	
(87)m=	16.55	16.8	17.34	18.16	19.01	_	9.84	20.33	20.2	_	19.59	18.52	17.44	16.56	1	(87)
						<u> </u>			<u> </u>			10.02	17.44	10.00		(0.)
- 1				eriods ir		_				_	<u> </u>		1		1	(00)
(88)m=	18	18	18	18.01	18.01	1	8.02	18.02	18.0	02	18.02	18.01	18.01	18		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)						_	
(89)m=	0.98	0.97	0.96	0.93	0.87	(0.72	0.45	0.5	52	0.81	0.94	0.97	0.98		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing	T2 (fo	ollow ste	ps 3	to 7	' in Tabl	e 9c)				
(90)m=	14.44	14.68	15.22	16.02	16.84	Ť	17.6	17.95	17.9	_	17.4	16.38	15.31	14.43	1	(90)
						_			!		f	LA = Livi	ng area ÷ (4	4) =	0.45	(91)
Maan	intorno	l tampar	oturo (fo	r tha wh	مام طبیم	ارانا	م/ fl	ΛΤ1	. /1	£I	Λ) Το					
(92)m=	15.39	15.64	16.18	r the wh	17.82	т —	g) = 11 8.61	19.02	18.9		18.39	17.35	16.27	15.39	1	(92)
				internal		_			<u> </u>				10.27	15.59		(32)
(93)m=	15.39	15.64	16.18	16.99	17.82	_	8.61	19.02	18.9	$\overline{}$	18.39	17.35	16.27	15.39	1	(93)
		ting requ			17.02	<u>L'</u>	0.01	10.02	10.0		10.00	17.00	10.27	10.00		(55)
					ra ohtair	had	at eta	an 11 of	Tabl	۵ Oh	on tha	t Ti m-	(76)m an	d re-cal	culata	
				using Ta		icu	ai si	ър 11 О	Table	6 30	, 30 ilia		(70)111 a11	u ie-cai	Culate	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:					•				•	•	-	
(94)m=	0.97	0.96	0.95	0.92	0.87	(0.77	0.63	0.6	57	0.83	0.93	0.96	0.97]	(94)
Usefu	ıl gains,	hmGm ,	W = (94	4)m x (84	4)m					•			•	•	_	
(95)m=	706.49	793.39	873.59	944.74	957.93	8	45.6	664.4	659.	.89	754.34	743.95	696.66	678.87		(95)
Month	nly avera	age exte	rnal tem	perature	from T	abl	e 8								_	
(96)m=	4.3	4.9	6.5	8.9	11.7		14.6	16.6	16.	.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for mea	an intern	al tempe	erature,	Lm	, W =	=[(39)m	x [(93	3)m-	- (96)m]			=	
(97)m=	4929.46	4744.38	4249.5	3442.45	2589.8	16	343.59	993.64	1048	3.46	1780.39	2853.96	3930.07	4854.2		(97)

Space heating requir 98)m= 3141.89 2655.06	1		1214.11	0	0	0	0		2328.05	3106.44		
, , ,					ļ	Tota	l per year	<u> </u>) = Sum(9	-	18325.44	(98)
Space heating requir	ement in	kWh/m²	/year							Ī	245.42	(99)
a. Energy requireme	nts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space heating:										_		_
Fraction of space hea		_		mentary	-					إ	0	(201
Fraction of space hea		•	` ,			(202) = 1 -				Ĺ	1	(202
Fraction of total heat	ing from	main sys	stem 1			(204) = (204)	Ĺ	1	(204			
Efficiency of main sp	ace heat	ing syste	em 1							Ĺ	100	(206
Efficiency of seconda	ary/supple	ementar	y heating	g systen	า, %						0	(208
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requir												
3141.89 2655.06				0	0	0	0	1569.84	2328.05	3106.44		
$211)$ m = {[(98)m x (20						_						(211
3141.89 2655.06	2511.67	1798.36	1214.11	0	0	0 Tota	0 L (k\\/b\/vor	<u> </u>	2328.05		18325.44	(211
Space heating fuel (s $\{[(98)m \times (201)]\} \times 1$, , .	month 0	0	0	0	0	0	0	0		
					ļ -	Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}		0	(215
Vater heating										L		_
Output from water hea	ter (calc				1							
362.73 323.2	347.65	323.04	324.82	302.1	301.41	315.19	309.76	334.41	339.28	357.85		¬
efficiency of water hea		400	400	400	100	400	400	400	400	400	100	(216
217)m= 100 100	100	100	100	100	100	100	100	100	100	100		(217
uel for water heating 219)m = (64)m x 10	-											
219)m= 362.73 323.2	347.65	323.04	324.82	302.1	301.41	315.19	309.76	334.41	339.28	357.85		
						Tota	I = Sum(2	19a) ₁₁₂ =			3941.44	(219
Annual totals	ad main	avatam	4					k\	Wh/year	Г	kWh/yea	¬
pace heating fuel us		system	1							Ĺ	18325.44	╣
Vater heating fuel use											3941.44	
lectricity for pumps, f	ans and	electric l	keep-hot	t								
central heating pump):									120		(230
otal electricity for the	above, k	«Wh/yea	r			sum	of (230a).	(230g) =			120	(23
Electricity for lighting										Ī	560.7	(232
12a. CO2 emissions	امطانيناط	ual baati	na cycto	ma inal	udina mi	cro-CHE				_		_

Energy kWh/year

Stroma FSAP 2012 Version: 1.0.4.18 (SAP 9.92) - http://www.stroma.com

Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.519	=	9510.9	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	2045.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =			11556.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	62.28	(267)
Electricity for lighting	(232) x	0.519	=	291	(268)
Total CO2, kg/year	sum	of (265)(271) =		11909.79	(272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =		159.5	(273)
El rating (section 14)				10	(274)

		User Details:			
Assessor Name:	Su Lee	Stroma Number:	CTD()	031315	
Software Name:	Stroma FSAP 2012	Software Version:		n: 1.0.4.18	
Contware Hame.	300000 TO 100000	Property Address: Flat 2- Existing	7 01010	11. 1.0. 1.10	
Address :	151-153, Camden High S	Street, LONDON, NW1 7JY			
1. Overall dwelling dime					
		Area(m²) Av. He	ight(m)	Volume(m³))
Ground floor		70.26 (1a) x 3	.04 (2a) =	213.59	(3a)
First floor		48.16 (1b) x 2	.39 (2b) =	115.1	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+	(1n) 118.42 (4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =	328.69	(5)
2. Ventilation rate:					
	main second heating heating			m³ per hou	r
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 fa	ns	4	x 10 =	40	(7a)
Number of passive vents		0	x 10 =	0	(7b)
Number of flueless gas fi	res	0	x 40 =	0	(7c)
			Air ch	anges per ho	ur
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)$)+(7a)+(7b)+(7c) = 40	÷ (5) =	0.12	(8)
•		ceed to (17), otherwise continue from (9) to (0.12	
Number of storeys in the	ne dwelling (ns)			0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
		or 0.35 for masonry construction		0	(11)
if both types of wall are pa deducting areas of openia	resent, use the value correspondin ngs); if equal user 0.35	g to the greater wall area (after			
= -	loor, enter 0.2 (unsealed) o	r 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, en	ter 0.05, else enter 0			0	(13)
Percentage of windows	s and doors draught strippe	d		0	(14)
Window infiltration		$0.25 - [0.2 \times (14) \div 100] =$		0	
		(0) + (40) + (44) + (40) + (40)	(45)		(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) -	F (15) =	0	(15) (16)
	q50, expressed in cubic me	etres per hour per square metre of e		0 35	=
Air permeability value, If based on air permeabil	ity value, then $(18) = [(17) \div 20]$	etres per hour per square metre of e 0]+(8), otherwise (18) = (16)	nvelope area		(16)
Air permeability value, If based on air permeabil Air permeability value applie	ity value, then $(18) = [(17) \div 20]$ s if a pressurisation test has been	etres per hour per square metre of e	nvelope area	35	(16) (17) (18)
Air permeability value, If based on air permeabil Air permeability value applie Number of sides sheltere	ity value, then $(18) = [(17) \div 20]$ s if a pressurisation test has been	etres per hour per square metre of e i]+(8), otherwise (18) = (16) done or a degree air permeability is being us	nvelope area	35 1.87 2	(16) (17) (18) (19)
Air permeability value, If based on air permeabil Air permeability value applie Number of sides sheltere Shelter factor	ity value, then (18) = [(17) ÷ 20 s if a pressurisation test has been	etres per hour per square metre of end; etres per hour per hour per square metre of end; etres per hour per ho	nvelope area	35 1.87 2 0.85	(16) (17) (18) (19) (20)
Air permeability value, If based on air permeabil Air permeability value applie Number of sides sheltere Shelter factor Infiltration rate incorporate	ity value, then (18) = [(17) ÷ 20 s if a pressurisation test has been ed	etres per hour per square metre of e i]+(8), otherwise (18) = (16) done or a degree air permeability is being us	nvelope area	35 1.87 2	(16) (17) (18) (19)
Air permeability value, If based on air permeabil Air permeability value applie Number of sides sheltere Shelter factor Infiltration rate incorporat Infiltration rate modified f	ity value, then (18) = [(17) ÷ 20 s if a pressurisation test has been ed	etres per hour per square metre of end; etres per hour per hour per square metre of end; etres per hour per hour per	nvelope area	35 1.87 2 0.85	(16) (17) (18) (19) (20)
Air permeability value, If based on air permeabil Air permeability value applie Number of sides sheltere Shelter factor Infiltration rate incorporate	ity value, then (18) = [(17) ÷ 20 s if a pressurisation test has been ed ing shelter factor or monthly wind speed Mar Apr May Jui	etres per hour per square metre of end; etres per hour per hour per square metre of end; etres per hour per hour per	nvelope area	35 1.87 2 0.85	(16) (17) (18) (19) (20)

4.4

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

(22)m=

Wind Factor (22	2a)m = ((22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjusted infiltret	tion rate	المسام	na for ob	oltor on	م لمشمط م		(21a) v	(22a)m	!				
Adjusted infiltrat	1.99	1.95	1.75	1.71	1.51	1.51	1.47	(22a)III 1.59	1.71	1.79	1.87		
Calculate effect							1.47	1.00	1.71	1.75	1.07		
If mechanical	ventila	tion:										0	(23a)
If exhaust air hea	at pump u	ising Appe	endix N, (2	3b) = (23a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	o) = (23a)			0	(23b)
If balanced with h	heat reco	very: effici	iency in %	allowing for	or in-use fa	actor (fron	n Table 4h) =				0	(23c)
a) If balanced						- ` ` 	- 	``	- 		``	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balanced	-						<u> </u>	``	- 	- 	1 1		(0.41.)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole ho					•				E (22h	.\			
if (22b)m (24c)m= 0	< 0.5 x	0	nen (240	c) = (230 0	o); otnerv	wise (24	C) = (220)) m + 0	.5 × (230	0	0		(24c)
(1)										0	0		(240)
d) If natural ve if (22b)m									0.5]				
(24d)m= 2.03	1.99	1.95	1.75	1.71	1.51	1.51	1.47	1.59	1.71	1.79	1.87		(24d)
Effective air c	hange	rate - en	ıter (24a	or (24b	o) or (240	c) or (24	d) in box	· (25)					
(25)m= 2.03	1.99	1.95	1.75	1.71	1.51	1.51	1.47	1.59	1.71	1.79	1.87		(25)
3. Heat losses	and he	at loss r	paramete	er:									
3. Heat losses ELEMENT	and he Gros area	S	oaramete Openin m	gs	Net Ar		U-valı W/m2		A X U (W/I	<)	k-value kJ/m²-ł		A X k kJ/K
	Gros	S	Openin	gs						<) 			
ELEMENT	Gros area	S	Openin	gs	A ,n	m² x	W/m2	K =	(W/I	<) 			kJ/K
ELEMENT Doors	Gros area 1	S	Openin	gs	A ,r	m ² x x1	W/m2	= 0.04] =	(W/I	<) 			kJ/K (26)
ELEMENT Doors Windows Type	Gros area 1	S	Openin	gs	A ,n 2.1 1.43	m² x x1 x1	W/m2 3 /[1/(4.8)+	0.04] = 0.04] =	(W/I 6.3 5.76	<) 			kJ/K (26) (27)
ELEMENT Doors Windows Type 2	Gros area 1 2	S	Openin	gs	A ,n 2.1 1.43 1.43	x1 x1 x1	W/m2 3 /[1/(4.8)+ /[1/(4.8)+	0.04] = 0.04] = 0.04] =	(W/I 6.3 5.76 5.76	<)			kJ/K (26) (27) (27)
ELEMENT Doors Windows Type 2 Windows Type 2 Windows Type 3	Gros area 1 2 3 4	S	Openin	gs	A ,n 2.1 1.43 1.43 0.91	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	0.04] = 0.04] = 0.04] = 0.04] =	(W/I 6.3 5.76 5.76 3.66	<)			kJ/K (26) (27) (27) (27)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4	Gros area 1 2 3 4	S	Openin	gs	A ,n 2.1 1.43 1.43 0.91 3.1	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	(W/I 6.3 5.76 5.76 3.66 12.48	<)			kJ/K (26) (27) (27) (27) (27)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 4	Gros area 1 2 3 4	S	Openin	gs	A ,n 2.1 1.43 1.43 0.91 3.1 1.43	n ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	(W/I 6.3 5.76 5.76 3.66 12.48 5.76				kJ/K (26) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 4 Windows Type 8 Windows Type 8	Gros area 1 2 3 4	S	Openin	gs	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	0.04] = 0.04]	(W/I 6.3 5.76 5.76 3.66 12.48 5.76 16.15				kJ/K (26) (27) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 4 Windows Type 6 Windows Type 6 Floor Type 1	Gros area 1 2 3 4	s (m²)	Openin	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+	0.04] = 0.04]	(W/I 6.3 5.76 5.76 3.66 12.48 5.76 16.15 84.312				kJ/K (26) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 4 Windows Type 6 Windows Type 6 Floor Type 1 Floor Type 2	Gros area 1 2 3 4 5 6	s (m²)	Openin m	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 1.2 1.2	0.04] = 0.04]	(W/I 6.3 5.76 5.76 3.66 12.48 5.76 16.15 84.312 57.792				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 4 Windows Type 6 Floor Type 1 Floor Type 2 Walls Type 1	Gros area 1 2 3 4 5 6	s (m²)	Openin m	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16	x1 x	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 1.2 2.1	0.04] = 0.04]	(W/I 6.3 5.76 5.76 3.66 12.48 5.76 16.15 84.312 57.792				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 4 Windows Type 6 Floor Type 1 Floor Type 2 Walls Type 1 Walls Type 2	Gros area 1 2 3 4 5 6	1 8	Openin m	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 1.2 1.2 2.1	0.04] = 0.04]	(W/I 6.3 5.76 5.76 3.66 12.48 5.76 16.15 84.312 57.792 -4.65 40.87				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 4 Windows Type 6 Windows Type 1 Floor Type 1 Floor Type 2 Walls Type1 Walls Type2 Walls Type3	Gros area 1 2 3 4 5 6 14.1 27.4	1 8 5	16.32 8.02	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46 6.75	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 1.2 1.2 2.1 0.73	0.04] = 0.04]	(W/I 6.3 5.76 5.76 3.66 12.48 5.76 16.15 84.312 57.792 -4.65 40.87				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 4 Windows Type 6 Windows Type 1 Floor Type 1 Floor Type 2 Walls Type 1 Walls Type 2 Walls Type 3 Walls Type 3 Walls Type 4	Gros area 1 2 3 4 5 6 14.1 27.4 6.75	1 8 5 7	16.32 8.02 0	gs 2	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46 6.75 6.75	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 1.2 2.1 2.1 0.73 0.73	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = = = =	(W/I 6.3 5.76 5.76 3.66 12.48 5.76 16.15 84.312 57.792 -4.65 40.87 4.9				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 6 Windows Type 6 Windows Type 1 Floor Type 1 Floor Type 2 Walls Type 1 Walls Type 2 Walls Type 3 Walls Type 4 Walls Type 5	Gros area 1 2 3 4 5 6 14.1 27.4 6.75 10.3	1 8 5 7 4	16.33 8.02 0 0 2.1	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46 6.75 6.75 8.27	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 1.2 1.2 2.1 0.73 0.73 0.73 2.1	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = = = = = = = =	(W/I 6.3 5.76 5.76 3.66 12.48 5.76 16.15 84.312 57.792 -4.65 40.87 4.9 6.01				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29) (29)
ELEMENT Doors Windows Type 2 Windows Type 3 Windows Type 3 Windows Type 4 Windows Type 6 Floor Type 1 Floor Type 1 Floor Type 2 Walls Type 1 Walls Type 2 Walls Type 3 Walls Type 4 Walls Type 5 Walls Type 5 Walls Type 6	Gros area 1 2 3 4 5 6 14.1 27.4 6.75 10.3	1 8 5 7 4 2	16.33 8.02 0 0 2.1 4.29	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46 6.75 6.75 8.27	m ²	W/m2 3 /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ /[1/(4.8)+ 1.2 2.1 2.1 0.73 0.73	0.04] = 0.04]	(W/I 6.3 5.76 5.76 3.66 12.48 5.76 16.15 84.312 57.792 -4.65 40.87 4.9 4.9 6.01 32.65				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29) (29) (29)

Walls Type9 2.1	4	0		2.14	x	2.1	=	4.49				(29)
Walls Type10 8.1	8	0		8.18	x	2.1	=	17.17	7 7			(29)
Roof 49.7	71	0	=	49.71	x	2.3	<u> </u>	114.33	T i		7 F	(30)
Total area of elements	s, m²			286.5	5							(31)
Party wall				38.91	x	0	=	0				(32)
Party wall				21.31	x	0	=	0				(32)
Party wall				2.13	x	0	=	0				(32)
Party wall				13.46	x	0	<u> </u>	0	T i		7 F	(32)
Party wall				13.45	5 x	0	<u> </u>	0	Ħ i		7 F	(32)
* for windows and roof wind ** include the areas on both					ated using	formula 1	/[(1/U-valu	e)+0.04] a	as given in	paragraph	1 3.2	
Fabric heat loss, W/K	= S (A x l	J)				(26)(30)	+ (32) =				540.45	(33)
Heat capacity Cm = So	(A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mass parame	eter (TMP	= Cm ÷	TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assessments who			constructi	ion are not	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridges: S (L			ısina An	pendix k	<						42.98	(36)
if details of thermal bridging	,		• .	•	•						42.90	(00)
Total fabric heat loss							(33) +	(36) =			583.42	(37)
Ventilation heat loss ca	alculated	monthly	′				(38)m	= 0.33 × (25)m x (5)			
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 220.02 215.71	211.39	189.82	185.51	163.94	163.94	159.62	172.57	185.51	194.14	202.77		(38)
Heat transfer coefficien	nt, W/K						(39)m	= (37) + (38)m		_	
(39)m= 803.44 799.13	794.82	773.24	768.93	747.36	747.36	743.05	755.99	768.93	777.56	786.19		
Heat loss parameter (H	HLP), W/r	m²K						Average = = (39)m ÷	Sum(39) _{1.} · (4)	12 /12=	772.17	(39)
(40)m= 6.78 6.75	6.71	6.53	6.49	6.31	6.31	6.27	6.38	6.49	6.57	6.64		
Number of days in mo	nth (Tahla	a 1a)					,	Average =	Sum(40) ₁ .	12 /12=	6.52	(40)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
(41)m= 31 28	31	30	31	30	31	31	30	31	30	31		(41)
` '	<u> </u>										J	
4. Water heating ene	rgy requir	rement:								kWh/y	ear:	
Assumed occupancy,	N								2.	86	1	(42)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1	+ 1.76 x	[1 - exp((-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	ΓFA -13.	.9)		_	, ,
Annual average hot wa Reduce the annual average								se taraet o		7.42	J	(43)
not more that 125 litres per				_	_							
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Hot water usage in litres per	r day for ead	ch month	Vd,m = fa	ctor from 7	Table 1c x	(43)					•	
(44)m= 118.17 113.87	109.57	105.28	100.98	96.68	96.68	100.98	105.28	109.57	113.87	118.17		
Energy content of hot water	used solo	ulated ma	inthly - 1	100 v V/d =	n v nm v [[]	Tm / 2600			m(44) ₁₁₂ =		1289.1	(44)
			-								1	
(45)m= 175.24 153.27	158.16	137.88	132.3	114.17	105.79	121.4	122.85	143.17	156.28 m(45) ₁₁₂ =	169.71	1690.21	(45)
								ı olal = SU	111(43)112 =	_	1090.21	(+3)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)26.29 22.99 23.72 20.68 19.85 17.13 15.87 18.43 21.48 23.44 25.46 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel (47)110 If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): (48)Temperature factor from Table 2b (49)0 Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)110 b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0.08 (51)If community heating see section 4.3 Volume factor from Table 2a (52)1.03 Temperature factor from Table 2b (53)0.78 Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ (54)6.71 Enter (50) or (54) in (55) 6.71 (55)Water storage loss calculated for each month $((56)m = (55) \times (41)m$ 208.01 187.88 208.01 201.3 208.01 201.3 208.01 208.01 201.3 208.01 201.3 208.01 (56)(56)m =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 208.01 208.01 201.3 (57)(57)m =187.88 208.01 201.3 201.3 208.01 208.01 201.3 208.01 208.01 (58)0 Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) \div 365 x (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)(59)m =0 Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m 0 0 0 (61)(61)m =Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ 383.24 341.14 366.16 339.18 340.31 315.46 313.8 329.4 324.14 351.17 (62)(62)m =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)(63)m =0 0 0 0 0 0 Output from water heater (64)m =383.24 341.14 366.16 339.18 340.31 315.46 313.8 324.14 351.17 377.71 329.4 357.58 Output from water heater (annual) 1...12 4139.31 (64)Heat gains from water heating, kWh/month 0.25 [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m] 201.26 218.99 206.88 210.39 201.58 206.77 214.01 (65)199 201.88 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 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 (66)(66)m =Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)42.91 38.11 23.47 17.54 14.81 20.8 27.92 35.45 41.37 (67)m =31 16 44.1

Appliances ga	ins (calcul	ated in	Append	dix L, eq	uat	ion L13 or L1	3a),	also see Tal	ole 5			-	
(68)m= 283.14	286.08	278.68	262.91	243.02	22	24.32 211.82	208	.89 216.29	232.0	251.95	270.65		(68)
Cooking gains	(calculate	d in Ap	pendix	L, equa	tior	L15 or L15a)	, als	o see Table	5				
(69)m= 37.28	37.28	37.28	37.28	37.28	3	7.28 37.28	37.	28 37.28	37.28	37.28	37.28		(69)
Pumps and fa	ns gains (Table 5	a)									_	
(70)m= 10	10	10	10	10		10 10	10	0 10	10	10	10		(70)
Losses e.g. ev	vaporation	(negati	ive valu	es) (Tab	ole :	5)						_	
(71)m= -114.28													
Water heating	gains (Tal	ble 5)										_	
(72)m= 301.98 299.5 294.34 287.34 282.79 276.38 270.94 277.92 280.39 287.64 295.83 299.51													(72)
Total internal	gains =					(66)m + (67)m	+ (68	3)m + (69)m + (70)m +	(71)m + (72))m		
(73)m= 703.89	699.54	679.87	649.57	619.2	59	91.37 574.62	583	.46 600.46	631	665.01	690.11		(73)
6. Solar gain	s:												
-		•	flux from	Table 6a	and	associated equa	tions	to convert to th	e applic		tion.		
Orientation:	Access Fa Table 6d	ctor	Area m²			Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
,	Table ou					Table 0a		Table ob	_	Table oc		(())	_
Northeast _{0.9x}	0.77	X	1.4	13	X	11.28	X	0.76	X	0.7	=	17.85	(75)
Northeast _{0.9x}	0.77	X	4.0)1	X	11.28	Х	0.76	X	0.7	=	33.36	(75)
Northeast _{0.9x}	0.77	X	1.4	13	X	22.97	Х	0.76	X	0.7	=	36.32	(75)
Northeast _{0.9x}	0.77	X	4.0)1	X	22.97	X	0.76	X	0.7	=	67.91	(75)
Northeast _{0.9x}	0.77	X	1.4	13	X	41.38	X	0.76	X	0.7	=	65.45	(75)
Northeast _{0.9x}	0.77	X	4.0)1	X	41.38	X	0.76	X	0.7	=	122.35	(75)
Northeast _{0.9x}	0.77	X	1.4	13	X	67.96	X	0.76	X	0.7	=	107.48	(75)
Northeast _{0.9x}	0.77	X	4.0)1	X	67.96	X	0.76	X	0.7	=	200.93	(75)
Northeast _{0.9x}	0.77	X	1.4	13	X	91.35	X	0.76	X	0.7	=	144.47	(75)
Northeast _{0.9x}	0.77	X	4.0)1	X	91.35	X	0.76	X	0.7	=	270.09	(75)
Northeast _{0.9x}	0.77	X	1.4	13	X	97.38	X	0.76	X	0.7	=	154.03	(75)
Northeast _{0.9x}	0.77	X	4.0)1	X	97.38	X	0.76	X	0.7	=	287.94	(75)
Northeast _{0.9x}	0.77	X	1.4	13	X	91.1	x	0.76	X	0.7	=	144.09	(75)
Northeast _{0.9x}	0.77	X	4.0)1	X	91.1	X	0.76	X	0.7	=	269.37	(75)
Northeast _{0.9x}	0.77	X	1.4	13	X	72.63	X	0.76	X	0.7	=	114.87	(75)
Northeast _{0.9x}	X)1	x	72.63	x	0.76	X	0.7	=	214.74	(75)		
Northeast 0.9x											79.75	(75)	
Northeast 0.9x 0.77 x 4.01 x 50.42 x 0.76 x 0.7 = 14												149.08	(75)
Northeast 0.9x 0.77 x 1.43 x 28.07 x 0.76 x 0.7 = 44.39												44.39	(75)
Northeast _{0.9x}	0.77	X	4.0)1	x	28.07	x	0.76	x	0.7	=	82.99	(75)
Northeast 0.9x	0.77	X	1.4	13	x	14.2	x	0.76	×	0.7		22.45	(75)
Northeast _{0.9x}	0.77	X	4.0)1	x	14.2	х	0.76	x	0.7		41.98	(75)

1.43

4.01

9.21

9.21

0.76

0.76

0.7

0.7

0.77

0.77

Northeast 0.9x

Northeast 0.9x

(75)

(75)

14.57

27.24

O 11 . F		1		1		_		1		1		_
Southwest _{0.9x}	0.77	X	1.43	X	36.79	Ļ	0.76	X	0.7	=	58.19	(79)
Southwest _{0.9x}	0.77	X	0.91	X	36.79	Ļ	0.76	X	0.7	=	37.03	(79)
Southwest _{0.9x}	0.77	X	3.1	X	36.79	<u>_</u>	0.76	X	0.7	=	126.15	(79)
Southwest _{0.9x}	0.77	X	1.43	X	36.79	Ĺ	0.76	X	0.7	=	58.19	(79)
Southwest _{0.9x}	0.77	X	1.43	X	62.67	L	0.76	X	0.7	=	99.13	(79)
Southwest _{0.9x}	0.77	X	0.91	X	62.67		0.76	X	0.7	=	63.08	(79)
Southwest _{0.9x}	0.77	X	3.1	X	62.67		0.76	X	0.7	=	214.89	(79)
Southwest _{0.9x}	0.77	X	1.43	X	62.67		0.76	X	0.7	=	99.13	(79)
Southwest _{0.9x}	0.77	X	1.43	X	85.75		0.76	X	0.7	=	135.63	(79)
Southwest _{0.9x}	0.77	X	0.91	x	85.75		0.76	X	0.7	=	86.31	(79)
Southwest _{0.9x}	0.77	X	3.1	X	85.75		0.76	X	0.7	=	294.02	(79)
Southwest _{0.9x}	0.77	X	1.43	x	85.75		0.76	x	0.7	=	135.63	(79)
Southwest _{0.9x}	0.77	x	1.43	x	106.25		0.76	x	0.7	=	168.05	(79)
Southwest _{0.9x}	0.77	x	0.91	x	106.25		0.76	x	0.7	=	106.94	(79)
Southwest _{0.9x}	0.77	x	3.1	x	106.25		0.76	x	0.7	=	364.3	(79)
Southwest _{0.9x}	0.77	x	1.43	x	106.25		0.76	x	0.7] =	168.05	(79)
Southwest _{0.9x}	0.77	x	1.43	x	119.01	Ī	0.76	x	0.7] =	188.23	(79)
Southwest _{0.9x}	0.77	x	0.91	x	119.01		0.76	x	0.7] =	119.78	(79)
Southwest _{0.9x}	0.77	x	3.1	x	119.01	Ī	0.76	x	0.7	=	408.05	(79)
Southwest _{0.9x}	0.77	x	1.43	x	119.01	Ī	0.76	x	0.7	j =	188.23	(79)
Southwest _{0.9x}	0.77	x	1.43	x	118.15	Ī	0.76	x	0.7	j =	186.87	(79)
Southwest _{0.9x}	0.77	x	0.91	x	118.15	Ī	0.76	x	0.7	j =	118.92	(79)
Southwest _{0.9x}	0.77	x	3.1	x	118.15	Ī	0.76	x	0.7	=	405.1	(79)
Southwest _{0.9x}	0.77	x	1.43	x	118.15	Ī	0.76	x	0.7	j =	186.87	(79)
Southwest _{0.9x}	0.77	x	1.43	x	113.91	Ī	0.76	x	0.7	j =	180.16	(79)
Southwest _{0.9x}	0.77	x	0.91	x	113.91	Ī	0.76	x	0.7	=	114.65	(79)
Southwest _{0.9x}	0.77	x	3.1	x	113.91	Ī	0.76	x	0.7	j =	390.56	(79)
Southwest _{0.9x}	0.77	х	1.43	x	113.91	Ī	0.76	x	0.7	j =	180.16	(79)
Southwest _{0.9x}	0.77	х	1.43	x	104.39	Ī	0.76	x	0.7	j =	165.11	(79)
Southwest _{0.9x}	0.77	х	0.91	x	104.39	Ī	0.76	x	0.7	j =	105.07	(79)
Southwest _{0.9x}	0.77	x	3.1	x	104.39	Ī	0.76	x	0.7	j =	357.92	(79)
Southwest _{0.9x}	0.77	x	1.43	x	104.39	Ī	0.76	x	0.7	j =	165.11	(79)
Southwest _{0.9x}	0.77	x	1.43	x	92.85	Ī	0.76	x	0.7	j =	146.86	(79)
Southwest _{0.9x}	0.77	x	0.91	x	92.85	Γ	0.76	x	0.7] =	93.45	(79)
Southwest _{0.9x}	0.77	x	3.1	x	92.85	Ī	0.76	x	0.7	i =	318.36	(79)
Southwest _{0.9x}	0.77	x	1.43	×	92.85	Γ	0.76	x	0.7	=	146.86	(79)
Southwest _{0.9x}	0.77	x	1.43	x	69.27	ř	0.76	x	0.7	=	109.55	(79)
Southwest _{0.9x}	0.77	x	0.91	×	69.27	ř	0.76	x	0.7	=	69.72	(79)
Southwest _{0.9x}	0.77	x	3.1	x	69.27	ř	0.76	x	0.7	=	237.5	(79)
Southwest _{0.9x}	0.77	x	1.43	x	69.27	F	0.76	x	0.7	=	109.55	(79)
Southwest _{0.9x}	0.77	x	1.43	x	44.07	F	0.76	x	0.7	=	69.7	(79)
L			<u> </u>			_		ı				_ ` `

Southwest _{0.9x} 0	77 x	0.9	91	x	44.07		0.76	x	0.7	=	44.36	(79)
Southwest _{0.9x} 0	77 x	3.	1	x	44.07		0.76	x	0.7	=	151.1	(79)
Southwest _{0.9x} 0	77 ×	1.4	13	x	44.07		0.76	x	0.7	=	69.7	(79)
Southwest _{0.9x} 0	77 ×	1.4	13	x	31.49		0.76	x	0.7	=	49.8	(79)
Southwest _{0.9x} 0	77 x	0.9)1	x	31.49		0.76	x	0.7	=	31.69	(79)
Southwest _{0.9x} 0	77 ×	3.	1	x	31.49		0.76	x	0.7	_	107.96	(79)
Southwest _{0.9x} 0	77 ×	1.4	13	x	31.49		0.76	_ x [0.7		49.8	(79)
Solar gains in watts	calculated	for eac	h month			(83)m = 9	Sum(74)m .	(82)m			•	
(83)m= 330.78 580.4			1318.86	<u> </u>		1122.81	934.36	653.7	399.3	281.08		(83)
Total gains – interna		<u>` </u>		<u> </u>	<u> </u>		,		1		1	
(84)m= 1034.67 1286	1519.25	1765.33	1938.06	1931.09	1853.6	1706.27	1534.81	1284.7	1064.31	971.19		(84)
7. Mean internal te	mperature	(heating	season)								
Temperature durin	g heating p	eriods ir	the livii	ng area	from Tal	ble 9, Th	n1 (°C)				21	(85)
Utilisation factor fo	gains for	living are	ea, h1,m	(see T	able 9a)		_				1	_
Jan Fe	b Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m= 0.99 0.98	0.97	0.95	0.92	0.86	0.8	0.82	0.91	0.96	0.98	0.99		(86)
Mean internal temp	erature in	living are	ea T1 (fo	ollow ste	eps 3 to 7	7 in Tab	le 9c)					
(87)m= 16.26 16.5	4 17.13	17.98	18.88	19.75	20.27	20.19	19.48	18.33	17.18	16.24		(87)
Temperature durin	g heating p	eriods ir	rest of	dwellin	g from Ta	able 9, T	h2 (°C)	-	-	-	•	
(88)m= 18 18	18	18	18	18	18	18	18	18	18	18		(88)
Utilisation factor fo	r gains for	rest of d	welling	h2 m (s	ee Table	9a)						
(89)m= 0.98 0.97	<u> </u>	0.93	0.86	0.72	0.45	0.52	0.81	0.94	0.97	0.98		(89)
Mean internal temp	oroturo in	the rest	of dwalli	na T2 (follow etc	nno 2 to	7 in Tabl	lo ()o)				
(90)m= 14.18 14.4		15.88	16.75	17.54	17.91	17.88	17.32	16.23	15.09	14.16		(90)
(66)	1	10.00			1				g area ÷ (4		0.15	(91)
Managa intermeditance			-11	U:\	41 A T4	. /4 - £1	. A) T O					` ′
Mean internal temp (92)m= 14.49 14.7		16.19	17.07	17.87	18.27	18.22	LA) × 12	16.55	15.4	14.47	1	(92)
Apply adjustment t				<u> </u>		1	<u> </u>		13.4	14.47		(02)
(93)m= 14.49 14.7	1	16.19	17.07	17.87	18.27	18.22	17.64	16.55	15.4	14.47		(93)
8. Space heating re	equiremen											
Set Ti to the mean	internal te	mperatu	e obtair	ed at s	tep 11 of	Table 9	b, so tha	ıt Ti,m=(76)m an	d re-calc	culate	
the utilisation facto	r for gains	using Ta	ble 9a	1					1		i	
Jan Fe		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor fo	<u> </u>	1			1	1	T				Ī	(0.4)
(94)m= 0.97 0.96		0.9	0.83	0.71	0.51	0.56	0.79	0.92	0.96	0.98		(94)
Useful gains, hmG (95)m= 1006.71 1229.	``	4)m x (84 1591.25		1262.0/	936.21	055.27	1212.76	1176.25	1022.87	947.64		(95)
Monthly average e			1615	1363.04	936.21	955.37	1213.76	1170.25	1022.67	947.04		(90)
(96)m= 4.3 4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for r				<u> </u>					<u> </u>	I	1	. ,
(97)m= 8186.31 7887.	_				1245.89				6454.82	8073.53		(97)
Space heating req	uirement fo	r each n	nonth, k	//h/mor	1 = 0.02	24 x [(97	')m – (95)m] x (4	1)m	I.	1	
(98)m= 5341.62 4474	T T	2915.13		0	0	0	0	2526.47	r -	5301.66		

			Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	30511.16	(98)
Space heating requirement in kWh/m²/year							Ī	257.65	(99)
9a. Energy requirements – Individual heating sys	stems ir	ncluding	micro-C	HP)					
Space heating:							r		_
Fraction of space heat from secondary/supplem	entary	-					ļ	0	(201)
Fraction of space heat from main system(s)			(202) = 1 -	,			ļ	1	(202)
Fraction of total heating from main system 1			(204) = (20	02) × [1 –	(203)] =		Į	1	(204)
Efficiency of main space heating system 1							Ţ	100	(206)
Efficiency of secondary/supplementary heating	system	, %					[0	(208)
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement (calculated above)				_	l				
5341.62 4474.2 4171.14 2915.13 1869.93	0	0	0	0	2526.47	3911.01	5301.66		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$			0	0	0500.47	0044.04	5004.00		(211)
5341.62 4474.2 4171.14 2915.13 1869.93	0	0	0 Tota	0 L(k\Wh/vea	2526.47 ar) =Sum(2		5301.66	20514.46	7(211)
Change booting fuel (accorded) IVM/b/month			Tota	i (KVVII/yCc	ar) =00m(2	- ' '/15,1012		30511.16	(211)
Space heating fuel (secondary), kWh/month = $\{[(98)\text{m x}(201)]\} \times 100 \div (208)$									
(215)m= 0 0 0 0 0	0	0	0	0	0	0	0		
	!		Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating							_		_
Output from water heater (calculated above)					l	Γ	T 1		
	315.46	313.8	329.4	324.14	351.17	357.58	377.71	400	(216)
Efficiency of water heater (217)m= 100 100 100 100 100	100	100	100	100	100	100	100	100	(217)
Fuel for water heating, kWh/month	100	100	100	100	100	100	100		(=11)
(219) m = (64) m × $100 \div (217)$ m					_				
(219)m= 383.24 341.14 366.16 339.18 340.31 3	315.46	313.8	329.4	324.14	351.17	357.58	377.71		_
			Tota	I = Sum(2			Į	4139.31	(219)
Annual totals Space heating fuel used, main system 1					k\	Wh/year	Г	kWh/year	<u></u>
							Ĺ	30511.16	╡
Water heating fuel used							L	4139.31	
Electricity for pumps, fans and electric keep-hot									
central heating pump:							120		(230c)
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =		[120	(231)
Electricity for lighting							[757.84	(232)
12a. CO2 emissions – Individual heating system	ns inclu	ıding mid	cro-CHP						
		ergy h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	
Space heating (main system 1)	(211) x			0.5	19	= [15835.29	(261)
Space heating (secondary)	(215	s) x			0.5	19	= [0	(263)
						·	L	-	_ ` ′

Water heating	(219) x	0.216	=	894.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			16729.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	62.28	(267)
Electricity for lighting	(232) x	0.519	=	393.32	(268)
Total CO2, kg/year	sum	of (265)(271) =		17184.98	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		145.12	(273)
EI rating (section 14)				8	(274)





SAP Proposed



















			Пост Г) otoilo:						
Assessor Name: Software Name:	Su Lee Stroma FSAP 20	12	User D	Strom Softwa					0031315 on: 1.0.4.18	
	4=4.4=0.0			Address		Propose	ed			
Address:	151-153, Camden I	High Stre	et, LON	IDON, N	W1 7JY					
1. Overall dwelling dim	ensions:		۸۳۵	o/m²\		۸۰، ۵۰	iaht/m\		Volume(m ³	11
Ground floor				a(m²) 74.67	(1a) x		ight(m) 2.75	(2a) =	205.34	(3a)
Total floor area TFA = (*	1a)+(1b)+(1c)+(1d)+(1	e)+(1r	ነ) 7	74.67	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	(3n) =	205.34	(5)
2. Ventilation rate:										
Number of chimneys		secondar heating	.y □ + □	other 0	7 - F	total	x	40 =	m³ per hou	(6a)
Number of open flues			┧╻┝		」 L 1 = 「		x	20 =		=
•		0	J . L	0	」 [─]	0			0	(6b)
Number of intermittent fa					L	2		10 =	20	(7a)
Number of passive vent	S					0	X	10 =	0	(7b)
Number of flueless gas	fires					0	X	40 =	0	(7c)
								Air ch	nanges per ho	our
Infiltration due to chimne	evs flues and fans = (6	6a)+(6b)+(7	7a)+(7b)+((7c) =	Г	20	_	÷ (5) =		(8)
	been carried out or is intend				continue fr	20 om (9) to		÷ (5) =	0.1	(6)
Number of storeys in		,,,	, ,			(1)	(-7		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: (0.25 for steel or timber	frame or	0.35 fo	r masonı	y constr	ruction			0	(11)
if both types of wall are p deducting areas of open	present, use the value corre	sponding to	the great	ter wall are	a (after					
•	floor, enter 0.2 (unsea	aled) or 0.	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, er	,	,	(,,					0	(13)
• .	vs and doors draught s	tripped							0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)
Air permeability value	, q50, expressed in cul	bic metre	s per ho	our per s	quare m	etre of e	envelope	area	4.5	(17)
If based on air permeab	•								0.32	(18)
	ies if a pressurisation test ha	is been don	ne or a de	gree air pe	rmeability	is being u	sed			7,40
Number of sides shelter Shelter factor	ea			(20) = 1 -	0.075 x (1	9)] =			0.85	(19) (20)
Infiltration rate incorpora	ating shelter factor			(21) = (18		/ -			0.03	(21)
Infiltration rate modified	•	d							0.21	(=:)
Jan Feb	Mar Apr May	1	Jul	Aug	Sep	Oct	Nov	Dec	1	
Monthly average wind s				1 1119			1		1	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
	I	1	<u> </u>	<u> </u>	<u> </u>	I		<u> </u>	1	
Wind Factor $(22a)m = (2a)m =$	' 1 1		Π.	1 .		1	1		1	
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	J	

Adjusted infiltra	ation rate	e (allowi	ng for sh	nelter an	nd wind s	peed) =	(21a) x	(22a)m					
0.35	0.34	0.34	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32]	
Calculate effect		•	rate for t	he appli	cable ca	se	•	•				_	
If mechanica			endix N (2	3h) = (23:	a) × Fmv (e	equation (I	N5)) othe	rwise (23h	n) = (23a)			0	
If balanced with) - (20u)			0	
		-	-	_					26\m . (22h) [1 (225)	0	(230
a) If balance (24a)m= 0		0	0	o with the	0	0	0	$\frac{1}{1} \frac{1}{0}$	0	23D) X [$\frac{1-(230)}{0}$) - 100]]	(24a
· · ·												J	(2.10
b) If balance	o mecha	o 0	o nulation	without 0	neat rec	overy (r	0 0	0	0	23D) 0	0	1	(24)
						<u> </u>				0		J	(2-1)
c) If whole he if (22b)m				•	•				5 × (23h)			
(24c)m = 0	0	0	0	0	0	0	0) = (22.	0	0	0	0	1	(240
d) If natural		n or wh	ole hous			ventilati						J	`
if (22b)m					•				0.5]				
(24d)m= 0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55]	(240
Effective air	change	rate - er	nter (24a) or (24h	o) or (24	c) or (24	d) in bo	x (25)	•		•	-	
(25)m= 0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55]	(25)
2 Heat lease	مطلمين	ot loop i		~ #.	•		•	•	•		•	•	
3. Heat losses	s and ne Gros				Net Ar	00	U-val	110	AXU		k-valu	2	ΑΧk
ELEMENT	area	-	Openin m		A,r		W/m2		(W/F	<)	kJ/m².		kJ/K
Doors					2.12	X	1.2	=	2.544				(26)
Windows Type	: 1				0.91	x1	/[1/(1.2)+	0.04] =	1.04				(27)
Windows Type	2				1.53		/[1/(1.2)+	0.04] =	1.75	=			(27)
Windows Type	3				4.42	〓 ,	/[1/(1.2)+	0.04] =	5.06				(27)
Windows Type					4.01		- ` / /[1/(1.2)+		4.59				(27)
Floor	•					=	0.22			 			(28)
Walls Type1					74.67	=		=	16.4274	<u>-</u>		북 늗	
	28.6		6.86	_	21.82	=	0.55	=	12	亅 !		⊣	(29)
Walls Type2	30.9	1	8.02		22.89) ×	0.55	=	12.59	_		닠 =	(29)
Walls Type3	12.2	4	2.12		10.12	2 X	0.55	= !	5.56	_		ᆜ	(29)
Roof	6.42		0		6.42	X	0.18	=	1.16				(30)
Total area of e	lements,	, m²			152.9	2							(31)
Party wall					28.6	X	0	=	0				(32)
Party wall					16.44	X	0	=	0				(32)
* for windows and ** include the area						ated using	g formula 1	/[(1/U-valu	ue)+0.04] a	s given in	paragrapi	h 3.2	
Fabric heat los	s, W/K =	= S (A x	U)				(26)(30)) + (32) =				67.3	32 (33)
Heat capacity	Cm = S(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mass	paramet	ter (TMF	o = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		25	0 (35)
For design assess				construct	ion are no	t known pi	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
can be used instead						,							
Thermal bridge	es : S (L	x Y) cal	culated i	using Ap	ppendix I	`						22.9	94 (36)

411 41 1								` '	(36) =	, ,_,	l	90.26	(3
entilation he	1	.	monthly	/ 	1		1	` '	= 0.33 × (25)m x (5) I			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
38.02	37.86	37.7	36.96	36.82	36.18	36.18	36.06	36.43	36.82	37.1	37.39		(3
at transfer	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
)m= 128.28	128.12	127.96	127.22	127.08	126.44	126.44	126.32	126.69	127.08	127.36	127.65		
		=\							Average =		12 /12=	127.22	(:
at loss para	r `							` ′	= (39)m ÷	<u>` </u>	1		
)m= 1.72	1.72	1.71	1.7	1.7	1.69	1.69	1.69	1.7	1.7	1.71	1.71		— ,
ımber of da	vs in mo	nth <i>(</i> Tahl	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.7	(-
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 31	28	31	30	31	30	31	31	30	31	30	31		(-
)III= <u>31</u>		31	30	31		1 31] 31	30			J 31		(
Water hea	ting ene	rgy requi	rement:								kWh/ye	ear:	
sumed occ	upancy.	N								2	35		(
f TFA > 13.			[1 - exp	(-0.0003	349 x (TI	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.				•
f TFA £ 13.	9, N = 1												
nual avera	•	_	•	•	•	_	` ,).11		(
duce the annu more that 125	_		• .		_	•	to acnieve	a water us	se target o	Ť			
			,		1								
Jan water usage	Feb	Mar day for ea	Apr	May	Jun	Jul Table 1c v	Aug	Sep	Oct	Nov	Dec		
						1	. /						
	95.51	91.91	88.3	84.7	81.1	81.1	84.7	88.3	91.91	95.51	99.12		_
)m= 99.12	95.51	91.91	88.3	84.7	81.1	81.1	84.7		I Total = Su	l m(44) ₁₁₂ =	=	1081.28	(
)m= 99.12 ergy content o	95.51	91.91 used - cal	88.3	84.7 onthly = 4.	81.1 190 x Vd,ı	81.1 m x nm x E	84.7 DTm / 3600	kWh/mor	Total = Su oth (see Ta	l m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1081.28	(
)m= 99.12 ergy content o	95.51	91.91	88.3	84.7	81.1	81.1	84.7	0 <i>kWh/mor</i> 103.04	Total = Sunth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)		`
99.12 ergy content o)m= 146.99	95.51 f hot water 128.56	91.91 used - cald	88.3 culated mo	84.7 onthly = 4. 110.97	81.1 190 x Vd,r 95.76	81.1 m x nm x E 88.74	84.7 0Tm / 3600 101.83) kWh/mor 103.04	Total = Su oth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1081.28	`
99.12 ergy content o m= 146.99 estantaneous i	95.51 f hot water 128.56 water heati	91.91 used - calc 132.66	88.3 culated model 115.66 of use (no	84.7 onthly = 4. 110.97 o hot water	81.1 190 x Vd,r 95.76 r storage),	81.1 m x nm x L 88.74 enter 0 in	84.7 0Tm / 3600 101.83 boxes (46)	103.04) to (61)	Total = Sunth (see Tail 120.09 Total = Sunth (see Sunth 120.09	m(44) ₁₁₂ = ables 1b, 1 131.09 m(45) ₁₁₂ =	c, 1d)		
99.12 ergy content o m= 146.99 estantaneous v m= 22.05	95.51 f hot water 128.56 water heatin 19.28	91.91 used - cald	88.3 culated mo	84.7 onthly = 4. 110.97	81.1 190 x Vd,r 95.76	81.1 m x nm x E 88.74	84.7 0Tm / 3600 101.83) kWh/mor 103.04	Total = Sunth (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)		
ergy content of the stantaneous of the storage of t	95.51 f hot water 128.56 water heatin 19.28 Floss:	91.91 used - cald 132.66 ng at point 19.9	88.3 culated mo 115.66 of use (no	84.7 onthly = 4. 110.97 o hot water 16.65	81.1 190 x Vd,r 95.76 r storage), 14.36	81.1 m x nm x E 88.74 enter 0 in 13.31	84.7 07m / 3600 101.83 boxes (46) 15.27	103.04 106 (61) 15.46	Total = Su tth (see Ta 120.09 Total = Su 18.01	m(44) ₁₁₂ = m(44) ₁₁₂ = 19.66	c, 1d) 142.35 21.35		(,
ergy content of the property o	95.51 f hot water 128.56 water heatin 19.28 loss: ne (litres)	91.91 used - calc 132.66 ng at point 19.9 includin	88.3 culated mo 115.66 of use (no 17.35	84.7 onthly = 4. 110.97 o hot water 16.65 olar or W	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS	81.1 m x nm x E 88.74 enter 0 in 13.31 storage	84.7 07m / 3600 101.83 boxes (46) 15.27 within sa	103.04 106 (61) 15.46	Total = Su tth (see Ta 120.09 Total = Su 18.01	m(44) ₁₁₂ = m(44) ₁₁₂ = 19.66	c, 1d)		(,
ergy content of the stantaneous of the storage or stora	95.51 f hot water 128.56 water heati 19.28 loss: ne (litres)	91.91 used - calc 132.66 ng at point 19.9 includin	88.3 culated mo 115.66 of use (no 17.35 g any so nk in dw	84.7 onthly = 4. 110.97 o hot water 16.65 clar or W relling, e	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS	81.1 m x nm x E 88.74 enter 0 in 13.31 storage) litres in	84.7 07m / 3600 101.83 boxes (46) 15.27 within sa (47)	103.04 106 (61) 15.46	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = m(44) ₁₁₂ = 19.66	c, 1d) 142.35 21.35		(,
ergy content of the property o	95.51 f hot water 128.56 vater heatin 19.28 closs: ne (litres) neating a o stored	91.91 used - calc 132.66 ng at point 19.9 includin	88.3 culated mo 115.66 of use (no 17.35 g any so nk in dw	84.7 onthly = 4. 110.97 o hot water 16.65 clar or W relling, e	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS	81.1 m x nm x E 88.74 enter 0 in 13.31 storage) litres in	84.7 07m / 3600 101.83 boxes (46) 15.27 within sa (47)	103.04 106 (61) 15.46	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = m(44) ₁₁₂ = 19.66	c, 1d) 142.35 21.35		((
ergy content of the property o	95.51 f hot water 128.56 water heatin 19.28 loss: ne (litres) neating a o stored a loss:	91.91 used - calc 132.66 ng at point 19.9 including and no tall hot water	88.3 culated mo 115.66 of use (no 17.35 ag any so nk in dw	84.7 onthly = 4. 110.97 o hot water 16.65 olar or W yelling, e	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS nter 110 nstantar	81.1 m x nm x E 88.74 enter 0 in 13.31 storage 0 litres in neous co	84.7 07m / 3600 101.83 boxes (46) 15.27 within sa (47)	103.04 106 (61) 15.46	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = m(44) ₁₁₂ = 19.66	c, 1d) 142.35 21.35		(
ergy content or m= 146.99 stantaneous v m= 22.05 ater storage orage volunt community l nerwise if n ater storage If manufac	95.51 f hot water 128.56 vater heatin 19.28 Floss: ne (litres) neating a o stored e loss: turer's de	91.91 used - calc 132.66 ng at point 19.9 including and no tale hot water eclared le	88.3 culated mo 115.66 of use (no 17.35 og any so nk in dw er (this in	84.7 onthly = 4. 110.97 o hot water 16.65 olar or W yelling, e	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS nter 110 nstantar	81.1 m x nm x E 88.74 enter 0 in 13.31 storage 0 litres in neous co	84.7 07m / 3600 101.83 boxes (46) 15.27 within sa (47)	103.04 106 (61) 15.46	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = 131.09 m(45) ₁₁₂ = 19.66	c, 1d) 142.35 21.35		(
ergy content of the property o	95.51 f hot water 128.56 vater heatin 19.28 loss: ne (litres) neating a o stored e loss: turer's defactor fro	91.91 used - calc 132.66 139.9 19.9 including and no tale hot water eclared lo	88.3 culated moderate and service and ser	84.7 onthly = 4. 110.97 o hot water 16.65 clar or Water velling, eacludes in the control of the control o	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS nter 110 nstantar	81.1 m x nm x E 88.74 enter 0 in 13.31 storage 0 litres in neous co	84.7 07m / 3600 101.83 boxes (46) 15.27 within sa (47)	103.04 103.04 15.46 15.46 ers) ente	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = 131.09 m(45) ₁₁₂ = 19.66	21.35 21.35		(4)
)m= 99.12 ergy content o)m= 146.99 estantaneous i	95.51 f hot water 128.56 vater heatin 19.28 Floss: ne (litres) neating a o stored e loss: turer's defactor from water	91.91 used - calc 132.66 ng at point 19.9 including and no tale hot water eclared learn Table ristorage	88.3 culated mo 115.66 of use (no 17.35 ag any so nk in dw er (this in coss facto 2b , kWh/ye	84.7 onthly = 4. 110.97 o hot water 16.65 clar or Water velling, eacludes in the control of the control o	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS enter 110 nstantar wn (kWh	81.1 m x nm x E 88.74 enter 0 in 13.31 storage 0 litres in neous con h/day):	84.7 27m / 3600 101.83 boxes (46) 15.27 within sa (47) pmbi boil	103.04 103.04 15.46 15.46 ers) ente	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = 131.09 m(45) ₁₁₂ = 19.66	21.35 125		(·) (·) (·) (·) (·) (·) (·) (·)
ergy content of the property o	95.51 f hot water 128.56 water heatin 19.28 loss: ne (litres) neating a o stored closs: turer's defactor fro om water turer's de	91.91 used - calc 132.66 ng at point 19.9 including and no tale and no tale and read leading at the colored l	88.3 culated mo 115.66 of use (no 17.35 ag any so nk in dw er (this in coss facto 2b , kWh/ye cylinder I om Tabl	84.7 onthly = 4. 110.97 o hot water 16.65 clar or W relling, e reludes i or is kno ear oss fact	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS enter 110 nstantar wn (kWh	81.1 m x nm x E 88.74 enter 0 in 13.31 storage 0 litres in neous con h/day):	84.7 27m / 3600 101.83 boxes (46) 15.27 within sa (47) pmbi boil	103.04 103.04 15.46 15.46 ers) ente	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = 131.09 m(45) ₁₁₂ = 19.66	21.35 21.35		(, (, (, (,
ergy content or ergy lost from ergy lost from ergy lost from ergy lost from ergy content or ergy lost from ergy los	95.51 f hot water 128.56 vater heating 19.28 closs: ne (litres) neating a o stored closs: turer's defactor fro om water	91.91 used - calc 132.66 ng at point 19.9 includin ind no ta hot wate eclared le m Table storage eclared of factor fr iee section	88.3 culated mo 115.66 of use (no 17.35 ag any so nk in dw er (this in coss facto 2b , kWh/ye cylinder I om Tabl	84.7 onthly = 4. 110.97 o hot water 16.65 clar or W relling, e reludes i or is kno ear oss fact	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS enter 110 nstantar wn (kWh	81.1 m x nm x E 88.74 enter 0 in 13.31 storage 0 litres in neous con h/day):	84.7 27m / 3600 101.83 boxes (46) 15.27 within sa (47) pmbi boil	103.04 103.04 15.46 15.46 ers) ente	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = 131.09 m(45) ₁₁₂ = 19.66	21.35 21.35 19 54		(, (, (, (,
ergy content or one of the standard or one of	95.51 f hot water 128.56 vater heating 19.28 Floss: ne (litres) neating a to stored floss: turer's defactor from turer's defactor	91.91 used - calc 132.66 ng at point 19.9 including and no tale hot water eclared lower than the storage eclared of factor from the section of the sect	88.3 culated mo 115.66 of use (no 17.35 ag any so nk in dw er (this in coss facto 2b , kWh/ye cylinder I om Tabl on 4.3	84.7 onthly = 4. 110.97 o hot water 16.65 clar or W relling, e reludes i or is kno ear oss fact	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS enter 110 nstantar wn (kWh	81.1 m x nm x E 88.74 enter 0 in 13.31 storage 0 litres in neous con h/day):	84.7 27m / 3600 101.83 boxes (46) 15.27 within sa (47) pmbi boil	103.04 103.04 15.46 15.46 ers) ente	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = sbles 1b, 1 131.09 m(45) ₁₁₂ = 19.66 47)	21.35 21.35 19 54		
ergy content of the property o	95.51 f hot water 128.56 vater heating 19.28 Floss: ne (litres) neating a to stored floss: turer's defactor from turer's defactor	91.91 used - calc 132.66 ng at point 19.9 including and no tale hot water eclared lower than the storage eclared of factor from the section of the sect	88.3 culated mo 115.66 of use (no 17.35 ag any so nk in dw er (this in coss facto 2b , kWh/ye cylinder I om Tabl on 4.3	84.7 onthly = 4. 110.97 o hot water 16.65 clar or W relling, e reludes i or is kno ear oss fact	81.1 190 x Vd,r 95.76 r storage), 14.36 /WHRS enter 110 nstantar wn (kWh	81.1 m x nm x E 88.74 enter 0 in 13.31 storage 0 litres in neous con h/day):	84.7 27m / 3600 101.83 boxes (46) 15.27 within sa (47) pmbi boil	103.04 103.04 15.46 15.46 ers) ente	Total = Su th (see Ta 120.09 Total = Su 18.01 sel	m(44) ₁₁₂ = m(44) ₁₁₂ = 131.09 m(45) ₁₁₂ = 19.66	21.35 19 54 64		(4)

Water	storage	loss cal	culated t	or each	month			((56)m = (55) × (41)	m				
(56)m=	19.92	17.99	19.92	19.28	19.92	19.28	19.92	19.92	19.28	19.92	19.28	19.92		(56)
If cylind	er contains	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	19.92	17.99	19.92	19.28	19.92	19.28	19.92	19.92	19.28	19.92	19.28	19.92		(57)
Prima	ry circuit	loss (an	nual) fro	m Table	3							0		(58)
Prima	ry circuit	loss cal	culated t	for each	month (59)m = ((58) ÷ 36	55 × (41)	m					
(mo	dified by	factor fi	om Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Comb	i loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total I	neat requ	uired for	water h	eating ca	alculated	I for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	166.91	146.55	152.58	134.93	130.89	115.04	108.66	121.75	122.32	140.01	150.36	162.27		(62)
Solar D	HW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	r heating)		
(add a	dditiona	l lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix C	3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Outpu	t from w	ater hea	ter											
(64)m=	166.91	146.55	152.58	134.93	130.89	115.04	108.66	121.75	122.32	140.01	150.36	162.27		
								Outp	out from w	ater heate	r (annual)₁	12	1652.28	(64)
Heat o	gains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	_
(65)m=	64.81	57.14	60.05	53.88	52.84	47.26	45.44	49.79	49.68		50.04	62.27		(65)
				00.00	02.01	77.20	45.44	49.79	49.00	55.87	59.01	63.27		(03)
incl	ude (57)	m in calc				ļ	!		ļ	ļ	ļ		eating	(03)
	ude (57) ternal da		ulation (of (65)m	only if c	ļ	!		ļ	ļ	ļ		eating	(00)
5. In	ternal ga	ains (see	culation of Table 5	of (65)m and 5a	only if c	ļ	!		ļ	ļ	ļ		eating	(00)
5. In	, ,	ains (see	culation of Table 5	of (65)m and 5a)	only if c	ylinder i	!	dwelling	or hot w	ļ	ļ		eating	(00)
5. In	ternal ga olic gain Jan	ains (see	culation of Table 5	of (65)m and 5a	only if c	ļ	s in the o		ļ	rater is fr	om com	munity h	eating	(66)
5. In Metab	ternal ga olic gain Jan	ains (see s (Table Feb 117.7	Eulation of Table 5 (25), Wat Mar	of (65)m and 5a ts Apr 117.7	only if c : : : : : : : : : : : : : : : : : : :	Jun	Jul	Aug	Sep	rater is fr	om com	munity h	eating	
5. In Metab	ternal gan olic gain Jan 117.7	ains (see s (Table Feb 117.7	Eulation of Table 5 (25), Wat Mar	of (65)m and 5a ts Apr 117.7	only if c : : : : : : : : : : : : : : : : : : :	Jun	Jul	Aug	Sep	rater is fr	om com	munity h	eating	
5. In Metab (66)m= Lightir (67)m=	ternal gar oolic gain Jan 117.7 ng gains	rins (see s (Table Feb 117.7 (calcula 16.59	Table 5 5), Wat Mar 117.7 ted in Ap	of (65)m and 5a ts Apr 117.7 opendix	May 117.7 L, equati 7.63	Jun 117.7 ion L9 o	Jul 117.7 r L9a), a	Aug 117.7 Iso see	Sep 117.7 Table 5 12.15	Oct 117.7	Nov	Dec	eating	(66)
5. In Metab (66)m= Lightir (67)m=	dernal gain Jan 117.7 ng gains 18.68	rins (see s (Table Feb 117.7 (calcula 16.59	Table 5 5), Wat Mar 117.7 ted in Ap	of (65)m and 5a ts Apr 117.7 opendix	May 117.7 L, equati 7.63	Jun 117.7 ion L9 o	Jul 117.7 r L9a), a	Aug 117.7 Iso see	Sep 117.7 Table 5 12.15	Oct 117.7	Nov	Dec	eating	(66)
5. In Metab (66)m= Lightir (67)m= Applia (68)m=	ternal gain Jan 117.7 ng gains 18.68 ances ga 207.94	reins (see s (Table Feb 117.7 (calcula 16.59 ins (calc	Table 5 Table	ts Apr 117.7 ppendix 10.21 Appendix 193.09	May 117.7 L, equati 7.63 dix L, eq 178.47	Jun 117.7 ion L9 o 6.45 uation L	Jul 117.7 r L9a), a 6.96 13 or L1	Aug 117.7 Iso see 9.05 3a), also	Sep 117.7 Table 5 12.15 see Ta 158.85	Oct 117.7 15.43 ble 5 170.42	Nov 117.7	Dec 117.7	eating	(66) (67)
5. In Metab (66)m= Lightir (67)m= Applia (68)m=	ternal gains Jan 117.7 ng gains 18.68 nces ga 207.94	reins (see s (Table Feb 117.7 (calcula 16.59 ins (calc	Table 5 Table	ts Apr 117.7 ppendix 10.21 Appendix 193.09	May 117.7 L, equati 7.63 dix L, eq 178.47	Jun 117.7 ion L9 o 6.45 uation L	Jul 117.7 r L9a), a 6.96 13 or L1	Aug 117.7 Iso see 9.05 3a), also	Sep 117.7 Table 5 12.15 see Ta 158.85	Oct 117.7 15.43 ble 5 170.42	Nov 117.7	Dec 117.7	eating	(66) (67)
5. In Metab (66)m= Lightir (67)m= Applia (68)m= Cookii (69)m=	Jan 117.7 ng gains 18.68 nnces ga 207.94 ng gains 34.77	res (Table Feb 117.7 (calcular 16.59 ins (calcular 210.1 (calcular 34.77	Table 5 25), Wat Mar 117.7 ted in Ap 13.49 ulated ir 204.66 ted in A 34.77	of (65)m s and 5a ts Apr 117.7 opendix 10.21 Append 193.09 opendix 34.77	May 117.7 L, equati 7.63 dix L, equate 178.47 L, equat	Jun 117.7 ion L9 of 6.45 uation L 164.74 ion L15	Jul 117.7 r L9a), a 6.96 13 or L1 155.57 or L15a)	Aug 117.7 Iso see 9.05 3a), also 153.41	Sep 117.7 Table 5 12.15 See Ta 158.85	Oct 117.7 15.43 ble 5 170.42	Nov 117.7 18.01	Dec 117.7 19.2 198.77	eating	(66) (67) (68)
5. In Metab (66)m= Lightir (67)m= Applia (68)m= Cookii (69)m=	Jan 117.7 ng gains 18.68 nnces ga 207.94 ng gains 34.77 s and fai	res (Table Feb 117.7 (calcular 16.59 ins (calcular 210.1 (calcular 34.77	Table 5 25), Wat Mar 117.7 ted in Ap 13.49 ulated ir 204.66 ted in A 34.77	of (65)m s and 5a ts Apr 117.7 opendix 10.21 Append 193.09 opendix 34.77	May 117.7 L, equati 7.63 dix L, equate 178.47 L, equat	Jun 117.7 ion L9 of 6.45 uation L 164.74 ion L15	Jul 117.7 r L9a), a 6.96 13 or L1 155.57 or L15a)	Aug 117.7 Iso see 9.05 3a), also 153.41	Sep 117.7 Table 5 12.15 See Ta 158.85	Oct 117.7 15.43 ble 5 170.42	Nov 117.7 18.01	Dec 117.7 19.2 198.77	eating	(66) (67) (68)
5. In Metab (66)m= Lightir (67)m= Applia (68)m= Cookii (69)m= Pump (70)m=	Jan 117.7 ng gains 18.68 nnces ga 207.94 ng gains 34.77 s and fai	resins (see Feb 117.7 (calcular 16.59 ins (calcular 34.77 ins gains 3	Mar 117.7 ted in Ap 13.49 ulated ir 204.66 ted in A 34.77 (Table \$	of (65)m and 5a ts Apr 117.7 ppendix 10.21 Appendix 193.09 ppendix 34.77 5a)	only if controls: May 117.7 L, equati 7.63 dix L, equati 178.47 L, equati 34.77	Jun 117.7 ion L9 of 6.45 uation L 164.74 ion L15 34.77	Jul 117.7 r L9a), a 6.96 13 or L1 155.57 or L15a) 34.77	Aug 117.7 Iso see 9.05 3a), also 153.41 , also se 34.77	Sep 117.7 Table 5 12.15 see Ta 158.85 ee Table 34.77	Oct 117.7 15.43 ble 5 170.42 5 34.77	Nov 117.7 18.01 185.03	Dec 117.7 19.2 198.77 34.77	eating	(66) (67) (68) (69)
5. In Metab (66)m= Lightir (67)m= Applia (68)m= Cookir (69)m= Pump (70)m=	ternal gain Jan 117.7 ng gains 18.68 nnces ga 207.94 ng gains 34.77 s and fai	resins (see Feb 117.7 (calcular 16.59 ins (calcular 34.77 ins gains 3	Mar 117.7 ted in Ap 13.49 ulated ir 204.66 ted in A 34.77 (Table \$	of (65)m and 5a ts Apr 117.7 ppendix 10.21 Appendix 193.09 ppendix 34.77 5a)	only if controls: May 117.7 L, equati 7.63 dix L, equati 178.47 L, equati 34.77	Jun 117.7 ion L9 of 6.45 uation L 164.74 ion L15 34.77	Jul 117.7 r L9a), a 6.96 13 or L1 155.57 or L15a) 34.77	Aug 117.7 Iso see 9.05 3a), also 153.41 , also se 34.77	Sep 117.7 Table 5 12.15 see Ta 158.85 ee Table 34.77	Oct 117.7 15.43 ble 5 170.42 5 34.77	Nov 117.7 18.01 185.03	Dec 117.7 19.2 198.77 34.77	eating	(66) (67) (68) (69)
5. In Metab (66)m= Lightir (67)m= Applia (68)m= Cookir (69)m= Pump (70)m= Losse (71)m=	ternal gain Jan 117.7 ng gains 18.68 nnces ga 207.94 ng gains 34.77 s and fai	s (Table Feb 117.7 (calcula 16.59 ins (calcula 210.1 (calcula 34.77 ns gains 3 raporatio -94.16	ted in Apulated in 204.66 ted in Apulated	of (65)m s and 5a ts Apr 117.7 opendix 10.21 n Append 193.09 opendix 34.77 sa) 3 tive valu	only if construction only if c	Jun 117.7 ion L9 o 6.45 uation L 164.74 ion L15 34.77	Jul 117.7 r L9a), a 6.96 13 or L1 155.57 or L15a) 34.77	Aug 117.7 Iso see 9.05 3a), also 153.41 , also se 34.77	Sep 117.7 Table 5 12.15 see Ta 158.85 ee Table 34.77	Oct 117.7 15.43 ble 5 170.42 5 34.77	Nov 117.7 18.01 185.03	Dec 117.7 19.2 198.77 34.77	eating	(66) (67) (68) (69) (70)
5. In Metab (66)m= Lightir (67)m= Applia (68)m= Cookir (69)m= Pump (70)m= Losse (71)m=	ternal garage olic gain Jan 117.7 ang gains 18.68 ances ga 207.94 ang gains 34.77 and fair 3 as e.g. ev -94.16 heating	s (Table Feb 117.7 (calcula 16.59 ins (calcula 210.1 (calcula 34.77 ns gains 3 raporatio -94.16	ted in Apulated in 204.66 ted in Apulated	of (65)m s and 5a ts Apr 117.7 opendix 10.21 n Append 193.09 opendix 34.77 sa) 3 tive valu	only if construction only if c	Jun 117.7 ion L9 o 6.45 uation L 164.74 ion L15 34.77	Jul 117.7 r L9a), a 6.96 13 or L1 155.57 or L15a) 34.77	Aug 117.7 Iso see 9.05 3a), also 153.41 , also se 34.77	Sep 117.7 Table 5 12.15 see Ta 158.85 ee Table 34.77	Oct 117.7 15.43 ble 5 170.42 5 34.77	Nov 117.7 18.01 185.03	Dec 117.7 19.2 198.77 34.77	eating	(66) (67) (68) (69) (70)
5. In Metab (66)m= Lightin (67)m= Applia (68)m= Cookin (69)m= Pump (70)m= Losse (71)m= Water (72)m=	ternal garage olic gain Jan 117.7 ang gains 18.68 ances ga 207.94 ang gains 34.77 and fair 3 as e.g. ev -94.16 heating	s (Table Feb 117.7 (calcular 16.59 ins (calcular 210.1 (calcular 34.77 ns gains 3 raporatio -94.16 gains (T	ted in Apulated in 204.66 ted in Apulated	of (65)m s and 5a ts Apr 117.7 opendix 10.21 Appendix 193.09 opendix 34.77 5a) 3 tive valu -94.16	only if construction only if c	Jun 117.7 ion L9 o 6.45 uation L 164.74 ion L15 34.77 3 le 5) -94.16	Jul 117.7 r L9a), a 6.96 13 or L1 155.57 or L15a) 34.77	Aug 117.7 Iso see 9.05 3a), also 153.41 1, also se 34.77 3	Sep 117.7 Table 5 12.15 See Ta 158.85 ee Table 34.77 3 -94.16	Oct 117.7 15.43 ble 5 170.42 15 34.77 3	Nov 117.7 18.01 185.03 34.77 3	Dec 117.7 19.2 198.77 34.77 3 -94.16	eating	(66) (67) (68) (69) (70)
5. In Metab (66)m= Lightin (67)m= Applia (68)m= Cookin (69)m= Pump (70)m= Losse (71)m= Water (72)m=	ternal gain Jan 117.7 Ing gains 18.68 Inces ga 207.94 Ing gains 34.77 Is and fair Inces gains Inces	s (Table Feb 117.7 (calcular 16.59 ins (calcular 210.1 (calcular 34.77 ns gains 3 raporatio -94.16 gains (T	ted in Apulated in 204.66 ted in Apulated	of (65)m s and 5a ts Apr 117.7 opendix 10.21 Appendix 193.09 opendix 34.77 5a) 3 tive valu -94.16	only if construction only if c	Jun 117.7 ion L9 o 6.45 uation L 164.74 ion L15 34.77 3 le 5) -94.16	Jul 117.7 r L9a), a 6.96 13 or L1 155.57 or L15a) 34.77	Aug 117.7 Iso see 9.05 3a), also 153.41 1, also se 34.77 3	Sep 117.7 Table 5 12.15 See Ta 158.85 ee Table 34.77 3 -94.16	Oct 117.7 15.43 ble 5 170.42 5 34.77 3 -94.16	Nov 117.7 18.01 185.03 34.77 3	Dec 117.7 19.2 198.77 34.77 3 -94.16	eating	(66) (67) (68) (69) (70)

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.01	x	11.28	x	0.76	x	0.7	=	33.36	(75)
Northeast 0.9x	0.77	x	4.01	x	22.97	x	0.76	x	0.7	=	67.91	(75)
Northeast 0.9x	0.77	x	4.01	x	41.38	x	0.76	x	0.7	=	122.35	(75)
Northeast 0.9x	0.77	x	4.01	x	67.96	x	0.76	x	0.7	=	200.93	(75)
Northeast 0.9x	0.77	x	4.01	x	91.35	x	0.76	X	0.7	=	270.09	(75)
Northeast 0.9x	0.77	x	4.01	x	97.38	x	0.76	x	0.7	=	287.94	(75)
Northeast 0.9x	0.77	x	4.01	x	91.1	x	0.76	x	0.7	=	269.37	(75)
Northeast 0.9x	0.77	x	4.01	x	72.63	X	0.76	x	0.7	=	214.74	(75)
Northeast 0.9x	0.77	x	4.01	x	50.42	x	0.76	x	0.7	=	149.08	(75)
Northeast 0.9x	0.77	x	4.01	x	28.07	x	0.76	x	0.7	=	82.99	(75)
Northeast 0.9x	0.77	X	4.01	x	14.2	X	0.76	X	0.7	=	41.98	(75)
Northeast 0.9x	0.77	x	4.01	x	9.21	x	0.76	x	0.7	=	27.24	(75)
Southwest _{0.9x}	0.77	x	0.91	x	36.79]	0.76	x	0.7	=	12.34	(79)
Southwest _{0.9x}	0.77	x	1.53	x	36.79		0.76	x	0.7	=	20.75	(79)
Southwest _{0.9x}	0.77	x	4.42	x	36.79		0.76	x	0.7	=	59.96	(79)
Southwest _{0.9x}	0.77	x	0.91	x	62.67		0.76	X	0.7	=	21.03	(79)
Southwest _{0.9x}	0.77	x	1.53	x	62.67		0.76	x	0.7	=	35.35	(79)
Southwest _{0.9x}	0.77	x	4.42	x	62.67		0.76	x	0.7	=	102.13	(79)
Southwest _{0.9x}	0.77	x	0.91	x	85.75		0.76	X	0.7	=	28.77	(79)
Southwest _{0.9x}	0.77	x	1.53	x	85.75		0.76	X	0.7	=	48.37	(79)
Southwest _{0.9x}	0.77	x	4.42	x	85.75		0.76	x	0.7	=	139.74	(79)
Southwest _{0.9x}	0.77	x	0.91	x	106.25		0.76	X	0.7	=	35.65	(79)
Southwest _{0.9x}	0.77	x	1.53	x	106.25		0.76	x	0.7	=	59.93	(79)
Southwest _{0.9x}	0.77	x	4.42	x	106.25]	0.76	x	0.7	=	173.14	(79)
Southwest _{0.9x}	0.77	x	0.91	x	119.01		0.76	x	0.7	=	39.93	(79)
Southwest _{0.9x}	0.77	X	1.53	x	119.01		0.76	X	0.7	=	67.13	(79)
Southwest _{0.9x}	0.77	x	4.42	x	119.01		0.76	x	0.7	=	193.93	(79)
Southwest _{0.9x}	0.77	x	0.91	x	118.15]	0.76	x	0.7	=	39.64	(79)
Southwest _{0.9x}	0.77	X	1.53	x	118.15		0.76	X	0.7	=	66.65	(79)
Southwest _{0.9x}	0.77	x	4.42	x	118.15		0.76	x	0.7	=	192.53	(79)
Southwest _{0.9x}	0.77	x	0.91	x	113.91		0.76	x	0.7	=	38.22	(79)
Southwest _{0.9x}	0.77	x	1.53	x	113.91		0.76	x	0.7	=	64.25	(79)
Southwest _{0.9x}	0.77	x	4.42	x	113.91]	0.76	x	0.7	=	185.62	(79)
Southwest _{0.9x}	0.77	x	0.91	x	104.39		0.76	X	0.7	=	35.02	(79)
Southwest _{0.9x}	0.77	x	1.53	x	104.39		0.76	x	0.7	=	58.88	(79)
Southwest _{0.9x}	0.77	X	4.42	x	104.39]	0.76	x	0.7	=	170.11	(79)
Southwest _{0.9x}	0.77	X	0.91	x	92.85]	0.76	x	0.7] =	31.15	(79)
Southwest _{0.9x}	0.77	X	1.53	x	92.85]	0.76	x	0.7] =	52.38	(79)
Southwest _{0.9x}	0.77	X	4.42	x	92.85]	0.76	x	0.7	j =	151.31	(79)

																	_
Southwe	<u> </u>	0.77	х	0.9	91	X	6	9.27			0.76	X	0.7		=	23.24	(79)
Southwe	est _{0.9x}	0.77	X	1.5	i3	X	6	9.27			0.76	X	0.7		=	39.07	(79)
Southwe	est _{0.9x}	0.77	X	4.4	12	X	6	9.27			0.76	X	0.7		=	112.87	(79)
Southwe	est _{0.9x}	0.77	X	0.9	91	x	4	4.07			0.76	x	0.7		=	14.79	(79)
Southwe	est _{0.9x}	0.77	X	1.5	53	x	4	4.07			0.76	x	0.7		=	24.86	(79)
Southwe	est _{0.9x}	0.77	Х	4.4	12	x	4	4.07			0.76	x [0.7		=	71.82	(79)
Southwe	est _{0.9x}	0.77	X	0.9)1	x	3	1.49			0.76	x	0.7		=	10.56	(79)
Southwe	est _{0.9x}	0.77	X	1.5	53	X	3	1.49			0.76	X	0.7		=	17.76	(79)
Southwe	est _{0.9x}	0.77	X	4.4	12	x	3	1.49] [0.76	x	0.7		=	51.31	(79)
Solar g	ains in wa	atts, ca	lculated	for eac	h month				(83)m	= St	ım(74)m .	(82)m	_			•	
(83)m=		226.42	339.23	469.65	571.08	_	36.76	557.46	478.	.76	383.92	258.17	153.44	106.8	88		(83)
Total ga	ains – inte	ernal a	nd solar	(84)m =	= (73)m	+ (8	33)m	, watts									
(84)m=	501.46	599.44	699.4	809.09	889.52	8	84.9	842.37	769.	.46	685.23	580.42	499.74	471.	19		(84)
7. Mea	an interna	ıl temp	erature	(heating	season)											
Tempe	erature du	uring h	eating p	eriods ir	the livi	ng	area f	from Tab	ole 9,	Th	1 (°C)					21	(85)
Utilisa	tion facto	r for ga	ains for I	iving are	ea, h1,m	ı (s	ee Ta	ble 9a)									_
	Jan	Feb	Mar	Apr	May		Jun	Jul	Αι	ug	Sep	Oct	Nov	De	ЭС		
(86)m=	1	0.99	0.98	0.95	0.88	(0.75	0.61	0.6	7	0.87	0.97	0.99	1			(86)
Mean	internal te	empera	ature in	living ar	ea T1 (fo	ollo	w ste	ps 3 to 7	in T	able	9c)					•	
(87)m=		19.33	19.67	20.12	20.55	_	0.84	20.95	20.9		20.68	20.14	19.55	19.0	9		(87)
Temna	erature du	ırina h	eating n	arinde ir	rest of	dw	مراالم	from Ta	hla C	Th	 \2 (°C\			1			
(88)m=		19.53	19.53	19.54	19.54	_	9.55	19.55	19.5	_	19.54	19.54	19.54	19.5	3		(88)
L						<u> </u>			0-1				1	<u> </u>			
(89)m=	tion facto	0.99	0.98	0.93	0.83	- 	m (se	0.43	9a) 0.4	<u>. </u>	0.79	0.96	0.99	1			(89)
` ′						<u> </u>			<u> </u>	ļ			0.99	<u> </u>			(00)
г	internal te					Ť			i 	_			1			l	(22)
(90)m=	17.1	17.39	17.89	18.54	19.11	1	9.44	19.53	19.5	52	19.3	18.57	17.72	17.0)5		(90)
											ı	LA = LIVI	ng area ÷ (4	+) =		0.45	(91)
Mean	internal te	empera	ature (fo	r the wh	ole dwe	llin	g) = fl	_A × T1	+ (1 -	– fL	A) × T2					•	
(92)m=	18.02	18.26	18.69	19.25	19.76	2	0.07	20.17	20.1	15	19.92	19.28	18.54	17.9	7		(92)
	adjustme					_			r	$\overline{}$			_			I	
(93)m=		18.11	18.54	19.1	19.61	1	9.92	20.02	20)	19.77	19.13	18.39	17.8	2		(93)
	ice heatir												()				
	to the me lisation fa					ned	at ste	ep 11 of	Table	e 9b	, so tha	t Ti,m=	(76)m an	d re-c	calc	culate	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Αı	ug	Sep	Oct	Nov	De	.C		
L Utilisa	tion facto				Iviay		Jan	- Oui		<u> </u>	ООР	001	1101		,,,		
(94)m=	0.99	0.99	0.97	0.93	0.83		0.67	0.49	0.5	5	0.81	0.95	0.99	0.99	9		(94)
Useful	I gains, hi	mGm ,	W = (94	4)m x (8	4)m	_			<u> </u>					!			
(95)m=	497.85 5	91.05	678.35	750.19	741.29	,	593	414.05	426.	.53	552.89	552.53	493.27	468.4	47		(95)
Month	ly averag	e exte	rnal tem	perature	from T	abl	e 8										
(96)m=	4.3	4.9	6.5	8.9	11.7	_	14.6	16.6	16.	4	14.1	10.6	7.1	4.2			(96)
Heat le	oss rate f					_	, W =	=[(39)m	x [(93	3)m-	- (96)m]				ı	
(97)m=	1740.11 1	692.97	1540.67	1298.18	1004.94	67	72.73	432.25	45	5	718.62	1083.45	1438.04	1738.	.39		(97)

opase nearing requir	ement fo	r each m	nonth, k\	Wh/mon	th = 0.02	24 x [(97))m – (95)m] x (4	1)m			
(98)m= 924.24 740.49	641.56	394.55	196.15	0	0	0	0	395.01	680.24	944.82		_
						Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	4917.07	(98)
Space heating requir	ement in	kWh/m²	?/year								65.85	(99)
9a. Energy requirement	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heating:			, .							г		¬,,,,,
Fraction of space hea		•		mentary	-		(004)			Ļ	0	(201)
Fraction of space hea		-	. ,			(202) = 1 -	` '	(222)		Ļ	1	(202)
Fraction of total heati	•	-				(204) = (204)	02) × [1 –	(203)] =		Ĺ	1	(204)
Efficiency of main sp										Ĺ	100	(206)
Efficiency of seconda	ıry/supple	ementar	y heating	g system	า, %						0	(208)
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requir		1		1								
924.24 740.49	641.56	394.55	196.15	0	0	0	0	395.01	680.24	944.82		
(211) m = {[(98)m x (20		<u> </u>						205.04	000.04	044.00		(211)
924.24 740.49	641.56	394.55	196.15	0	0	0 Tota	0 L(k\\/h/ves	395.01	680.24 211) _{15.1012}	944.82	4047.07	(211)
Space booting fuel (c	ooondor	v/ k//h/	month			Tota	ii (KVVII/ yCc	ar) =00m(2	- 1 15,1012	L	4917.07	(211)
Space heating fuel (s = $\{[(98)m \times (201)]\}$ x 1		- /	monun									
(215)m = 0 0	0	0	0	0	0	0	0	0	0	0		
•	.!					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating										_		_
Output from water hea				145.04	400.00	104 75	400.00	440.04	450.00	100.07		
166.91 146.55	152.58	134.93	130.89	115.04	108.66	121.75	122.32	140.01	150.36	162.27	400	7(246)
Efficiency of water hea	100	100	100	100	100	100	100	100	100	100	100	(216)
Fuel for water heating			100	100	100	100	100	100	100	100		(211)
$(219)m = (64)m \times 100$	•											
(219)m= 166.91 146.55	152.58	134.93	130.89	115.04	108.66	121.75	122.32	140.01	150.36	162.27		_
						Tota	I = Sum(2	19a) ₁₁₂ =		L	1652.28	(219)
								k\	Wh/year	_	kWh/yea	<u>r</u>
Annual totals	منحمد امح		4									
Space heating fuel use	•	system	1							Ĺ	4917.07	=
	•	system	1								1652.28	
Space heating fuel use	ed	·		t								
Space heating fuel use Water heating fuel use	ed fans and	·		t						30		(2300
Space heating fuel use Water heating fuel use Electricity for pumps, f	ed fans and	electric	keep-ho	t		sum	of (230a).			30		_
Space heating fuel use Water heating fuel use Electricity for pumps, f central heating pump	ed fans and	electric	keep-ho	t		sum	of (230a).			30	1652.28	(230c) (231) (232)
Space heating fuel use Water heating fuel use Electricity for pumps, f central heating pump Total electricity for the	ed fans and o: above, k	electric	keep-ho	t		sum	of (230a).			30	1652.28	(231)

Energy

kWh/year

Stroma FSAP 2012 Version: 1.0.4.18 (SAP 9.92) - http://www.stroma.com

Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.519 =	2551.96	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.519 =	857.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =		3409.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	15.57	(267)
Electricity for lighting	(232) x	0.519 =	171.18	(268)
Energy saving/generation technologies Item 1		0.519 =	-721.19	(269)
Total CO2, kg/year	sum	n of (265)(271) =	2875.05	(272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	38.5	(273)
El rating (section 14)			68	(274)

		User Details:				
Assessor Name:	Su Lee	Stroma N	lumber:	STRO	031315	
Software Name:	Stroma FSAP 2012	Software		Versio	n: 1.0.4.18	
		Property Address: Fla				
Address :	151-153, Camden High S	treet, LONDON, NW1	7JY			
1. Overall dwelling dime	nsions:					
Ground floor		Area(m²) 70.26 (1a)	Av. Height(n	n) (2a) = [Volume(m³)) (3a)
First floor		48.16 (1b)		$(2b) = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1$	115.1](3b)
	a)+(1b)+(1c)+(1d)+(1e)+(^	(20) -	115.1	(00)
·	a)+(1b)+(1c)+(1a)+(1e)+(` '	. (21.) (2.) (2.) (2.)	(α.)		_
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+	+(3n) =	328.69	(5)
2. Ventilation rate:						
	main second heating heating	lary other g	total		m³ per hou	•
Number of chimneys	0 + 0		= 0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0	= 0	x 20 =	0	(6b)
Number of intermittent fa	ns		4	x 10 =	40	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fi	res		0	x 40 =	0	(7c)
					_	_
				Air ch	anges per ho	ur
•	ys, flues and fans = $(6a)+(6b)$		40	÷ (5) =	0.12	(8)
Number of storeys in the	een carried out or is intended, prod oe dwelling (ns)	eea to (17), otnerwise contil	nue from (9) to (16)	Г		(9)
Additional infiltration	ic dwelling (113)		ſ	(9)-1]x0.1 =	0	(10)
	.25 for steel or timber frame	or 0.35 for masonry co		[0	(11)
	resent, use the value corresponding	-		L		\` ′
	loor, enter 0.2 (unsealed) or	0.1 (sealed), else ente	er 0		0	(12)
If no draught lobby, en	ter 0.05, else enter 0				0	(13)
Percentage of windows	s and doors draught stripped	d			0	(14)
Window infiltration		0.25 - [0.2 x (1	4) ÷ 100] =	Ī	0	(15)
Infiltration rate		(8) + (10) + (11)	1) + (12) + (13) + (15) =	• [0	(16)
Air permeability value,	q50, expressed in cubic me	tres per hour per squa	re metre of envelo	pe area	4.5	(17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20]$]+(8), otherwise (18) = (16)		Ī	0.35	(18)
Air permeability value applie	s if a pressurisation test has been o	done or a degree air permea	bility is being used	_		_
Number of sides sheltere	d	(00) 4 [0.07]	75 · · (40)1	-	2	(19)
Shelter factor		(20) = 1 - [0.07			0.85	(20)
Infiltration rate incorporat	_	$(21) = (18) \times (2)$	20) =		0.29	(21)
Infiltration rate modified f						
Jan Feb	Mar Apr May Jur	n Jul Aug S	Sep Oct No	v Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

Wind Factor (2	2a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
Adjusted infiltre	otion rote	o (allowi	na for ok	oltor on	d wind o	nood) –	(21a) v	(220)m	!				
Adjusted infiltra	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35		
Calculate effec							0.27	0.20	0.02	0.00	0.00		
If mechanica	al ventila	tion:										0	(23a)
If exhaust air he	eat pump u	using Appe	endix N, (2	3b) = (23a	ı) × Fmv (e	equation (N	N5)) , othe	rwise (23b	o) = (23a)			0	(23b)
If balanced with	heat reco	very: effic	iency in %	allowing for	or in-use fa	actor (fron	n Table 4h) =				0	(23c)
a) If balance							- ` ` - 	ŕ	- 		r ` ´	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance							<u> </u>	í `	- 	- 	1		(0.41.)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole he					•				E (22h	.\			
if (22b)m (24c)m= 0	0.5 X	(23b), t	nen (240	c) = (230 0	o); otnerv	wise (24	C) = (220)) m + 0	.5 × (230	0	0		(24c)
(' '										0	0		(240)
d) If natural v if (22b)m									0.5]				
(24d)m= 0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(24d)
Effective air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in box	· (25)					
(25)m= 0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
Heat losses	s and he	at loss r	paramete	er:									
3. Heat losses	s and he Gros area	S	oaramete Openin m	gs	Net Ar		U-valı W/m2		A X U (W/I	<)	k-value kJ/m²-k		A X k kJ/K
	Gros	S	Openin	gs						<) 			
ELEMENT	Gros area	S	Openin	gs	A ,n	m² x	W/m2	= =	(W/I	<) 			kJ/K
ELEMENT Doors	Gros area	S	Openin	gs	A ,r	m ² x x x 1.	W/m2 1.2	= 0.04] =	(W/I 2.52	<) 			kJ/K (26)
ELEMENT Doors Windows Type	Gros area 1	S	Openin	gs	A ,n 2.1 1.43	x x1.	W/m2 1.2 /[1/(1.6)+	0.04] =	2.52 2.15	<) 			kJ/K (26) (27)
ELEMENT Doors Windows Type Windows Type	Gros area	S	Openin	gs	A ,n 2.1 1.43 1.43	x1. x1. x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] =	2.52 2.15 2.15	<) 			kJ/K (26) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type	Gros area	S	Openin	gs	A ,n 2.1 1.43 1.43 0.91	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] =	2.52 2.15 2.15 1.37	<)			kJ/K (26) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type	Gros area 1 2 2 3 4 4	S	Openin	gs	A ,n 2.1 1.43 1.43 0.91 3.1	x1. x1. x1. x1. x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	2.52 2.15 2.15 1.37 4.66	<)			kJ/K (26) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 1 2 2 3 4 4	S	Openin	gs	A ,n 2.1 1.43 1.43 0.91 3.1 1.43	x1. x1. x1. x1. x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	2.52 2.15 2.15 1.37 4.66 2.15				kJ/K (26) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 1 2 2 3 4 4	S	Openin	gs	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	(W/I 2.52 2.15 2.15 1.37 4.66 2.15 6.03				kJ/K (26) (27) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Type 1	Gros area 1 2 2 3 4 4	es (m²)	Openin	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	2.52 2.15 2.15 1.37 4.66 2.15 6.03				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Type 1 Floor Type 2	Gros area 1 2 3 4 4 5 5	es (m²)	Openin m	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.25 0.15	0.04] = 0.04]	(W/I 2.52 2.15 2.15 1.37 4.66 2.15 6.03 17.565 7.224				kJ/K (26) (27) (27) (27) (27) (27) (27) (28)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Type 1 Floor Type 2 Walls Type1	Gros area 1 2 2 3 4 4 5 5 6 6	ss (m²)	Openin m	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.25 0.15	0.04] = 0.04]	(W/I 2.52 2.15 2.15 1.37 4.66 2.15 6.03 17.565 7.224				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Type 1 Floor Type 2 Walls Type1 Walls Type2	Gros area 1	1 8 5	16.33 8.02	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.25 0.15 0.28	K	(W/I 2.52 2.15 2.15 1.37 4.66 2.15 6.03 17.565 7.224 -0.62 5.45				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29)
ELEMENT Doors Windows Type Floor Type 1 Floor Type 2 Walls Type1 Walls Type2 Walls Type3	Gros area 1 1 2 2 3 3 4 4 5 5 6 6 14.1 27.4 6.75	1 8 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	16.33 8.02	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46 6.75	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.25 0.15 0.28 0.28 0.13	K	(W/I 2.52 2.15 2.15 1.37 4.66 2.15 6.03 17.565 7.224 -0.62 5.45				kJ/K (26) (27) (27) (27) (27) (27) (28) (28) (29) (29)
ELEMENT Doors Windows Type Floor Type 1 Floor Type 2 Walls Type1 Walls Type2 Walls Type3 Walls Type4	Gros area 1 1 2 2 3 3 4 4 5 5 6 6 6 6 7 5	1 8 5 7 7	16.33 8.02 0	gs 2	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46 6.75 6.75	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.25 0.15 0.28 0.28 0.13 0.13	K	(W/I 2.52 2.15 2.15 1.37 4.66 2.15 6.03 17.565 7.224 -0.62 5.45 0.89				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29)
ELEMENT Doors Windows Type Floor Type 1 Floor Type 2 Walls Type1 Walls Type2 Walls Type3 Walls Type4 Walls Type5	Gros area 1 1 2 2 3 3 4 4 5 5 6 6 6 6 6 7 5 6 7	1 8 5 7 4	16.33 8.02 0 0 2.1	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46 6.75 6.75 8.27	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.25 0.15 0.28 0.28 0.13 0.13	K	(W/I 2.52 2.15 2.15 1.37 4.66 2.15 6.03 17.565 7.224 -0.62 5.45 0.89 0.89				(26) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29) (29)
ELEMENT Doors Windows Type Floor Type 1 Floor Type 2 Walls Type 1 Walls Type 2 Walls Type 2 Walls Type 3 Walls Type 4 Walls Type 5 Walls Type 6	Gros area 1	1 8 5 7 4 2 2	16.33 8.02 0 0 2.1 4.29	gs ²	A ,n 2.1 1.43 1.43 0.91 3.1 1.43 4.01 70.26 48.16 -2.21 19.46 6.75 6.75 8.27	x1.	W/m2 1.2 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.25 0.15 0.28 0.13 0.13 0.13 0.15	K	(W/I 2.52 2.15 1.37 4.66 2.15 6.03 17.565 7.224 -0.62 5.45 0.89 0.89 1.09 2.33				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (28) (29) (29) (29) (29) (29)

Walls Type9	2.1	4	0		2.14	х	0.15	= [0.32				(29)
Walls Type10	8.1	8	0		8.18	x	0.15	<u> </u>	1.23				(29)
Roof	49.7	71	0		49.71	X	0.18	=	8.95				(30)
Total area of e	lements	, m²		<u> </u>	286.5	5							(31)
Party wall					38.91	x	0	= [0				(32)
Party wall					21.31	x	0	<u> </u>	0				(32)
Party wall					2.13	x	0	=	0				(32)
Party wall					13.46	x	0	<u> </u>	0				(32)
Party wall					13.45	5 x	0	<u> </u>	0			=	(32)
* for windows and ** include the area						ated using	formula 1	/[(1/U-valu	ie)+0.04] á	as given in	paragraph	n 3.2	
Fabric heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				100.12	(33)
Heat capacity	Cm = S	(A x k)						((28)	(30) + (32	2) + (32a).	(32e) =	0	(34)
Thermal mass	parame	eter (TMI	⊃ = Cm ÷	- TFA) ir	kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assess can be used instead				construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridge				ısina An	pendix k	<						42.98	(36)
if details of therma	,	,		• .	•	•						42.50	(00)
Total fabric hea	at loss							(33) +	(36) =			143.09	(37)
Ventilation hea	t loss c	alculated	monthly	/		-		(38)m	= 0.33 × ((25)m x (5)		,	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 61.89	61.59	61.3	59.93	59.68	58.48	58.48	58.26	58.94	59.68	60.2	60.74		(38)
Heat transfer of	oefficie	nt, W/K							= (37) + (· · · · · · · · · · · · · · · · · · ·		1	
(39)m= 204.98	204.69	204.39	203.03	202.77	201.58	201.58	201.36	202.04	202.77	203.29	203.83		
Heat loss para	meter (l	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) _{1.} · (4)	12 /12=	203.02	(39)
(40)m= 1.73	1.73	1.73	1.71	1.71	1.7	1.7	1.7	1.71	1.71	1.72	1.72		
NI C -l		- (l. / T - l.				-	-		Average =	Sum(40) ₁ .	12 /12=	1.71	(40)
Number of day			<u> </u>	Mov	lun	11	۸۰۰۰	Con	Oct	Nov	Doo	1	
(41)m= 31	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31		(41)
(41)1112 31	20			- 31	30	J 1	J 31] 30	J 31] 30	J 31	J	(,
4. Water heat	ing ene	rgy requ	irement:								kWh/y	ear:	
Assumed seen	nono.	N I										1	(40)
Assumed occu if TFA > 13.9			(1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (TFA -13.		.86	J	(42)
if TFA £ 13.9	9, N = 1											1	
Annual averag Reduce the annua									se target o		2.05		(43)
not more that 125	litres per	person pe	r day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Hot water usage in	n litres per	r day for e	ach month	Vd,m = fa	ctor from 7	Table 1c x	(43)					_	
(44)m= 112.26	108.18	104.09	100.01	95.93	91.85	91.85	95.93	100.01	104.09	108.18	112.26		
Energy content of	hot water	used - ca	lculated mo	onthlv – 4	190 x Vd n	n x nm v 「)Tm / 360(m(44) ₁₁₂ =		1224.64	(44)
(45)m= 166.48	145.6	150.25	130.99	125.69	108.46	100.5	115.33	116.71	136.01	148.47	161.22	1	
100.46	140.0	130.23	130.99	120.08	100.40	100.5	110.00			m(45) ₁₁₂ =		1605.7	(45)
									. o.a. – ou	(10)112 -		1000.7	()

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 22.27 (46)24.97 21.84 22.54 19.65 18.85 16.27 15.08 17.51 20.4 24.18 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel (47)145 If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): (48)1.32 Temperature factor from Table 2b (49)0.54 Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0.71 b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)If community heating see section 4.3 Volume factor from Table 2a (52)0 Temperature factor from Table 2b 0 (53)Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ (54)n Enter (50) or (54) in (55) 0.71 (55)Water storage loss calculated for each month $((56)m = (55) \times (41)m$ 22.1 19.96 22 1 21.38 22 1 21.38 22 1 22 1 21.38 22 1 21.38 (56)(56)m =22.1 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)(57)m =22.1 19.96 22.1 21.38 22.1 21.38 22.1 22.1 21.38 22.1 21.38 22.1 (58)0 Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) \div 365 x (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)(59)m =0 Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m 0 0 0 (61)(61)m =Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ 188.57 165.56 172.34 152.37 147.78 129.84 122.6 137.43 138.09 158.11 (62)(62)m =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)(63)m =0 0 0 0 0 0 Output from water heater 188.57 165.56 172.34 152.37 147.78 129.84 122.6 137.43 158.11 (64)m =138.09 169.85 183.32 Output from water heater (annual) 1...12 1865.87 (64)Heat gains from water heating, kWh/month $0.25 (0.85 \times (45)m + (61)m] + 0.8 \times ((46)m + (57)m + (59)m]$ 67.63 51.09 56.02 55.91 (65)(65)m =73.03 60.66 59.47 53.17 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 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 142.85 (66)(66)m =Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 16.42 (67)25.24 22.42 18.23 13.8 10.32 8.71 9.41 20.85 24.34 (67)m =12.24 25.94

Appliances ga	ins (calc	ulated in	Append	dix L, eq	uatio	on L1	3 or L1:	3a), a	also	see Tab	ole 5			_	
(68)m= 283.14	286.08	278.68	262.91	243.02	224	4.32	211.82	208	.89	216.29	232.05	251.95	270.65		(68)
Cooking gains	(calcula	ted in Ap	pendix	L, equat	tion	L15 c	or L15a)	, als	o se	e Table	5			_	
(69)m= 37.28	37.28	37.28	37.28	37.28	37	.28	37.28	37.	28	37.28	37.28	37.28	37.28		(69)
Pumps and fa	ns gains	(Table 5	ia)												
(70)m= 3	3	3	3	3	;	3	3	3		3	3	3	3		(70)
Losses e.g. ev	/aporatio	n (negat	ive valu	es) (Tab	ole 5)								_	
(71)m= -114.28	-114.28	-114.28	-114.28	-114.28	-114	4.28	-114.28	-114	.28	-114.28	-114.28	3 -114.28	-114.28		(71)
Water heating	gains (T	able 5)												_	
(72)m= 98.16	95.8	90.91	84.25	79.93	73	.85	68.68	75.	.3	77.66	84.54	92.32	95.81		(72)
Total internal	gains =					(66)n	n + (67)m	+ (68	3)m +	- (69)m + (1	70)m +	(71)m + (72)	m	_	
(73)m= 475.4	473.16	456.67	429.82	402.12	375	5.73	358.77	365	.28	379.22	406.3	437.46	461.26		(73)
6. Solar gain															
Solar gains are		_			and a			tions	to co	nvert to the	e applica		ion.		
Orientation:	Access F Table 6d	actor	Area m²			Flux	t le 6a		т,	g_ able 6b	•	FF Table 6c		Gains (W)	
	i abic oa		111												
Namela a a 4 a a 5					_			ı :			- I		_	. ,	–
Northeast 0.9x	0.77	x	1.4	13	x [1.28	x		0.76	_ x [0.7	=	17.85	(75)
Northeast _{0.9x}	0.77	x	4.0)1	x [11	1.28	x		0.76	x [0.7	=	17.85	(75)
Northeast _{0.9x}	0.77		4.0	13	늗	11 11 22	1.28 1.28 2.97			0.76	_ x [0.7 0.7 0.7	=	17.85 33.36 36.32	(75) (75)
Northeast _{0.9x} Northeast _{0.9x} Northeast _{0.9x}	0.77	x	4.0	13	x [11 11 22	1.28	x		0.76	x [0.7	=	17.85	(75) (75) (75)
Northeast 0.9x Northeast 0.9x Northeast 0.9x Northeast 0.9x	0.77	x x	4.0	13	x [11 11 22 22	1.28 1.28 2.97	x x		0.76 0.76 0.76	x [x [x [0.7 0.7 0.7	= =	17.85 33.36 36.32	(75) (75) (75) (75)
Northeast 0.9x Northeast 0.9x Northeast 0.9x Northeast 0.9x Northeast 0.9x Northeast 0.9x	0.77 0.77 0.77	x x x	4.0)1 3)1 3	x [x [111 111 222 222 41	1.28 1.28 2.97	x x x		0.76 0.76 0.76 0.76	x x	0.7 0.7 0.7 0.7	= = =	17.85 33.36 36.32 67.91	(75) (75) (75) (75) (75) (75)
Northeast 0.9x	0.77 0.77 0.77 0.77	x x x x x	4.0 1.4 4.0 1.4	01	x	111 111 222 222 411	1.28 1.28 2.97 2.97	x x x		0.76 0.76 0.76 0.76 0.76	x x	0.7 0.7 0.7 0.7 0.7	= = = = = = = = = = = = = = = = = = = =	17.85 33.36 36.32 67.91 65.45	(75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	0.77 0.77 0.77 0.77 0.77	x x x x x	4.0 1.4 4.0 1.4	01	x	111 111 222 222 411 411	1.28 1.28 2.97 2.97 1.38	x x x x		0.76 0.76 0.76 0.76 0.76 0.76	x x x x x x x x x x	0.7 0.7 0.7 0.7 0.7	= = = = = =	17.85 33.36 36.32 67.91 65.45 122.35	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	0.77 0.77 0.77 0.77 0.77 0.77 0.77	x x x x x x x	4.0 1.4 4.0 1.4 4.0 1.4	01	x	111 222 22 41 41 67 67	1.28 1.28 2.97 2.97 1.38 1.38 7.96 7.96	x x x x x		0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76	x x x x x x x x x x	0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	= = = = = = =	17.85 33.36 36.32 67.91 65.45 122.35 107.48 200.93 144.47	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	0.77 0.77 0.77 0.77 0.77 0.77	x x x x x x x x	4.0 1.4 4.0 1.4 4.0 1.4	01	x	111 222 22 41 41 67 67	1.28 1.28 2.97 2.97 1.38 1.38 7.96	x x x x x x		0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76	x x x x x x x x x x	0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	- - - - - - -	17.85 33.36 36.32 67.91 65.45 122.35 107.48 200.93	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	0.77 0.77 0.77 0.77 0.77 0.77 0.77	x x x x x x x x	4.0 1.4 4.0 1.4 4.0 1.4	01 13 01 13 01 13 01 13 01	x	111 222 222 411 411 677 91	1.28 1.28 2.97 2.97 1.38 1.38 7.96 7.96	x x x x x x		0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76	x x x x x x x x x x	0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	- - - - - - -	17.85 33.36 36.32 67.91 65.45 122.35 107.48 200.93 144.47	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.77	x x x x x x x x x x x x	4.0 1.4 4.0 1.4 4.0 1.4 4.0	01 13 01 13 01 13 01 13 01	×	111 222 222 411 411 677 6791 91997	1.28 1.28 2.97 2.97 1.38 1.38 7.96 1.35	x x x x x x x x x		0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76	x x x x x x x x x x	0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7		17.85 33.36 36.32 67.91 65.45 122.35 107.48 200.93 144.47 270.09	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.77	x x x x x x x x x x x x x x x x x x x	4.0 1.4 4.0 1.4 4.0 1.4 4.0 1.4	01	x	111 222 222 411 411 677 91 91 97	1.28 1.28 2.97 2.97 1.38 1.38 7.96 1.35 1.35	x x x x x x x x x		0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76	x x x x x x x x x x	0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7		17.85 33.36 36.32 67.91 65.45 122.35 107.48 200.93 144.47 270.09 154.03	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.77	x x x x x x x x x x x x x x x x x x x	4.0 1.4 4.0 1.4 4.0 1.4 4.0 1.4 4.0	01 13 01 13 01 13 13 11 13 13 11 13 13 14 13 14 15 16 17 18 18 18 18 18 18 18 18 18 18	x	111 222 222 411 411 67 67 91 91 97	1.28 1.28 2.97 2.97 1.38 1.38 7.96 1.35 1.35 1.35	x x x x x x x x x x x x x x x x x x x		0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76	x x x x x x x x x x	0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7		17.85 33.36 36.32 67.91 65.45 122.35 107.48 200.93 144.47 270.09 154.03 287.94	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.77 0.77	x x x x x x x x x x x x x x x x x x x	4.0 1.4 4.0 1.4 4.0 1.4 4.0 1.4 4.0 1.4	01 13 01 13 01 13 01 13 13 101 13 13 101	x	111 22 22 41 41 67 67 91 97 97 97	1.28 1.28 2.97 2.97 1.38 1.38 7.96 1.35 1.35 1.35 7.38 7.38	x x x x x x x x x x x x x x x x x x x		0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76 0.76	x x x x x x x x x x	0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7		17.85 33.36 36.32 67.91 65.45 122.35 107.48 200.93 144.47 270.09 154.03 287.94 144.09	(75) (75) (75) (75) (75) (75) (75) (75)

X

X

X

Х

1.43

4.01

1.43

4.01

1.43

4.01

1.43

4.01

50.42

50.42

28.07

28.07

14.2

14.2

9.21

9.21

X

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0.7

Northeast 0.9x

Northeast 0.9x

Northeast _{0.9x}

Northeast 0.9x

Northeast 0.9x

Northeast 0.9x

Northeast 0.9x

Northeast 0.9x

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(75)

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(75)

(75)

(75)

79.75

149.08

44.39

82.99

22.45

41.98

14.57

27.24

O 11 . F		1		1		_		1		1		_
Southwest _{0.9x}	0.77	X	1.43	X	36.79	Ļ	0.76	X	0.7	=	58.19	(79)
Southwest _{0.9x}	0.77	X	0.91	X	36.79	Ļ	0.76	X	0.7	=	37.03	(79)
Southwest _{0.9x}	0.77	X	3.1	X	36.79	Ĺ	0.76	X	0.7	=	126.15	(79)
Southwest _{0.9x}	0.77	X	1.43	X	36.79	Ĺ	0.76	X	0.7	=	58.19	(79)
Southwest _{0.9x}	0.77	X	1.43	X	62.67	L	0.76	X	0.7	=	99.13	(79)
Southwest _{0.9x}	0.77	X	0.91	X	62.67		0.76	X	0.7	=	63.08	(79)
Southwest _{0.9x}	0.77	X	3.1	X	62.67		0.76	X	0.7	=	214.89	(79)
Southwest _{0.9x}	0.77	X	1.43	X	62.67		0.76	X	0.7	=	99.13	(79)
Southwest _{0.9x}	0.77	X	1.43	X	85.75		0.76	X	0.7	=	135.63	(79)
Southwest _{0.9x}	0.77	X	0.91	x	85.75		0.76	X	0.7	=	86.31	(79)
Southwest _{0.9x}	0.77	x	3.1	x	85.75		0.76	x	0.7	=	294.02	(79)
Southwest _{0.9x}	0.77	X	1.43	x	85.75		0.76	x	0.7	=	135.63	(79)
Southwest _{0.9x}	0.77	x	1.43	x	106.25		0.76	x	0.7	=	168.05	(79)
Southwest _{0.9x}	0.77	x	0.91	x	106.25		0.76	x	0.7	=	106.94	(79)
Southwest _{0.9x}	0.77	x	3.1	x	106.25		0.76	x	0.7	=	364.3	(79)
Southwest _{0.9x}	0.77	x	1.43	x	106.25		0.76	x	0.7] =	168.05	(79)
Southwest _{0.9x}	0.77	x	1.43	x	119.01	Ī	0.76	x	0.7] =	188.23	(79)
Southwest _{0.9x}	0.77	x	0.91	x	119.01		0.76	x	0.7] =	119.78	(79)
Southwest _{0.9x}	0.77	x	3.1	x	119.01	Ī	0.76	x	0.7	=	408.05	(79)
Southwest _{0.9x}	0.77	x	1.43	x	119.01	Ī	0.76	x	0.7	j =	188.23	(79)
Southwest _{0.9x}	0.77	x	1.43	x	118.15	Ī	0.76	x	0.7	j =	186.87	(79)
Southwest _{0.9x}	0.77	x	0.91	x	118.15	Ī	0.76	x	0.7	j =	118.92	(79)
Southwest _{0.9x}	0.77	x	3.1	x	118.15	Ī	0.76	x	0.7	=	405.1	(79)
Southwest _{0.9x}	0.77	x	1.43	x	118.15	Ī	0.76	x	0.7	j =	186.87	(79)
Southwest _{0.9x}	0.77	х	1.43	x	113.91	Ī	0.76	x	0.7	j =	180.16	(79)
Southwest _{0.9x}	0.77	x	0.91	x	113.91	Ī	0.76	x	0.7	=	114.65	(79)
Southwest _{0.9x}	0.77	x	3.1	x	113.91	Ī	0.76	x	0.7	j =	390.56	(79)
Southwest _{0.9x}	0.77	х	1.43	x	113.91	Ī	0.76	x	0.7	j =	180.16	(79)
Southwest _{0.9x}	0.77	х	1.43	x	104.39	Ī	0.76	x	0.7	j =	165.11	(79)
Southwest _{0.9x}	0.77	х	0.91	x	104.39	Ī	0.76	x	0.7	j =	105.07	(79)
Southwest _{0.9x}	0.77	x	3.1	x	104.39	Ī	0.76	x	0.7	j =	357.92	(79)
Southwest _{0.9x}	0.77	x	1.43	x	104.39	Ī	0.76	x	0.7	j =	165.11	(79)
Southwest _{0.9x}	0.77	x	1.43	x	92.85	Ī	0.76	x	0.7	j =	146.86	(79)
Southwest _{0.9x}	0.77	x	0.91	x	92.85	Γ	0.76	x	0.7] =	93.45	(79)
Southwest _{0.9x}	0.77	x	3.1	x	92.85	Ī	0.76	x	0.7	i =	318.36	(79)
Southwest _{0.9x}	0.77	x	1.43	×	92.85	Γ	0.76	x	0.7	=	146.86	(79)
Southwest _{0.9x}	0.77	x	1.43	x	69.27	ř	0.76	x	0.7	=	109.55	(79)
Southwest _{0.9x}	0.77	x	0.91	×	69.27	ř	0.76	x	0.7	=	69.72	(79)
Southwest _{0.9x}	0.77	x	3.1	x	69.27	ř	0.76	x	0.7	=	237.5	(79)
Southwest _{0.9x}	0.77	x	1.43	x	69.27	F	0.76	x	0.7	=	109.55	(79)
Southwest _{0.9x}	0.77	x	1.43	X	44.07	F	0.76	x	0.7	=	69.7	(79)
L			<u> </u>			_		ı				_ ` `

Southwest _{0.9x} 0.77	X	0.9	1	x .	44.07	1 [0.76	х	0.7	=	44.36	(79)
Southwest _{0.9x} 0.77	X	3.1	1	x	44.07	Ī	0.76	_ x [0.7		151.1	(79)
Southwest _{0.9x} 0.77	X	1.4	3	X	44.07		0.76	x	0.7	=	69.7	(79)
Southwest _{0.9x} 0.77	X	1.4	3	X	31.49		0.76	x	0.7	=	49.8	(79)
Southwest _{0.9x} 0.77	X	0.9	1	X	31.49		0.76	x	0.7	=	31.69	(79)
Southwest _{0.9x} 0.77	X	3.1	1	X	31.49		0.76	x	0.7	=	107.96	(79)
Southwest _{0.9x} 0.77	X	1.4	3	X	31.49		0.76	x	0.7	=	49.8	(79)
Solar gains in watts, ca						`	Sum(74)m .	(82)m			•	
(83)m= 330.78 580.45					1278.98	1122.81	934.36	653.7	399.3	281.08		(83)
Total gains – internal a		` 	` '	<u> </u>	 						Ī	
(84)m= 806.18 1053.61	1296.05	1545.58	1720.98	1715.45	1637.75	1488.09	1313.58	1060.01	836.76	742.34		(84)
7. Mean internal temp	erature	(heating	season)								
Temperature during h	eating p	eriods ir	the livi	ng area	from Tal	ble 9, Th	n1 (°C)				21	(85)
Utilisation factor for ga	ains for l	iving are	a, h1,m	(see Ta	able 9a)		_				•	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m= 1 0.99	0.97	0.92	0.82	0.66	0.51	0.58	0.81	0.96	0.99	1		(86)
Mean internal tempera	ature in I	iving are	ea T1 (fo	ollow ste	eps 3 to 7	7 in Tab	le 9c)					
(87)m= 19.12 19.38	19.78	20.26	20.66	20.89	20.97	20.95	20.76	20.21	19.57	19.07		(87)
Temperature during h	eating p	eriods in	rest of	dwelling	g from Ta	able 9, T	h2 (°C)	-	-			
(88)m= 19.52 19.52	19.52	19.53	19.53	19.54	19.54	19.54	19.54	19.53	19.53	19.53		(88)
Utilisation factor for ga	ains for r	est of du	welling	h2 m (s	ee Table	(9a)					ı	
(89)m= 0.99 0.99	0.96	0.9	0.75	0.55	0.36	0.41	0.71	0.94	0.99	1		(89)
Mean internal temper	oturo in t	ho root	of dwolli	na T2 /:	follow etc	2 to	I 7 in Tabl	lo ()o)			l	
(90)m= 17.08 17.47	18.04	18.72	19.23	19.48	19.53	19.52	19.37	18.67	17.74	17.02		(90)
(00)					10.00	1 .0.02			g area ÷ (0.15	(91)
Maran Satawa al tanan an	-1 //	. 11		III \	(I A T4	. /4 (1						`
Mean internal tempera (92)m= 17.39 17.75	18.3	18.95	19.44	19.69	19.75	+ (1 - fi	_A) × 12 19.57	18.9	18.01	17.32]	(92)
Apply adjustment to the				<u> </u>	<u> </u>	<u> </u>			10.01	17.32		(32)
(93)m= 17.24 17.6	18.15	18.8	19.29	19.54	19.6	19.59	19.42	18.75	17.86	17.17		(93)
8. Space heating requ							-					
Set Ti to the mean into		nperatur	e obtair	ed at st	tep 11 of	Table 9	b, so tha	ıt Ti,m=(76)m an	d re-calc	culate	
the utilisation factor fo								`	,		•	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for ga	ī	i		i				1	1		1	
(94)m= 0.99 0.98	0.95	0.88	0.74	0.55	0.36	0.42	0.7	0.92	0.98	0.99		(94)
Useful gains, hmGm,	`			205.00	T 504.40	005.7	1 000 05	070.04	T 204.0	707.44	1	(OE)
` '	1229.24			935.68	594.43	625.7	923.65	976.31	821.8	737.41		(95)
Monthly average exte (96)m= 4.3 4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mea				l	1	<u> </u>				7.2		(55)
(97)m= 2652.36 2600.41	2380.46					641.97	- ` 		2188.02	2644.67		(97)
Space heating require				<u> </u>		<u> </u>	ļ .			I	I	
(98)m= 1378.83 1054.85	856.51	471.16	195.92	0	0	0	0	503.51	983.67	1419		
<u> </u>	!				•		•	•	•		•	

		Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	6863.46	(98)
Space heating requirement in kWh/m²/year							57.96	(99)
9a. Energy requirements – Individual heating syste	ems including	micro-C	CHP)					
Space heating:						ı		-
Fraction of space heat from secondary/suppleme		(222)	(224)				0	(201)
Fraction of space heat from main system(s)		(202) = 1 -	` '				1	(202)
Fraction of total heating from main system 1		(204) = (20	02) x [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1							100	(206)
Efficiency of secondary/supplementary heating sy	ystem, %			•	,	•	0	(208)
	Jun Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement (calculated above) 1378.83 1054.85 856.51 471.16 195.92	0 0	0	0	E02 E4	002.67	1410		
	0 0	0	U	503.51	983.67	1419		(0.4.4)
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$ $1378.83 \ 1054.85 \ 856.51 \ 471.16 \ 195.92$	0 0	0	0	503.51	983.67	1419		(211)
1010.00 100 100 00001 111110 100.02	Ů Ů				211),5.1012		6863.46	(211)
Space heating fuel (secondary), kWh/month								`′
$= \{[(98) \text{m x } (201)] \} \times 100 \div (208)$								
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		
		Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
Water heating								
Output from water heater (calculated above) 188.57 165.56 172.34 152.37 147.78 12	29.84 122.6	137.43	138.09	158.11	169.85	183.32		
Efficiency of water heater			.00.00		100.00	.00.02	100	(216)
·	100 100	100	100	100	100	100		(217)
Fuel for water heating, kWh/month	l .				l			
(219) m = (64) m x $100 \div (217)$ m (219)m = 188.57 165.56 172.34 152.37 147.78 12	29.84 122.6	137.43	138.09	158.11	169.85	102.22		
(219)m= 188.57 165.56 172.34 152.37 147.78 12	29.84 122.6		I = Sum(2		169.85	183.32	1865.87	(219)
Annual totals					Wh/year		kWh/yea	
Space heating fuel used, main system 1					, oa.		6863.46	T
Water heating fuel used							1865.87	Ħ
Electricity for pumps, fans and electric keep-hot								
central heating pump:						30		(230c)
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =			30	(231)
Electricity for lighting				,			445.79	(232)
Electricity generated by PVs							-2203.75	(233)
12a. CO2 emissions – Individual heating systems	s including mi	cro_CHD)				-2200.10	
12a. CO2 emissions – mulvidual neating systems	s melaaling mi	oro- OFIP						
	Energy kWh/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	
Space heating (main system 1)	(211) x			0.5	19	=	3562.14	(261)

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	968.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4530.52	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	231.36	(268)
Energy saving/generation technologies Item 1		0.519	=	-1143.75	(269)
Total CO2, kg/year	sum	of (265)(271) =		3633.71	(272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =		30.68	(273)
EI rating (section 14)				70	(274)