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Planning Statement Energy Assessment 40-42 Mill Lane

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Executive Summary Energy Assessment 40-42 Mill Lane

About the Scheme:	The proposed development is located in the Royal Borough Camden and comprises the refurbishment and extension of the upper ancillary residential space of an existing development. The proposed site is within close proximity of several conservation areas but is not considered a 'historic building' and is therefore not subject to the 'historic building' requirements under BREEAM Domestic Refurbishment for ventilation, security and sound insulation.		
Planning Policy	In accordance with the London Borough of Camden's CPG and Core Strategy CS13, the scheme is required to make improvements in line with the energy hierarchy as set out in The London Plan Policy 5.2.		
	The scheme complies with the 2013 Building Regulations Part L and the minimum energy efficiency targets in the following documents have been followed:		
	 New build (Part L1A) – New build elements have exceeded minimum requirements as outlined within Approved Document L. 		
	• Refurbishment (Part L1B) – Consequential improvements to refurbished areas have been made to ensure that the building complies with Part L, to the extent that such improvements are technically, functionally, and economically feasible.		
The Energy Hierarchy:	The proposed scheme has followed the energy hierarchy that is illustrated below: Reduce the need for energy Use energy more efficiently		
	Supply energy from renewable sources Ensure that any continuing use of fossil fuels should use clean technologies and to be efficient		

The resulting energy savings are shown below in accordance with the GLA's Energy Hierarchy:

GLA's Energy Hierarchy – Regulated Carbon Emissions				
	Baseline:Be Lean:Be Clean:Be Green:			
CO ₂ emissions (Tonnes CO ₂ /yr)	10.61	7.78	-	6.32
CO ₂ emissions saving (Tonnes CO ₂ /yr)	-	2.83	-	1.46
Saving from each stage (%)	-	26.7	-	13.8
Total CO_2 emissions saving (Tonnes CO_2/yr)		4.	29	·

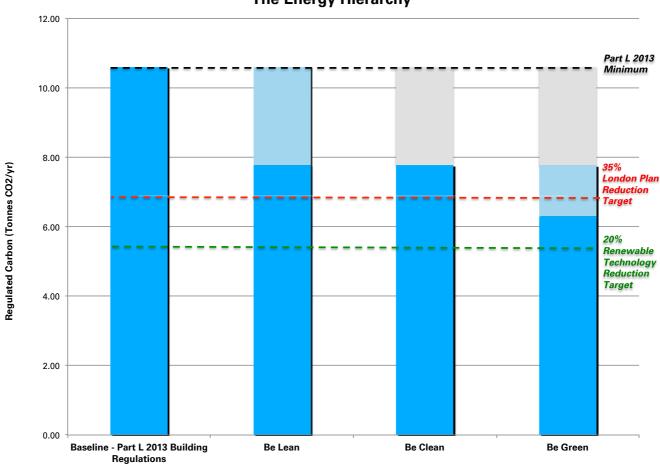
40.4% Total carbon emissions savings over Part L of the Building Regulations 2013 achieved

Executive Summary Energy Assessment 40-42 Mill Lane

GLA's Energy Hierarchy – Regulated Carbon Emissions:

A graphical illustration of how the scheme performs in relation to Building Regulations and the Energy Hierarchy is shown below.

Figure:



The Energy Hierarchy

Summary:

As demonstrated above the development will reduce carbon emissions by 26.7% from the fabric energy efficiency measures described in the 'Be Lean' section and will reduce total carbon emissions by 40.4% over Building Regulations with the further inclusion of low and zero carbon technologies. The inclusion of photovoltaic panels of the roof of the scheme contributes a 13.8% reduction in CO_2 emissions over the 'be lean' scenario.

A feasibility analysis of renewable technologies has been undertaken (page 10) determining the suitability of each possible technology.

Executive Summary Energy Assessment 40-42 Mill Lane

Shortfall in Emissions:

As set out in Policy 5.2 of the London Plan, if the development fails to meet the 35% target, the annual shortfall is determined by subtracting the overall regulated carbon dioxide savings from the target savings. The result is then multiplied by the assumed lifetime of the development's services (e.g. 30 years) to give the cumulative shortfall. The cumulative shortfall is multiplied by the carbon dioxide off-set price to determine the required cash-in-lieu contribution, as shown below.

Carbon Dioxide Emissions – Regulated (Tonnes CO ₂ /yr)			
	(Tonnes CO ₂ /yr)	%	
Savings from 'Be Lean'-After energy demand reduction	2.83	26.7%	
Savings from 'Be Clean'-After CHP	0.00	0.0%	
Savings from 'Be Green'-After renewable energy	1.46	13.8%	
Total Cumulative Savings	128.7	40.4%	
Total Cumulative Savings (from 'be green' scenario)	43.8	-	
Total Target Savings (35% reduction as set out in London Plan policy 5.2)	111.6	35%	
Annual Surplus	0.71		
Total Target Savings (20% reduction through renewables as set out in Camden's policy CS13)	63.3	20%	
Annual shortfall	0.48	-	

Total Carbon Emissions:

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

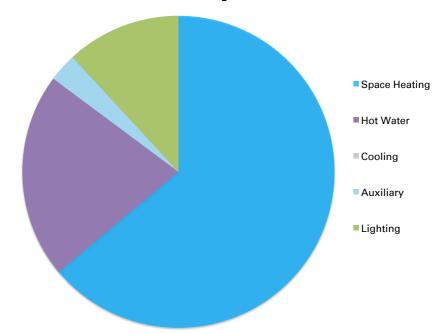
Carbon Dioxide Emissions – Regulated and Unregulated (Tonnes CO_2/yr)				
	Regulated Emissions	Unregulated Emissions	Total Emissions	
Baseline: Part L 2013	10.61	4.65	15.26	
Be Lean: After demand reduction	7.78	4.65	12.43	
Be Clean: After CHP	7.78	4.65	12.43	
Be Green: After Renewable energy	6.32	4.65	10.97	

Introduction Energy Assessment 40-42 Mill Lane

Aim of this study:	The purpose of an energy appagement is to demonstrate that elimete shange mitigation		
	The purpose of an energy assessment is to demonstrate that climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy. It also ensures energy remains an integral part of the development's design and evolution.		
Methodology:	The methodology followed in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the document "ENERGY PLANNING: Greater London Authority guidance on preparing energy assessments (April 2015)"		
	Under the GLA's guidance and the London Borough of Camden's policy document CPG3, an energy statement should accompany planning applications. The energy statement should provide information demonstrating how the energy hierarchy has been followed i.e. 'Lean, Clean, Green', including consideration of passive design and decentralised energy options such CHP/Community CHP.		
	This report has followed these documents and comprises the following components:		
	 BASELINE: A calculation of the Part L 2013 Building Regulations complaint CO₂ emission baseline using approved software. The baseline assumes a gas boiler would provide heating and any active cooling would be electrically powered. 		
	 LEAN: A calculation of the impact of demand reduction measures. For example, passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading, and active design measures such as high efficacy lighting and efficient mechanical ventilation with heat recovery 		
	 COOLING HIERARCHY: in accordance with Policy 5.9 of London Plan, measures that are proposed to reduce the demand for cooling have been set out such as minimisation of solar and internal gains and night cooling strategies. 		
	 CLEAN: in accordance with Policy 5.6 of London Plan, this report has demonstrated how the scheme has selected heating, cooling and power systems to minimise carbon emissions. This comprises an evaluation of the feasibility of connecting to existing low carbon heat networks, planned networks, site-wide and communal hea networks and CHP. 		
	• GREEN: in accordance with Policy 5.7 of London Plan, this report has conducted a feasibility assessment of renewable energy technologies. This comprised a site-specific analysis of the technologies and if applicable how they would be integrated into the heating and cooling strategy for the scheme.		
	Please note that these findings are currently subject to a detailed analysis from a building services design engineer and qualified quantity surveyor.		

Establishing Emissions: The Carbon Profile Energy Assessment 40-42 Mill Lane

Building Regulations Part L 2013 Minimum Compliance:	The 'baseline' carbon emissions for the development are 10.61 Tonnes CO_2 /yr.				
	The pie chart below provides a breakdown of the scheme's baseline ca system over the course of one year.		ne's baseline carbor	bon emissions by	
Carbon Emissions in Tonnes CO ₂ /yr	Heating	Hot Water	Cooling	Auxiliary	Lighting
	6.78	2.26	0.00	0.31	1.26



Baseline CO₂ Breakdown

Overview:

The chart above shows that space heating is the primary source of carbon emissions, and domestic hot water is the second largest, across the scheme as a whole. Space heating accounts for approximately 64% of the residential scheme's total energy demand whilst domestic hot water accounts for approximately 21%.

'Be Lean': Demand Reduction Measures Energy Assessment 40-42 Mill Lane

Be Lean - Summary:

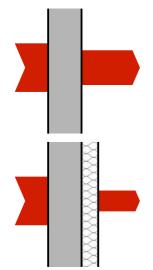
Site Layout Passive Design measures: Demand reduction measures have reduced the scheme's carbon emissions by 26.7 % over the minimum Part L 2013 Building Regulations baseline.

The existing building is orientated north/south with glazing on all exposed facades. As part of the refurbishment works, existing single glazing will be replaced with high performance low emissivity, double glazing to reduce excessive solar gains and to improve the thermal comfort within each unit. Windows will be fully openable to reduce the need for active cooling measures.

Building Fabric Passive Design measures:

U	Val	ues

Element	Minimum Building Regulations U value	Proposed U value
	W/m ² K	W/m²K
External wall (new)	0.28	0.25
External wall (upgraded)	0.30	0.25
Semi exposed wall	0.30	0.28
Party Wall	0.20	0.00
Semi exposed floors	0.25	0.25
Roof (new)	0.18	0.18
Roof (upgraded)	0.18	0.18
Flat roof (upgraded)	0.18	0.16
Glazing (new)	1.6	1.4
Doors (new)	1.8	1.5



Graphic illustrations of the heat flow through a wall and how is it minimized with low uvalue (consequence of the additional insulation).

Airtightness:

The target air permeability for the scheme has been modelled as 5 m³/(hr.m²) @ 50 pa.

This will require careful attention to two key areas:

- Structural leakage
- Services leakage

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

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

Thermal Bridging:

As a refurbishment project there is limited scope to minimise heat loss via linear junctions. The scheme has therefore been indicatively modelled with the default thermal bridge y-values for all junction types, 0.15W/m²K.

Thermal Mass:

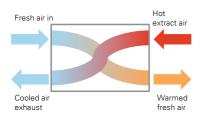
Thermal mass of the scheme has been indicatively modelled as 250 kJ/m²K (medium).

'Be Lean': Demand **Reduction Measures Energy Assessment** 40-42 Mill Lane

Energy Efficient Services Active Design measures:

Heating:

Heating to the units will be provided by high efficiency combi-gas boilers, featuring time and temperature zone control, delayed thermostat and a weather compensator. The heat will be distributed via radiators The gas boiler will have a minimum efficiency of 90% and will provide space and domestic hot water heating.



Graphic illustration of a heat recovery unit, which exploits the extract hot air of the room to heat the cold supply air.

Ventilation: Balanced mechanical ventilation with heat recovery (90% efficiency) will be provided to wet rooms and kitchen within each unit with a specific fan power of 0.6 W/l/s.

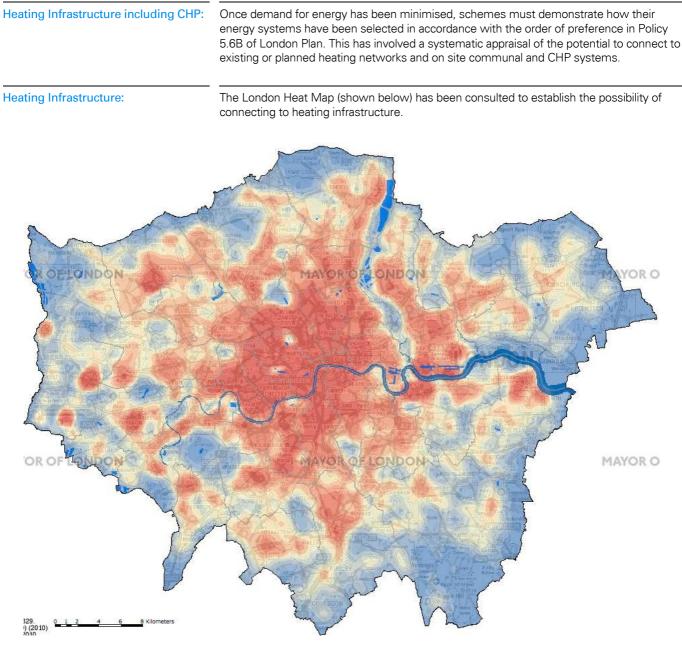
Air Conditioning:

No cooling system has been specified for the dwellings. Natural ventilation through openable windows will be used as a passive cooling measure alongside supply ventilation to living spaces.

Lighting:

At least 75% of lighting specified will be high efficiency ensuring a total internal wattage of <9watts/m².

'Be Clean': Heating Infrastructure & CHP Energy Assessment 40-42 Mill Lane



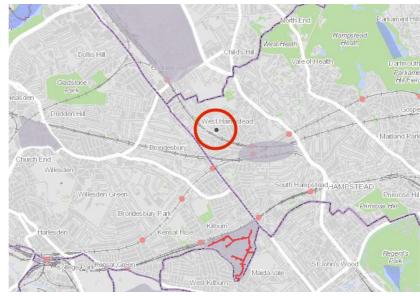
Source: http://www.londonheatmap.org.uk/Mapping

'Be Clean': Connection to Existing and Planned Networks Energy Assessment 40-42 Mill Lane

Existing and Planned Networks:

Existing networks:

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



Existing DH NetworksPotential DH Networks

There are no existing or potential networks within the vicinity of the scheme, therefore a connection is not possible. The closest potential district heating network is located in Kilburn, however this falls outside of the connectable range of the proposed scheme.

'Be Clean': Site Wide Networks and CHP Energy Assessment 40-42 Mill Lane

Site-wide Heat Networks:	In accordance with section 8.2 of the GLA guidance for Energy Planning, where it is demonstrable that a site wide network is not feasible then an individual heating strategy can be implemented. A site wide network will not be adopted because the dwellings on site will not have adequate density and local conditions are not favourable to centralised distribution. Therefore, it is considered that distribution losses would be relatively large and the effectiveness and carbon reducing potential would be undermined when compared to an individual servicing strategy.
Combined Heat and Power (CHP)	In accordance with section 8.3 of the GLA guidance for Energy Planning where connection to an area wide heat network will not be available in the foreseeable future i.e. 5 years following completion, or the development is of such a scale that it could be the catalyst for an area wide heat network, applicants should evaluate the feasibility of on-site CHP
	GLA guidance stipulates that small, or purely residential developments of less than 350 dwellings will not be expected to include on-site CHP. CHP systems are best utilised where there is a consistent and high demand for heat. Because of the small electricity supplies and demand of this scheme, a CHP installed to meet the base heat load would typically require the export of electricity to the grid. The administrative burden of managing CHP electricity sales at a small scale without an active energy service companies (ESCOs) is prohibitive for smaller operators of residential developments.
	The heat demand profile of this residential scheme is not suitable to CHP. The implemented fabric improvements from the 'Be Lean' scenario have also reduced the energy demand from space heating to hot water. For CHP systems to be economically viable they need to run for at least 5,000 hours per year. Therefore, a CHP system would most likely be oversized, and as a result less efficient and economic.

'Be Clean': Cooling Energy Assessment 40-42 Mill Lane

 The aim of this policy is to reduce the impact of the urban heat island effect in London and encourage the design of spaces to avoid overheating and excessive heat generation, and to mitigate overheating due to the impact of climate change. Where design measures and the use of natural and/or mechanical ventilation are not enough to guarantee the occupant's comfort, in line with the cooling hierarchy the development's cooling strategy must include details of the active cooling plant being proposed, including efficiencies, and the ability to take advantage of free cooling and/or renewable cooling sources. Where appropriate, the cooling strategy should investigate the opportunities to improve cooling efficiencies through the use of locally available sources such as ground cooling and river/dock water-cooling. 				
				Major developments should reduce potential overheating and reliance on air conditioning systems and demonstrate this with the Cooling Hierarchy:
				1) Minimise internal heat generation through energy efficient design
2) Reduce the amount of heat entering the building in summer (e.g. shading and fenestration)				
3) Manage the heat within the building through thermal mass, room height and green roofs				
4) Passive ventilation				
5) Mechanical ventilation				
6) Active cooling systems (ensuring the lowest carbon option)				
The following measures have been taken in accordance with the cooling hierarchy to reduce overheating and the need for cooling:				
1) Minimise internal heat generation through energy efficient design				
Internal heat gains have been minimised where possible. The scheme will target the BREEAM Domestic Refurbishment Energy 5: Energy Labelled White Goods. Energy Efficient appliances will help reduce internal heat gain and reduce the cooling requirement.				

Energy efficient lighting will also be specified (>45 lumens per circuit watt). LED lighting will be specified and a power lighting density figure of 9W/m² will be targeted. Occupancy sensors will also be specified to reduce unnecessary lighting usage.

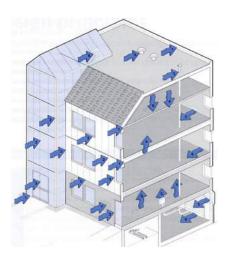
LED bulbs can emit 80% less heat compared to an incandescent bulb and their life span is up to 41 times more.

'Be Clean': Cooling Energy Assessment 40-42 Mill Lane

Avoiding Overheating Measures taken:

2)





Examples of possible air leakage points in a building



Examples of how the thermal mass absorbs heat during day and emits it during night.

Direct solar gains will be controlled in the following ways:

Reduce the amount of heat entering the building in summer (e.g. shading

- Solar control methods controlling solar gain to within tolerable limits have been considered. The location, design and type of window openings and glazing have been optimised, and reduced solar gain factors from low emissivity windows with a g-value of 0.57 have been specified.
- Dark-coloured curtain/roller blinds will be specified to limit solar gain. The shading has also been optimised to avoid substantially reducing daylighting or increasing the requirement for electric lighting.

Heat transfer and infiltration has been controlled in the following ways:

- Insulation levels have been maximised and the resulting u-values are lower than required by Building Regulations. The build-ups therefore prevent the penetration of heat as much as practically possible. See the 'Be Lean' section of this report for target u values.
- A reduced air permeability rate of 5 m³/(hr.m²) @ 50 pa has been targeted to minimise uncontrolled air infiltration. This will require attention to detailing and sealing. See 'Be Lean' section of this report for details of how this will be achieved.

Manage the heat within the building through thermal mass, room height and 3) areen roofs.

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

High thermal mass - High thermal mass - Existing building fabric materials such as masonry (walls) and concrete act as 'thermal batteries'; they absorb heat gains during the day when the building is occupied and 'store' it for an extended period, thereby helping to stabilise daytime temperatures. At night this heat can be dissipated, which 'resets' the heating cycle. Ventilation will also be used at night to purge the stored heat within the structure. A 'ground coupled' system that uses the thermal storage capacity of the ground has not been specified as the passive ventilation option has been selected instead

'Be Clean': Cooling Energy Assessment 40-42 Mill Lane

Avoiding Overheating Measures taken:

- Room heights high ceilings are traditionally used in hot climates to allow thermal stratification so that occupants can inhabit the lower cooler space, and to decrease the transfer of heat gain through the roof. The existing building has floor to ceiling heights of approximately 2.8m. As the roof will be well insulated to achieve a U-value of 0.18 W/m²K, there will be minimal penetration of heat through the roof.
- Green roofs A green roof has been considered to be unpractical by the design team due to site constraints. Consequently, a roof covering with a high albedo (reflective) surface has been specified in order to minimise the heat absorbed by the roof, and significant thermal insulation has been specified to prevent any heat absorbed being transferred into the building.

4) Passive ventilation

Ventilation that does not use fans or mechanical systems has been specified to reduce the cooling load.

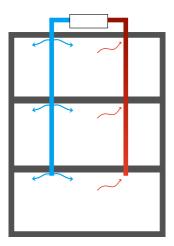
- Openable windows are specified on all exposed facades of the building. Cross ventilation will be achieved within Unit 1 by opening windows on two facades and ensuring there is a clear path for airflow.
- Night time cooling will also be utilised in the form of openable windows. This will work in tandem with high thermal mass materials part of the existing structure. The larger temperature differential that exists between internal and external temperatures at night will allow effective stack ventilation and purging of heat accumulated within the stricture during the day.



Typical building section demonstrating passive cross ventilation.

'Be Clean': Cooling Energy Assessment 40-42 Mill Lane

Avoiding Overheating Measures taken:



Typical building section demonstrating a simple method of supply and extract ventilation system.

Overheating Risk:

5) Mechanical ventilation

Passive ventilation will not be adequate to cool the building to the required temperature. Mechanical ventilation will be utilised in the following forms:

- A mixed mode system will be implemented. This will be complimentary to the passive cooling measures taken. During summer months, mechanical ventilation using fans will circulate and remove hot air from the building. The building will also adopt a zoned design to allow natural ventilation where possible and mechanical ventilation where there are increased cooling loads such as server/IT rooms and equipment and highdensity offices.
- Fan powered ventilation: single point extracts will be used in WCs and kitchen areas. A whole building system will be specified which will use air handling units with separate supply and extract fans. Heat recovery units will also be specified to reduce energy demand, optimal performance will be achieved by the reduced air permeability rate of 5 m³/(hr.m²) @ 50 pa.
- The mechanical systems will have the following efficiencies which are in compliance with the Domestic Building Services Compliance Guide:
 - ✓ Specific fan power of 0.6 W/l/s for whole ventilation systems with heat recovery
 - ✓ Heat recovery efficiency of 90%

The overheating risk considering all the above measures have been assessed for each dwelling and is presented in the table below:

Dwellings	Overheating risk according to SAP
Flat 1	Slight
Flat 2	Slight
Flat 3	Slight
Flat 4	Slight
Flat 5	Not Significant

According to the GLA guidance on preparing energy assessments (April 2015), Section 11, a dynamic modelling to assess the risk of overheating should be carried out. However, due to the overheating results of SAP showing that there is no significant risk of overheating, it has been considered that a dynamic modelling is not required.

'Be Clean': Cooling Energy Assessment 40-42 Mill Lane

Efficiency Measures taken:

6) Active cooling systems (ensuring the lowest carbon option)

Air conditioning has not been specified for the scheme, since the overheating analysis demonstrates the there is no significant risk of overheating and the passive design measured are enough to guarantee the occupant's comfort.

'Be Green': Renewable Energy Energy Assessment 40-42 Mill Lane

Renewable Energy Feasibility:	has been considered. A detailed site-specific analysis and associated carbon saving calculations has also been provided for renewable energy technologies considered feasible.								
Renewable Energy Technology Comparison:									
	\checkmark \checkmark \checkmark \checkmark \checkmark = 1 scored out of a possible 5								
	The weighting of each of the criteria within the categories is shown below:								
	 Local, site-specific impact: (Maximum score of 4) Local planning criteria = Land used by all components = Noise impact from operation = 								
	 Suitability and design impact: (Maximum score of 4) Interaction on the current building design = Building orientation suitability = Buildability of installation = 								
	 Economic viability: (Maximum score of 5) Capital cost of all components = Grants and funding available = Payback periods (years) 3-5, 5-10, 10-15 = 								
	 Operation and maintenance: (Maximum score of 3) Servicing requirements (low or high) = ✓ Maintenance costs (low or high) = ✓ Resource use from future maintenance (low or high) = ✓ 								
	 CO₂ and sustainability: (Maximum score of 10) Carbon saving per year = V V V V Impact of future grid decarbonisation (gas vs. electric) = V V Local air quality/pollution = V V Resource use of installation = V V 								
	Key comments on each of the criteria and the corresponding score will be provided in a tabl (example below) for each of the technologies. The score for each of the criteria will be summed and each of the technologies will then be ranked. The assessment of each								

CO₂ and Renewable Local, site-specific Suitability and Economic **Operation and** Technology viability design impact maintenance sustainability impact ~~~ ~ ~ ~ ~ ~ ~ ~~~ ~ ~ ~ ~ ~ ~ ~~~~

technology is undertaken on the following pages.

'Be Green': Renewable Energy Energy Assessment 40-42 Mill Lane

Biomass & Biofuel:

Rejected



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

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

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

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

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

It is estimated that the heating and hot water demand of the site is too small to meet the required CO_2 emissions reduction if a biomass boiler was a standalone system. Therefore a biomass boiler would need to be combined with energy demand reduction measures and/or CHP. As there is no scope to provide CHP to the scheme, biomass boilers are likely to be unsuitable for the site. Site constraints such as limited transport/access issues, and storage of the biomass fuel also make this technology unsuitable. A detailed feasibility study will be required to investigate the suitability.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability		
Biomass Boiler	••••	~ ~ ~ ~ ~	~~ ~~~~	v v v	<i></i>		
	Local air quality impacts, increased transport usage on the restricted site, increased plant space.	Increase in plant space required, orientation fine, slightly increased buildability issues.	Increased capital costs of installation, typical payback of >15 years	Increased maintenance relative to gas boiler, resource use not significantly increased if well serviced.	Very low carbon intensity of feedstock if properly procured. Decarbonisation impact not applicable, air quality issues.		

'Be Green': Renewable Energy Energy Assessment 40-42 Mill Lane

Photovoltaic (PV):

Accepted



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

Photovoltaic systems can be discreet through being designed as an integral part of the roof. An 'invisible' design using slates or shingles as opposed to an architectural statement could be preferable in a sensitive area.

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

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

The most suitable location for mounting photovoltaic panels is on roofs as they usually have the greatest exposure to the sun. The proposed site has a potential useable roof area of approximately $30m^2$ (south facing) with PV cells positioned on the rear-facing roof. This would allow 10 panels to be installed to provide additional electricity generation to the 5 apartments.

Renewable Technology	Local, site-specific Suitability and impact design impact		Economic viability	Operation and maintenance	CO₂ and sustainability		
Photovoltaic	<i></i>	~ ~ ~ ~ ~	<i>~~~</i>	~ ~ ~ ~	<i>~~~~</i>		
	No local air quality impacts, use of unutilised roof space, no noise issues.	Can be added to the roof, good orientation, and slightly increased buildability issues for wiring and metering.	Increased capital costs of installation, typical payback of >10 years, Feed in Tariff available.	Limited servicing and maintenance i.e. 1 visit per year, inverter will require replacement.	High carbon saving from electricity, uses minimal grid electricity, no local air impact, high embodied energy of panels.		

'Be Green': Renewable Energy Energy Assessment 40-42 Mill Lane

Solar Thermal:

Rejected



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

Like photovoltaic panels the most suitable location for mounting solar hot water panels is on roofs as they usually have the greatest exposure to the sun. The most suitable location for mounting photovoltaic panels is on roofs as they usually have the greatest exposure to the sun. The proposed site has a potential useable roof area of approximately $30m^2$ (south facing) with PV cells positioned on the rear-facing roof.

It is estimated that the CO_2 emissions reduction that would be produced by solar hot water as a standalone system would not be adequate to achieve the required CO_2 emissions reduction target. Therefore a solar hot water system would need to be combined with more energy efficiency strategies, a CHP or additional renewable technologies to achieve the carbon reduction target.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO₂ and sustainability		
Solar Thermal	~~~~	< < < <	~~~~~	~ ~ ~ ~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
	No local air quality impacts, use of unutilised roof space, conservation officer has concerns for part of the site, no noise issues.	Can be added to the roof, good orientation, and slightly increased buildability issues for piping and cylinders.	Increased capital costs of installation, typical payback of 8 years, Renewable Heat Incentive available.	Limited servicing and maintenance i.e. 1 visit every two years, heat transfer fluid requires replacing every 10 years.	Lower carbon saving as primarily displacing gas, uses minimal grid electricity, no local air impact, medium embodied energy of panels.		

'Be Green': Renewable Energy Energy Assessment 40-42 Mill Lane

Wind Energy:

Rejected



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

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

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

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

Typically a 1.5 kW turbine can provide 4,000 kWh of electrical power annually. To achieve the required CO_2 emissions reduction target of 20% approximately 2 turbines would be required as a standalone solution. The indicative cost of a smaller roof mounted turbine is £2,000/kW so achieving the required CO_2 emissions reduction would cost approximately £16,000.00.

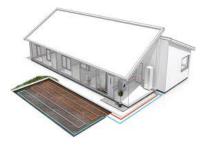
A detailed wind resource evaluation would be required for the site to fully understand the generation potential and payback period. Also, it is likely that planning restrictions and resistance from small groups within the local community could also affect the viability of wind energy for the project.

Renewable Technology			Economic viability	Operation and maintenance	CO₂ and sustainability		
Wind Energy	No local air quality impacts, use of unutilised roof space, conservation officer will have concerns for the site, minor noise	design impact Can be added to the roof, relatively limited wind speeds in local area, increased buildability issues for wiring and metering.	Medium capital costs of installation, typical payback < 5 years, Feed in Tariff available.	Very limited servicing and maintenance, costs of 2-3% typical.	High carbon saving from electricity, output limited from urban installation, consumes little grid electricity, no local air impact,		
	issues.				low embodied energy of panels.		

'Be Green': Renewable Energy Energy Assessment 40-42 Mill Lane

Ground Source Heat Pump (GSHP):

Rejected



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

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

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

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

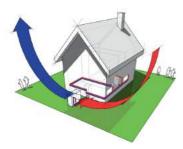
Typical costs for an installation this are in the region of £50,00.00 for a smaller commercial or domestic size installation, with general installation costs at £1200 /kW of energy produced.

Renewable	Local, site-specific	Suitability and	Economic	Operation and	CO₂ and sustainability
Technology	impact	design impact	viability	maintenance	
GSHP	No local air quality impacts, not visible so conservation friendly, no noise issues, however the constrained site may prohibit its installation.	Can be added to the roof, good air- flow on roof, increased buildability issues for pipework and heating emitters internally.	High capital costs of installation, typical payback of 15 years where gas is displaced, Renewable Heat Incentive available.	Limited servicing and maintenance i.e. 1 visit per year, mechanical parts may require replacement over lifespan.	Limited carbon saving from gas displacement, consumes some electricity so benefits from decarbonisation, no local air impact, high embodied energy of equipment.

'Be Green': Renewable Energy Energy Assessment 40-42 Mill Lane

Air Source Heat Pump (ASHP):

Rejected



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

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

ASHPs are cheaper to install than ground source heat pumps but are only available on a relatively small scale. If applied across a larger site a number of plant zones would be required for generation of heat, leading to increased plant space requirements. Typical costs for an installation this are in the region of £15,000 for a smaller commercial or domestic size installation.

Carbon dioxide emissions savings will typically be less than that of the ground source heat pump. Air source heat pumps may be more suitable as an HVAC solution.

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

'Be Green': Summary of Renewable Technologies Energy Assessment 40-42 Mill Lane

Summary Comparison Matrix:

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

Renewable Technology	Local, site- specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO₂ and sustainability	Total Score
Biomass Boiler	v v v v	~ ~ ~ ~ ~	~ ~ ~ ~ ~ ~ ~	v v v	<i>~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ </i>	13 out of 26
Photovoltaic	~~~~	~~ ~	~~ ~~~	~ ~ ~	~ ~ ~ ~ ~ ~	18 out of 26
Solar Thermal	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~~ ~	~~ ~~~	~ ~ ~ ~	~~~~	16 out of 26
Wind Energy	v v v v	~~ ~	<i>~~~</i>	~ ~ ~ ~	<i>~~~~</i>	17 out of 26
GSHP	• • • • •	~~ ~	• • • • • •	~ ~ ~ ~	<i>~~~~</i>	14 out of 26
ASHP	~ ~ ~ ~ ~	~~ ~~	~ ~ ~ ~ ~ ~	~ ~ ~	<i>、、、、、、</i> 、、、、、、	15 out of 26

Renewable Technology Conclusion & Specification: Photovoltaic panels, wind energy and solar thermal cells have scored the best. It is assumed that wind energy would be considered unsuitable for the area by conservation criteria and that the local residents would raise concerns over potential noise and turbulence.

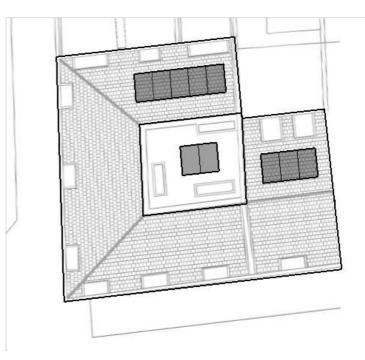
Photovoltaic panels have been considered viable based on the available rear facing roof space. A payback analysis of the proposed system has been provided on page 25.

'Be Green': Photovoltaic Energy Assessment 40-42 Mill Lane

Summary:

A photovoltaic panel system of 3.27 kWp has been specified for the development and detailed summary of the lifecycle cost, revenue and payback for the photovoltaic panels is presented in this section.

The following drawing shows that there are $30m^2$ of available roof that could be used to install photovoltaic modules. PV panels will be oriented south, covering approximately $16m^2$ of the roof.



Location:

'Be Green': Photovoltaic Energy Assessment 40-42 Mill Lane

Lifecycle Cost:	The lifecycle of the proposed high efficiency panels is 25 years. cost of the panels, the maintenance of the system and replacen								
	The total costs for the proposed system's lifetime is:								
	 Capital Cost and maintenance = £5,000 Maintenance = £1,500 Operation Cost = £900 (replacement inverters etc.) Total Costs = £7,400.00 								
Revenue and Payback Parameters:	• The cost of electricity to be displaced is 14p/kWh.								
	• The 3.27kWp system is estimated to generate 2,824 kWh/yr. Based on the assumption that 50% of the electricity will be used on site, an offset saving of £198yr will be achieved.								
	• With the current Feed in Tariff, a tariff of 4.25/kWh will be received for generation, and 4.85/kWh will be received for export, which gives an additional saving of £194.								
Summary Performance Calculations:	The following tables summarise the reduction in carbon emissic the photovoltaic system.	ons and the life cycle cost of							
	Energy and Carbon Performance Criteria	Value							
	Predicted Annual Energy Saved (kWh/yr)	2,824							
	Annual Carbon Emissions Reductions (kg CO ₂ /year)	1,465							
	CO ₂ Emissions Reduction (%)	13.8							
	Cost Performance Criteria	Value							
	Total Cost Over Life Cycle (£)	7,400							
	Predicted Annual Savings (£)	392							
	Payback Period (years) 18.9								

Conclusion Energy Assessment 40-42 Mill Lane

Summary

The baseline carbon emissions for the scheme are 10.61 Tonnes $\rm CO_2/yr.$

As demonstrated above the development will reduce carbon emissions by 26.7% from the fabric energy efficiency measures described in the 'Be Lean' section and will reduce total carbon emissions by 40.4% over Building Regulations with the further inclusion of low and zero carbon technologies.

GLA's Energy Hierarchy – Regulated Carbon Emissions									
	Baseline:	Be Lean:	Be Clean:	Be Green:					
CO ₂ emissions (Tonnes CO ₂ /yr)	10.61	7.78	-	6.32					
CO ₂ emissions saving (Tonnes CO ₂ /yr)	-	2.83	- 1.46						
Saving from each stage (%)	-	-	13.8						
Total CO ₂ emissions saving (Tonnes CO ₂ /yr)	4.29								

40.4% Total carbon emissions savings over Part L of the Building Regulations 2013 achieved

Appendix Energy Assessment 40-42 Mill Lane

Further Information:

As required by the GLA, the emission figures and details of the calculations and methodology used to determine the figures provided within the report can be found in the following pages:

Baseline (Part L1B)– DER from the Part L1B worksheets Lean - DER from the Lean SAP DER Worksheets Green – DER from the Green SAP DER Worksheets



Appendix Energy Assessment 40-42 Mill Lane

Baseline Scenario

			User D	etails:						
Assessor Name:	Oliver Morris			Stroma	a Num	ber:		STRO	025430	
Software Name:	Stroma FSAP 20	12		Softwa	are Ver	sion:		Versio	n: 1.0.3.4	
		Pr	operty A	Address:	Unit 1-	energy s	strategy			
Address :	, London, NW6 1N	R								
1. Overall dwelling dimer	nsions:		_							
Ground floor			Area 5		(1a) x	Av. Hei	ght(m) .8	(2a) =	Volume(m ³) 156.41) (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1	e)+(1n) 5	5.86	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	156.41	(5)
2. Ventilation rate:	mein			o th o r		totol			m ³ nor hou	
		econdary heating	y	other	_	total			m ³ per hou	r
Number of chimneys	0 +	0	+	0] = [0	x 4	40 =	0	(6a)
Number of open flues	0 +	0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fan	is					2	x 1	0 =	20	(7a)
Number of passive vents					Ē	0	x 1	0 =	0	(7b)
Number of flueless gas fire	es					0	x 4	40 =	0	(7c)
								Air ch	anges per ho	our
Infiltration due to chimney	s flues and fans = $($	6a)+(6b)+(7	a)+(7b)+(7	7c) =	Г	20		÷ (5) =	0.13	(8)
If a pressurisation test has be					ontinue fro	-		. (0) –	0.13	
Number of storeys in the	e dwelling (ns)								1	(9)
Additional infiltration							[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0.2					•	uction			0.35	(11)
if both types of wall are pre deducting areas of opening		sponding to	the greate	er wall area	a (after					
If suspended wooden flo		led) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter 0	,	,	,.					0	(13)
Percentage of windows	and doors draught s	tripped							5	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0.24	(15)
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) +	- (15) =	d).7178706979314	93 <mark>(16)</mark>
Air permeability value, o			•	•	•	etre of e	nvelope	area	0	(17)
If based on air permeabilit	•								0.72	(18)
Air permeability value applies		as been don	e or a deg	ree air per	meability i	is being us	sed			-
Number of sides sheltered Shelter factor	1			(20) = 1 - [0.075 x (1	9)] =			1	(19)
Infiltration rate incorporati	ng shelter factor			(21) = (18)		-/1			0.92	(20)
Infiltration rate modified fo	0	d		() (·-)					0.66	(21)
	Mar Apr May		Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe		. 1								
<u> </u>	4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
		. 1							I	
Wind Factor $(22a)m = (22)$, 		0.05	0.02	4	1.00	1 4 0	1 4 0		
(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		

Adjuste	ed infiltr	ation rat	e (allowi	ng for sh	elter an	nd wind s	speed) =	: (21a) x	(22a)m					
	0.85	0.83	0.81	0.73	0.71	0.63	0.63	0.61	0.66	0.71	0.75	0.78		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	ise					Г		
				endix N, (2	3b) = (23;	a) × Fmv (e	equation (N5)), othe	rwise (23b) = (23a)		L	0	(23a) (23b)
				iency in %						(_000)		L	0	(230) (23c)
			-	-	-					2h)m ⊥ ('	23h) x [[,]	L 1 – (23c)	-	(230)
(24a)m=					0				0		0		÷ 100]	(24a)
		-	_	entilation	÷	Ţ	-	Ţ	÷		Ţ			· · · ·
(24b)m=				0	0						0	0		(24b)
	-			tilation c		-			÷	Ů	ů			· · ·
				hen (240	-	-				.5 × (23b))			
(24c)m=	, <i>,</i>	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positi	ve input	ventilati	on from	loft	!				
,				m = (22k		•				0.5]	-			
(24d)m=	0.86	0.84	0.83	0.77	0.75	0.7	0.7	0.69	0.72	0.75	0.78	0.8		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24l	o) or (24	c) or (24	ld) in bo	x (25)	-	-			
(25)m=	0.86	0.84	0.83	0.77	0.75	0.7	0.7	0.69	0.72	0.75	0.78	0.8		(25)
3. He	at losse	s and he	eat loss r	paramete	er:									
ELEN		Gros		Openin		Net Ar	ea	U-val	ue	AXU		k-value		AXk
		area	(m²)	'n		A ,r	m²	W/m2	2K	(W/I	<)	kJ/m²∙K	ζ.	kJ/K
Window	ws Type	e 1				2.48	x1	/[1/(4.8)+	0.04] =	9.99				(27)
Window	ws Type	2				3.63	x1	/[1/(4.8)+	0.04] =	14.62				(27)
Window	ws Type	93				2.9	x1	/[1/(4.8)+	0.04] =	11.68				(27)
Window	ws Type	94				2.94	x1	/[1/(1.8)+	0.04] =	4.94				(27)
Floor						55.56	3 X	0.25	=	13.89	_ r			(28)
Walls 7	Type1	47.5	59	18.06	6	29.53	3 X	0.3		8.86	i F		i –	(29)
Walls 1	Гуре2	11.5	56	0		11.50	3 X	0.28	=	3.24	i F		i H	(29)
Total a	irea of e	lements	, m²			114.7	····				L			(31)
Party v	vall					30.8		0		0				(32)
Party v						4.79		0.2		0.96	\dashv		\exists	(32)
Party c						55.88		0.2		0.00	L 		\dashv	(32b)
•	-	roof wind	ows, use e	effective wi	ndow U-v			n formula 1	1/I(1/U-valı	ıe)+0.041 a	L Is aiven in	paragraph	_	(020)
				nternal wal				y lonnaid i	//(// O Vale	<i>io)</i> i o.o ij o	io givoir in	paragraph	0.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26) (30) + (32) =			[92.77	(33)
Heat c	apacity	Cm = S((A x k)						((28)	(30) + (32	2) + (32a)	(32e) =	13848.8	87 (34)
Therma	al mass	parame	eter (TMF	⊃ = Cm ÷	- TFA) iı	n kJ/m²K			Indica	tive Value	Medium	Γ	250	(35)
	-		ere the de tailed calci	tails of the ulation.	construct	ion are no	t known pl	recisely the	e indicative	e values of	TMP in T	able 1f		
Therma	al bridg	es : S (L	x Y) cal	culated u	using Ap	opendix l	к					Г	17.21	(36)
			are not kn	own (36) =	= 0.15 x (3	81)						-		
Total fa	abric he	at loss							(33) +	(36) =			109.9	7 (37)

Ventila	tion hea	at loss ca	alculated	d monthl	у									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	44.31	43.59	42.88	39.58	38.96	36.08	36.08	35.54	37.19	38.96	40.21	41.52		(38)
Heat tr	Heat transfer coefficient, W/K (39)m = (37) + (38)m													
(39)m=	154.28	153.56	152.86	149.55	148.93	146.05	146.05	145.52	147.16	148.93	150.18	151.49		
Heat lo	oss para	meter (H	HLP), W	/m²K	•		-	•		Average = = (39)m ÷	Sum(39)₁ · (4)	₁₂ /12=	149.55	(39)
(40)m=	2.76	2.75	2.74	2.68	2.67	2.61	2.61	2.61	2.63	2.67	2.69	2.71		
Numb			nth (Tab			I	I		,	Average =	Sum(40)1	₁₂ /12=	2.68	(40)
NULLING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(+1)11-	51	20		50	- 01		01	51	- 50	01	- 50	51		()
4 \\/	torboo	ting one		iromonti								k\A/b/v		
4. 882	ater nea	ung ene	rgy requ	irement:								kWh/ye	al.	
		ipancy,		14	(0.000	40 (T	- 40.0					86		(42)
	A > 13. A £ 13.		+ 1.76 x	(1 - exp	(-0.0003	349 X (11	-A -13.9)2)] + 0.0	J013 X (IFA -13.	.9)			
		,	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		78	.43		(43)
		-		usage by		-	-	to achieve	a water us	se target o	f			
notmore		illies per	person pe I	r day (all w 1			ia) I					·1		
Latwat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			r day lor ea	ach month				· ·		i	1			
(44)m=	86.28	83.14	80	76.87	73.73	70.59	70.59	73.73	76.87	80	83.14	86.28		-
Energy	content of	hot water	used - ca	lculated m	onthly = 4.	190 x Vd,r	n x nm x D)))))))))))))))))))			m(44) _{1 12} = ables 1b, 1		941.22	(44)
(45)m=	127.95	111.9	115.47	100.67	96.6	83.36	77.24	88.64	89.7	104.53	114.11	123.91		
lf instan	taneous v	vater heati	ng at poin	t of use (no	o hot water	r storage),	enter 0 in	boxes (46		Total = Su	m(45) _{1 12} =	=	1234.08	(45)
(46)m=	19.19	16.79	17.32	15.1	14.49	12.5	11.59	13.3	13.45	15.68	17.12	18.59		(46)
Water	storage	loss:												
Storag	e volum	e (litres)) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	•	-		ank in dw	-			. ,						
			hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
	storage		eclared I	loss facto	or is kno	wn (k\//h	n/dav).					0		(48)
			m Table				"uuy).					0		
•								$(49) \times (40)$	\ _			0		(49)
•••			-	e, kWh/ye cylinder∣		or is not		(48) x (49)) =			0		(50)
				rom Tabl								0		(51)
If com	munity ł	neating s	see secti	on 4.3										
		from Ta										0		(52)
Tempe	erature f	actor fro	m Table	e 2b								0		(53)
			-	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
	. ,	(54) in (8	•									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)

If cylinder conta	ins dedicate	ed solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56))m where ((H11) is fro	om Append	lix H					
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)				
Primary circ	uit loss (ar	nnual) fro	om Table	e 3	-	-			-		0		(58)				
Primary circuit loss (annual) from Table 30Primary circuit loss calculated for each month (59)m = $(58) \div 365 \times (41)m$ (58)																	
(modified	by factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)	-						
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)				
Combi loss	Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m																
(61)m= 43.9 [°]	7 38.27	40.77	37.91	37.57	34.81	35.97	37.57	37.91	40.77	41	43.97		(61)				
Total heat re	Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$																
(62)m= 171.9	1 150.17	156.24	138.58	134.17	118.17	113.22	126.21	127.6	145.3	155.11	167.88		(62)				
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)																	
(add additio	(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)																
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)				
Output from	water hea	ater	_						_	_							
<mark>(64)m=</mark> 171.9	1 150.17	156.24	138.58	134.17	118.17	113.22	126.21	127.6	145.3	155.11	167.88						
							Outp	out from w	ater heate	<mark>r (annual)</mark> ₁	12	1704.56	(64)				
Heat gains f	rom water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)m	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]					
(65)m= 53.53	3 46.77	48.59	42.95	41.51	36.42	34.68	38.86	39.3	44.95	48.19	52.19		(65)				
include (5	7)m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating					
5. Internal	gains (see	e Table 5	5 and 5a):													
Metabolic ga	ains (Table	e 5), Wat	ts														
Jar		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
(66)m= 93.13	3 93.13	93.13	93.13	93.13	93.13	93.13	93.13	93.13	93.13	93.13	93.13		(66)				
Lighting gair	ns (calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5									
(67)m= 24.6	1 21.86	17.78	13.46	10.06	8.49	9.18	11.93	16.01	20.33	23.73	25.3		(67)				
Appliances	gains (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5		8						
(68)m= 162.4	164.08	159.84	150.8	139.38	128.66	121.49	119.81	124.06	133.1	144.51	155.23		(68)				
Cooking gai	ns (calcula	ated in A	ppendix	L, equat	tion L15	or L15a), also se	e Table	5								
(69)m= 32.3	I 32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31	32.31		(69)				
Pumps and	fans gains	; (Table (5a)														
(70)m= 10	10	10	10	10	10	10	10	10	10	10	10		(70)				
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)												
(71)m= -74.8	5 -74.5	-74.5	-74.5	-74.5	-74.5	-74.5	-74.5	-74.5	-74.5	-74.5	-74.5		(71)				
Water heatir	ng gains (1	rable 5)	!							!							
(72)m= 71.9	<u> </u>	65.31	59.65	55.8	50.58	46.61	52.24	54.58	60.42	66.93	70.15		(72)				
Total intern	al gains =				(66)	• m + (67)m	n + (68)m +	- (69)m +	• (70)m + (7	1)m + (72)	m	I					
(73)m= 319.9		303.86	284.85	266.18	248.67	238.22	244.91	255.59	274.78	296.11	311.62		(73)				
6. Solar ga	ins:																
Solar gains ar	e calculated	using sola	r flux from	Table 6a	6. Solar gains: Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.												
Orientation:																	
Onemation.	Access F Table 6d		Area m²		Flu	x ble 6a		g_ able 6b		FF able 6c		Gains (W)					

Northeast 0.9x	0.77	1 🗸	2.02		44.00	1 .	0.05	v	0.7	=	22.70	(75)
Northeast 0.9x	0.77	X	3.63	×	11.28	X 	0.85	x	0.7		33.78	4
Northeast 0.9x	0.77] ×]	2.9	X	11.28	X 	0.85	x	0.7	=	13.49	(75)
Northeast 0.9x	0.77) ×] v	3.63	x	22.97	× 	0.85	x	0.7	=	68.75	(75)
Northeast 0.9x	0.77	×	2.9	×	22.97	X 	0.85	x	0.7	=	27.46	(75)
Northeast 0.9x	0.77	X	3.63	X	41.38	X 	0.85	x	0.7	=	123.87	(75)
L	0.77	X	2.9	X	41.38	X 	0.85	x	0.7	=	49.48	(75)
Northeast 0.9x	0.77	X	3.63	×	67.96	X 1	0.85	x	0.7	=	203.43	(75)
Northeast 0.9x	0.77	X	2.9	X	67.96	X	0.85	x	0.7	=	81.26	(75)
Northeast 0.9x	0.77	X	3.63	X	91.35	X	0.85	x	0.7	=	273.45	(75)
Northeast 0.9x	0.77	X	2.9	X	91.35	X	0.85	x	0.7	=	109.23	(75)
Northeast 0.9x	0.77	X	3.63	X	97.38	X	0.85	x	0.7	=	291.53	(75)
Northeast 0.9x	0.77	X	2.9	X	97.38	X	0.85	x	0.7	=	116.45	(75)
Northeast 0.9x	0.77	X	3.63	X	91.1	×	0.85	x	0.7	=	272.72	(75)
Northeast 0.9x	0.77	x	2.9	X	91.1	X	0.85	x	0.7	=	108.94	(75)
Northeast 0.9x	0.77	×	3.63	x	72.63	x	0.85	x	0.7	=	217.41	(75)
Northeast 0.9x	0.77	x	2.9	×	72.63	×	0.85	x	0.7	=	86.85	(75)
Northeast 0.9x	0.77	x	3.63	x	50.42	x	0.85	x	0.7	=	150.94	(75)
Northeast 0.9x	0.77	x	2.9	x	50.42	x	0.85	x	0.7	=	60.29	(75)
Northeast 0.9x	0.77	x	3.63	x	28.07	x	0.85	x	0.7	=	84.02	(75)
Northeast 0.9x	0.77	x	2.9	x	28.07	x	0.85	x	0.7	=	33.56	(75)
Northeast 0.9x	0.77	x	3.63	x	14.2	x	0.85	x	0.7	=	42.5	(75)
Northeast 0.9x	0.77	x	2.9	x	14.2	x	0.85	x	0.7	=	16.98	(75)
Northeast 0.9x	0.77	x	3.63	×	9.21	x	0.85	x	0.7	=	27.58	(75)
Northeast 0.9x	0.77	x	2.9	×	9.21	x	0.85	x	0.7	=	11.02	(75)
Southeast 0.9x	0.77	x	2.94	×	36.79	x	0.63	x	0.7	=	33.06	(77)
Southeast 0.9x	0.77	x	2.94	x	62.67	x	0.63	x	0.7	=	56.31	(77)
Southeast 0.9x	0.77	x	2.94	×	85.75	x	0.63	x	0.7	=	77.05	(77)
Southeast 0.9x	0.77	x	2.94	x	106.25	x	0.63	x	0.7	=	95.47	(77)
Southeast 0.9x	0.77	x	2.94	×	119.01	x	0.63	x	0.7	=	106.93	(77)
Southeast 0.9x	0.77	x	2.94	x	118.15	x	0.63	x	0.7	=	106.16	(77)
Southeast 0.9x	0.77	x	2.94	x	113.91	x	0.63	x	0.7	=	102.35	(77)
Southeast 0.9x	0.77	x	2.94	x	104.39	x	0.63	x	0.7	=	93.8	(77)
Southeast 0.9x	0.77	x	2.94	x	92.85	x	0.63	x	0.7	=	83.43	(77)
Southeast 0.9x	0.77	x	2.94	×	69.27	x	0.63	x	0.7	=	62.24	(77)
Southeast 0.9x	0.77	x	2.94	x	44.07	x	0.63	x	0.7	=	39.6	(77)
Southeast 0.9x	0.77	x	2.94	x	31.49	x	0.63	x	0.7	=	28.29	(77)
Northwest 0.9x	0.77	×	2.48	x	11.28	x	0.85	x	0.7	=	23.08	(81)
Northwest 0.9x	0.77	x	2.48	x	22.97	x	0.85	x	0.7	=	46.97	(81)
Northwest 0.9x	0.77	×	2.48	x	41.38	x	0.85	x	0.7	=	84.63	(81)
Northwest 0.9x	0.77	x	2.48	×	67.96	×	0.85	x	0.7	=	138.98	(81)
Northwest 0.9x	0.77	x	2.48	x	91.35	x	0.85	x	0.7	=	186.82	(81)

Northwest 0.9x		×	2.4	8	x	× 97.38		×	0.85		0.7	=	199.17	(81)
Northwest 0.9x	0.77	x	2.4	8	x	× 91.1		x	0.85	×	0.7	=	186.32	(81)
Northwest 0.9x	0.77	x	2.4	8	× 72.6		2.63	x	0.85	x	0.7	=	148.54	(81)
Northwest 0.9x	0.77	x	2.4	8	x	5	0.42	x	0.85	x	0.7	=	103.12	(81)
Northwest 0.9x	0.77	x	2.4	8	x	2	8.07	x	0.85	×	0.7	=	57.4	(81)
Northwest 0.9x	0.77	x	2.4	8	x	1	4.2	x	0.85	x	0.7	=	29.04	(81)
Northwest 0.9x	0.77	x	2.4	8	x	g	9.21	x	0.85	x	0.7	=	18.84	(81)
Solar <u>g</u> ains ir	Solar gains in watts, calculated for each month							(83)m =	Sum(74)m	(82)m	-	-		
(83)m= 103.4		335.03	519.14	676.43		13.3	670.32	546.5	9 397.78	237.22	128.11	85.74		(83)
Total gains –	internal and	d solar	(84)m =	= (73)m	+ (8	83)m ,	watts							
(84)m= 423.31	515.99 6	638.88	803.99	942.61	90	61.98	908.54	791.5	653.36	512	424.21	397.36		(84)
7. Mean inte	ernal temper	rature (heating	season)									
Temperatur	e during hea	ating pe	eriods ir	n the livi	ng	area f	rom Tab	ole 9, 1	⁻ h1 (°C)				21	(85)
Utilisation fa	actor for gair	ns for li	ving are	ea, h1,m	n (s	ee Ta	ble 9a)							
Jan	Feb	Mar	Apr	May	Ì	Jun	Jul	Aug	g Sep	Oct	Nov	Dec		
(86)m= 0.99	0.99	0.97	0.94	0.85	(0.72	0.6	0.67	0.87	0.97	0.99	0.99		(86)
Mean intern	al temperati	ure in li	ivina ar			w stor	ns 3 to 7	ín Ta			.			
(87)m= 18.2		18.92	19.61	20.24	1	20.68	20.87	20.82		19.61	18.81	18.19		(87)
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $														
	<u>т т</u>	<u> </u>			1					10.00	10.01	10.0	l	(88)
(88)m= 18.87 18.88 18.89 18.92 18.93 18.96 18.96 18.96 18.94 18.93 18.91 18.9												(00)		
Utilisation fa	<u>т</u>	ns for r			h2,	m (se		9a)				1	l	
(89)m= 0.99	0.98	0.96	0.91	0.78	(0.57	0.36	0.44	0.76	0.95	0.98	0.99		(89)
Mean intern	al temperat	ure in t	he rest	of dwell	ing	T2 (fo	ollow ste	eps 3 te	o 7 in Tabl	e 9c)				
(90)m= 16.5	16.75	17.22	17.91	18.48	1	8.84	18.94	18.93	18.66	17.93	17.13	16.5		(90)
									f	LA = Livi	ng area ÷ (•	4) =	0.54	(91)
Mean intern	al temperat	ure (foi	r the wh	ole dwe	llin	a) = fL	_A × T1	+ (1 –	fLA) × T2					
(92)m= 17.41	<u> </u>	18.13	18.82	19.42	-	9.83	19.97	19.94		18.83	18.03	17.4		(92)
Apply adjus	tment to the	mean	interna	temper	atu	ire froi	m Table	4e, w	here appro	priate				
(93)m= 17.41	17.66	18.13	18.82	19.42	1	9.83	19.97	19.94	19.6	18.83	18.03	17.4		(93)
8. Space he	ating requir	ement												
Set Ti to the			•		ned	at ste	ep 11 of	Table	9b, so tha	t Ti,m=	(76)m an	d re-calo	ulate	
the utilisatio	- I - I - I	<u> </u>			-				-				I	
Jan	Feb	Mar	Apr	May		Jun	Jul	Auç	g Sep	Oct	Nov	Dec		
Utilisation fa	<u> </u>	· · · ·		0.0		0.05	0.40	0.50		0.04		0.00	l	(94)
(94)m= 0.99		0.96	0.9	0.8		0.65	0.49	0.56	0.81	0.94	0.98	0.99		(94)
Useful gains (95)m= 418.2	<u> </u>	v = (94 612.24	726.93	+)m 754.32	6	20.67	446.4	446.9	5 526.98	483.56	416.25	393.34		(95)
Monthly ave							- -1 0.4	-+0.9	5 520.90	-00.00	-10.25	000.04		
(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 ra											1	I		x =/
(97)m= 2022.1					1	63.41	492.23	514.8		-	1641.52	2000.19		(97)
Space heati							h = 0.02	24 x [(9				I	I	
	- <u>ř</u>	367.23	544.6	293.94	Γ	0	0	0	0	552.2	882.19	1195.5		
					1						1	<u> </u>	l	

Total per year (kWh/year) = Sum(98) ₁₅₉₁₂ =												6505.69	(98)	
Space heating requirement in kWh/m²/year												116.46	(99)	
9a. En	ergy rec	quiremer	nts – Ind	lividual h	eating sy	ystems i	ncluding	micro-C	HP)					
•	e heatir	-			, .							I		
Fraction of space heat from secondary/supplementary system												0	(201)	
Fraction of space heat from main system(s) $(202) = 1 - (201) =$ $(202) = 1 - (201) =$ $(202) = 1 - (201) =$												1	(202)	
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$													88.8	(204)
	Efficiency of main space heating system 1													(206)
Efficiency of secondary/supplementary heating system, %												0	(208)	
_	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space		ř. – –	· `		í			0	0	550.0	000.40	4405 5		
	1193.35		867.23	544.6	293.94	0	0	0	0	552.2	882.19	1195.5		
(211)m		i		100 ÷ (20	1				-		000.40	4040.00		(211)
	1343.87	1099.87	976.61	613.28	331.01	0	0	0 Tota		621.84	993.46 211) _{15.10, 12}	1346.28	7000.00	(211)
Casa	o bootin	a fuel (a			una a un tila			Tota			- 715,10. 12	-	7326.23	(211)
•		01)]}x1		ˈy), kWh/ ງ8)	month									
(215)m=		0	00.(20	0	0	0	0	0	0	0	0	0		
				Į				Tota	l (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
Water	heating	3												_
		-	ter (calc	ulated a	bove)						-			
	171.91	150.17	156.24	138.58	134.17	118.17	113.22	126.21	127.6	145.3	155.11	167.88		_
	-	ater hea	iter	r	1	r	1			I	1		79.5	(216)
(217)m=		87.44	87.24	86.74	85.66	79.5	79.5	79.5	79.5	86.69	87.27	87.54		(217)
		heating, m x 100												
(219)m=		171.75	179.09	159.76	156.63	148.64	142.41	158.75	160.51	167.61	177.72	191.77		
			1	ļ		1		Tota	I = Sum(2	19a) ₁₁₂ =			2011.11	(219)
Annua	I totals	i								k	Wh/year		kWh/year	J
Space	heating	fuel use	ed, main	system	1								7326.23	
Water	heating	fuel use	d										2011.11]
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								-
centra	al heatir	ng pump	:									120		(230c)
Total e	electricity	y for the	above,	kWh/yea	r			sum	of (230a)	(230g) =			120	(231)
Electri	city for l	ighting											434.67	(232)
12a. (CO2 em	nissions ·	– Individ	lual heat	ing syste	ems inclu	uding mi	cro-CHP						-
						-				_ ·				
	EnergyEmission factorkWh/yearkg CO2/kWh										Emissions kg CO2/yea	ar		
Space	heating	ı (main s	ystem 1)		(21	1) x			0.2	16	=	1582.47	(261)
Space heating (secondary) (215) x									0.5	19	=	0	(263)	

Water heating	(219) x	0.216	=	434.4	(264)
Space and water heating	(261) + (262) + (263) + (264)	=		2016.86	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	62.28	(267)
Electricity for lighting	(232) x	0.519	=	225.59	(268)
Total CO2, kg/year	S	um of (265) (271) =		2304.74	(272)
Dwelling CO2 Emission Rate	(2	272) ÷ (4) =		41.26	(273)
El rating (section 14)				69	(274)

			User D	etails:						
Assessor Name:	Oliver Morris			Strom	a Num	ber:		STRO	025430	
Software Name:	Stroma FSAP 2	012		Softwa	are Ver	sion:		Versio	on: 1.0.3.4	
		Р	roperty <i>i</i>	Address:	Unit 2 e	energy s	trategy			
Address :	, London, NW6 1	NR								
1. Overall dwelling dimer	nsions:									
Ground floor				a(m²) 0.77	(1a) x	Av. He i	ight(m) 2.8	(2a) =	Volume(m ³) 142.16) (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1r	n) 5	0.77	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	142.16	(5)
2. Ventilation rate:									<u> </u>	
	main heating	secondar heating	У	other		total			m ³ per hou	r
Number of chimneys	0 +	0	+	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent far	ns					2	x ′	10 =	20	(7a)
Number of passive vents					Ē	0	x ^	10 =	0	(7b)
Number of flueless gas fir	es				Γ	0	x 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney	s. flues and fans =	(6a)+(6b)+(7	′a)+(7b)+(1	7c) =	Г	20	<u> </u>	÷ (5) =	0.14	(8)
If a pressurisation test has be					continue fro	-		. (0)	0.14	
Number of storeys in th	e dwelling (ns)								1	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.					•	uction			0.35	(11)
if both types of wall are pro deducting areas of opening		responding to	o the greate	er wall are	a (after					
If suspended wooden fl	- · · ·	ealed) or 0	.1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else enter (C							0	(13)
Percentage of windows	and doors draught	stripped							5	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0.24	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =	(.7306905101456	82 <mark>(16)</mark>
Air permeability value, o			•	•	•	etre of e	nvelope	area	0	(17)
If based on air permeabili	•								0.73	(18)
Air permeability value applies		has been dor	ne or a deg	gree air pei	rmeability i	is being us	sed			
Number of sides sheltered Shelter factor	L L L L L L L L L L L L L L L L L L L			(20) = 1 -	0.075 x (1	9)] =			3 0.78	(19) (20)
Infiltration rate incorporati	ng shelter factor			(21) = (18)		/-			0.78	(21)
Infiltration rate modified for	0	ed		. , . ,					0.57	(21)
	Mar Apr Ma		Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7									
	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Easter (22a) ~ (22										
Wind Factor (22a)m = (22 (22a)m = 1.27 1.25 1	2)m ÷ 4 1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
		0.00	0.00	0.02					l	

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0-11	0.72	0.71	0.69	0.62	0.61	0.54	0.54	0.52	0.57	0.61	0.64	0.67		
		<i>ctive air</i> al ventila	-	rate for t	ne appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (N5)) , othe	rwise (23b) = (23a)			0	(23b)
lf bala	anced wit	h heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h) =				0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (22	2b)m + (23b) × [1 – (23c)	-	,
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	_	(24a)
b) If	balance	d mech	anical ve	entilation	without	heat rec	overy (N	MV) (24b)m = (22	2b)m + (i	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	iouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatio	on from o	outside	-	-	-		
	if (22b)r	n < 0.5 ×	< (23b), t	hen (240	c) = (23b	o); otherv	wise (24	c) = (22k	o) m + 0.	.5 × (23b) 		L	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,				ole hous $m = (22k)$	•	•				0.51				
(24d)m=	<u> </u>	0.75	0.74	0.69	0.69	0.64	0.64	0.5 + [(2	0.66	0.5	0.7	0.72		(24d)
				nter (24a						0.00	0.7	0.72		(=)
(25)m=	0.76	0.75	0.74	0.69	0.69	0.64	0.64	0.64	0.66	0.69	0.7	0.72		(25)
						0.01	0.01	0.01	0.00	0.00	0.1	0.12		()
				paramete										
ELEN	/IENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I		k-value kJ/m²·ł		A X k <j k<="" td=""></j>
Windo	WS					2.48	x1.	/[1/(4.8)+	0.04] =	9.99				(27)
Floor						50.77	′ X	0.25	=	12.692	5			(28)
Walls		26.7	'5	9.92		16.83	3 X	0.3	=	5.05				(29)
Total a	area of e	elements	, m²			77.52	2							(31)
Party v	wall					3.89	x	0	=	0				(32)
Party v	wall					20.05	5 x	0.2	=	4.01				(32)
Party v	wall					20.38	3 X	0.2	=	4.08	ו ר			(32)
Party o	ceiling					50.77	,				ī		\exists	(32b)
				effective wi nternal wall			ated using	g formula 1	/[(1/U-valı	ıe)+0.04] a	as given in	paragraph	3.2	
Fabric	heat los	ss, W/K :	= S (A x	U)				(26) (30)) + (32) =				65.77	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	16585.92	(34)
Therm	al mass	parame	ter (TM	⁻ = Cm ÷	- TFA) ir	א kJ/m²K			Indica	tive Value	: Medium		250	(35)
	•	sments wh ad of a de		tails of the ulation.	constructi	ion are not	t known pr	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						11.63	(36)
			are not kr	own (36) =	= 0.15 x (3	1)								_
	abric he									(36) =			77.4	(37)
Ventila		1	·	monthly				i .	· · ·	= 0.33 × (1	i	l	
(0.0)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00)
(38)m=	35.68	35.21	34.74	32.56	32.15	30.24	30.24	29.89	30.98	32.15	32.98	33.84		(38)
		coefficier	r						r	= (37) + (3	r		I	
(39)m=	113.09	112.61	112.14	109.96	109.55	107.65	107.65	107.29	108.38	109.55	110.38	111.24	100.00	
										Average =	Sum(39)₁	12/12=	109.96	(39)

Heat lo	oss para	ameter (H	HLP), W	/m²K					(40)m	= (39)m ÷	÷ (4)			
(40)m=	2.23	2.22	2.21	2.17	2.16	2.12	2.12	2.11	2.13	2.16	2.17	2.19		
Numbr	or of day	/s in mo	nth (Tab					ļ		Average =	= Sum(40)₁	₁₂ /12=	2.17	(40)
Numbe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
()	0.													()
4 W/a	iter hea	tina ene	rav reau	irement:								kWh/ye	ar.	
		upancy,		irement.								71		(42)
if TF	A > 13.			([1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		/ 1		(42)
								(25 x N)				.88		(43)
		-		r usage by r day (all w		-	-	to achieve	a water us	se target c	of .			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	82.37	79.37	76.38	73.38	70.39	67.39	67.39	70.39	73.38	76.38	79.37	82.37		_
Enormy	contont of	that watar	used ea	loulated m	onthly - 1	100 v Vd	m v nm v [Tm / 2600			ım(44) _{1 12} = ables 1b, 1	L	898.54	(44)
			. <u> </u>			. <u> </u>	. <u> </u>		. <u> </u>	· ·				
(45)m=	122.15	106.83	110.24	96.11	92.22	79.58	73.74	84.62	85.63	99.79	108.93 Im(45) _{1 12} =	118.29	1178.13	(45)
lf instant	taneous v	vater heati	ng at poin	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46		10tal = 30	IIII(43)1 12 =		1170.13	(40)
(46)m=	18.32	16.02	16.54	14.42	13.83	11.94	11.06	12.69	12.84	14.97	16.34	17.74		(46)
	storage		1			1	1	1	1		·			
-		. ,		• •			-	within sa	ame ves	sel		0		(47)
	•	•		ank in dw ar (this ir	•			ı (47) ombi boil	ars) ante	or '0' in <i>(</i>	(17)			
	storage		not wate			nstantai					(47)			
	•		eclared l	loss fact	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	e 2b								0		(49)
			-	e, kWh/y				(48) x (49)) =			0		(50)
				cylinder										(54)
		age loss neating s		rom Tab on 4.3	ie z (kvv	n/litre/da	ay)					0		(51)
		from Ta		011 1.0								0		(52)
Tempe	erature f	actor fro	m Table	e 2b								0		(53)
Energy	/ lost fro	om water	- storage	e, kWh/y	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or	(54) in (5	55)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	50), else (5	7)m = (56)	m where	(H11) is fro	m Appendi	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (. ,	65 × (41)						
•		I	I	1	· · · · · ·	I	r	ng and a	· ·	1	<u> </u>	1		1
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for eac	ch I	month ((61)m =	= (60	D) ÷ 30	65 × (41))m								
(61)m=	41.97	36.53	38.92		36.19	35.87	:	33.23	34.34	35.	87	36.19	38.92	39.14	4 41	1.97		(61)
Total h	eat req	uired for	water	he	ating ca	alculate	ed fo	or eacl	h month	(62)	m =	0.85 × (45)m	+ (46)m	+ (57)m +	(59)m + (61)m	
(62)m=	164.12	143.36	149.16	3	132.3	128.09	1	12.81	108.08	120	.49	121.82	138.7	1 148.0	7 16	0.27		(62)
Solar DH	W input	calculated	using Ap	ope	ndix G or	Append	ix H	(negati	ve quantity	/) (ent	ter '0'	' if no solar	r contrib	ution to w	ater he	ating)		
(add a	dditiona	l lines if	FGHR	Sa	and/or V	VWHR	S a	pplies	, see Ap	penc	dix G	G)						
(63)m=	0	0	0		0	0		0	0	C)	0	0	0		0		(63)
Output	from w	ater hea	ter															
(64)m=	164.12	143.36	149.16	3	132.3	128.09	1	12.81	108.08	120	.49	121.82	138.7	1 148.0	7 16	0.27		
I											Outp	out from wa	ater hea	ter (annua	al) _{1 12}		1627.28	(64)
Heat g	ains fro	m water	heatin	g, I	kWh/ma	onth 0.2	25 ´	[0.85	× (45)m	+ (6	61)m	n] + 0.8 x	: [(46)ı	m + (57)	m + (59)m]	
(65)m=	51.11	44.65	46.38	Т	41	39.63		34.77	33.1	37	.1	37.52	42.91	46.01	49	9.83		(65)
inclu	de (57)	m in calo	culatior	۰ ۱o	f (65)m	only if	cyli	nder i	s in the o	dwell	ling	or hot wa	ater is	from co	mmu	nity h	leating	
5. Int	ernal a	ains (see	e Table	5	and 5a):					-					•	-	
	Ŭ	ns (Table			,													
metabl	Jan	Feb	Mar		Apr	May	,	Jun	Jul	A	ug	Sep	Oct	No		Dec		
(66)m=	85.64	85.64	85.64	+	85.64	85.64	-	35.64	85.64	85.	<u> </u>	85.64	85.64	_		5.64		(66)
l iahtin	a gains	(calcula	ted in <i>i</i>	 Api	pendix l	equa	tion	19 o	rl9a)a	lso s	ee T	L I Table 5						
(67)m=	22.63	20.1	16.34	<u> </u>	12.37	9.25	_	7.81	8.44	10.		14.72	18.69	21.81	23	3.25		(67)
		ins (calc	ulated	in	Annenc	l liv I o		tion L	13 or I 1	(32)	also							
(68)m=	149.23	150.78	146.88	-	138.57	128.09	<u>.</u>	18.23	111.64	110		114	122.3	1 132.7	9 14	2.65	l	(68)
														1 102.7	0	2.00		()
(69)m=	31.56	(calcula 31.56	31.56	-i-	31.56	2, equa	_	31.56	31.56	31.		31.56	3 31.56	31.56	2	1.56		(69)
						51.50	<u> </u>	51.50	51.50	51.	50	51.50	51.50	51.50	, ,	1.50		(00)
		ns gains	r`			10		10	10		0	10	40	10		10	I	(70)
(70)m=	10		10		10	10	<u> </u>	10	10	1	0	10	10	10		10		(70)
1		/aporatio	<u> </u>	-		, ,	-				1						I	(74)
(71)m=	-68.51	-68.51	-68.51		-68.51	-68.51	-	68.51	-68.51	-68	.51	-68.51	-68.5	1 -68.5	1 -6	8.51		(71)
		gains (T		<u>́</u>											-		I	(70)
(72)m=	68.69	66.45	62.35		56.95	53.27	4	48.29	44.5	49.		52.11	57.68			5.97		(72)
		gains =						. ,	. ,	<u>`</u>	<i>'</i>	+ (69)m + (,	· / ·				
(73)m=	299.24	296.02	284.26	5	266.59	249.29	2	33.02	223.27	229	.62	239.52	257.3	6 277.1	9 29	1.57		(73)
	ar gain					T 1 1 0				<i>.</i> .								
•		calculated	-	lar			a and			tions	to co		e applic		itation.		Qaina	
Orienta		Access F Table 6d	actor		Area m²			Flu Tat	x ole 6a		т	g_ able 6b		FF Table 6	с		Gains (W)	
Northwy	_									1						1	. ,	
Northwe	L	0.77		x	2.4		x		1.28	×		0.85	×	0.7] =	46.15	(81)
Northwe	Ļ	0.77		x	2.4		x	<u> </u>	2.97	X		0.85		0.7] =	93.94	(81)
Northwe	L	0.77		x	2.4		x		1.38	X		0.85	_ ×	0.7] =	169.25	(81)
Northwe	L	0.77		x	2.4		x	<u> </u>	57.96	×		0.85	×	0.7] =	277.96	(81)
Northwe	est <mark>0.9x</mark>	0.77		x	2.4	8	X	9	1.35	x		0.85	X	0.7	,	=	373.64	(81)

														_
Northwest 0.9x	•	×	2.4	8	x	9	7.38	×	0.85	_ × [0.7	=	398.34	(81)
Northwest 0.9x	0.77	x	2.4	8	x	9	91.1	x	0.85	×	0.7	=	372.64	(81)
Northwest 0.9x	0.77	x	2.4	8	x	7:	2.63	x	0.85	x	0.7	=	297.07	(81)
Northwest 0.9x	0.77	x	2.4	8	x	5	0.42	x	0.85	x	0.7	=	206.24	(81)
Northwest 0.9x	0.77	x	2.4	8	x	2	8.07	x	0.85	×	0.7	=	114.8	(81)
Northwest 0.9x	0.77	x	2.4	8	x	1	4.2	x	0.85	x	0.7	=	58.07	(81)
Northwest 0.9x	0.77	x	2.4	8	x	g	9.21	x	0.85	x	0.7	=	37.69	(81)
Solar <u>g</u> ains ir	n watts, calo	culated	for eac	h month				(83)m =	Sum(74)m	(82)m				
(83)m= 46.15		169.25	277.96	373.64		98.34	372.64	297.0	7 206.24	114.8	58.07	37.69		(83)
Total gains –	internal and	d solar	(84)m =	= (73)m ·	+ (8	33)m ,	, watts							
(84)m= 345.39	9 389.96 4	453.51	544.55	622.93	63	31.36	595.91	526.6	9 445.76	372.17	335.27	329.25		(84)
7. Mean inte	ernal tempe	rature (heating	season)									
Temperatur	e during hea	ating pe	eriods ir	n the livi	ng a	area f	rom Tab	ole 9, 1	Гh1 (°С)				21	(85)
Utilisation fa	actor for gain	ns for li	ving are	ea, h1,m	(se	ee Tal	ble 9a)							
Jan	Feb	Mar	Apr	May	Ĺ,	Jun	Jul	Aug	g Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.99	0.96	0.9	().79	0.67	0.74	0.91	0.98	0.99	1		(86)
Mean intern	al temperat	ure in li	iving ar		مالد	w ster	ns 3 to 7	'in Ta	hle 9c)		I			
(87)m= 18.61		19.17	19.74	20.29	r –	20.7	20.88	20.83	-	19.79	19.13	18.6		(87)
	-				L									
	т ^т т	19.2			<u> </u>	<u> </u>				19.23	19.22	10.01	l	(88)
(88)m= 19.19	19.19	19.2	19.23	19.23	1	9.25	19.25	19.26	5 19.25	19.23	19.22	19.21		(00)
Utilisation fa	т <u>т</u>	ns for r			h2,	m (se		9a)			1	r	l	
(89)m= 0.99	0.99	0.98	0.95	0.85	(0.67	0.45	0.53	0.84	0.97	0.99	0.99		(89)
Mean intern	al temperat	ure in t	he rest	of dwelli	ng	T2 (fc	ollow ste	eps 3 te	o 7 in Tabl	e 9c)				
(90)m= 17.11	17.3	17.68	18.26	18.77	1	9.13	19.23	19.22	2 18.96	18.32	17.65	17.12		(90)
									f	LA = Livi	ng area ÷ (4	4) =	0.47	(91)
Mean intern	al temperat	ure (for	the wh	ole dwe	lling	g) = fL	_A × T1	+ (1 –	fLA) × T2					
(92)m= 17.82		18.38	18.96	19.49	<u> </u>	9.87	20.01	19.98		19.01	18.35	17.82		(92)
Apply adjus	tment to the	e mean	internal	temper	atu	re froi	m Table	4e, w	here appro	opriate				
(93)m= 17.82	18	18.38	18.96	19.49	1	9.87	20.01	19.98	19.67	19.01	18.35	17.82		(93)
8. Space he	ating requir	rement										-		
Set Ti to the			•		ned	at ste	ep 11 of	Table	9b, so tha	t Ti,m=	(76)m an	d re-calo	ulate	
the utilisatio		<u> </u>			-								I	
Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	g Sep	Oct	Nov	Dec		
Utilisation fa	<u> </u>			0.00		. 70	0.50	0.00	0.00	0.00	0.00	0.00	l	(94)
(94)m= 0.99		0.98	0.94	0.86).72	0.56	0.63	0.86	0.96	0.99	0.99		(94)
Useful gains (95)m= 342.65	<u> </u>	442.75)m x (84 512.94	4)m 537.15	Л	53.99	332.41	332.4	8 383.57	359.06	331.18	327.03		(95)
Monthly ave							552.41	552.4	5 505.57	555.00		521.05		(00)
(96)m= 4.3	4.9	6.5	8.9	11.7	<u> </u>	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra											1	I		. /
(97)m= 1529.1						67.66	367.16	384.3		921.53	1241.66	1515.41		(97)
Space heati							h = 0.02	24 x [(9)m] x (4			I	
(98)m= 882.73	<u> </u>	662.19	427.04	235.17		0	0	0	0	418.48	655.55	884.16		
	L				-							!	I	

														-
								Tota	l per year	(kWh/year	[.]) = Sum(9	8)15,912 =	4898.08	(98)
Space	e heating	g require	ement ir	n kWh/m²	²/year								96.48	(99)
9a. En	ergy req	uiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatin	-												-
Fract	on of sp	ace hea	at from s	econdar	y/supple	mentary	-						0	(201)
Fract	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 -	– (201) =				1	(202)
Fract	on of tot	al heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of n	nain spa	ace heat	ting syste	em 1								88.8	(206)
Efficie	ency of s	econda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heating	g require	ement (o	calculate	d above))				1			l	
	882.73	732.77	662.19	427.04	235.17	0	0	0	0	418.48	655.55	884.16		
(211)m	n = {[(98)	m x (20	4)] } x ′	100 ÷ (20	06)	r		i	i	i	i	i	L	(211)
	994.06	825.2	745.71	480.9	264.83	0	0	0	0	471.26	738.23	995.68		-
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	7	5515.86	(211)
•				y), kWh/	month									
)m x (20 0	1)]}x1 0	00 ÷ (20	0	0	0	0	0	0	0	0	0		
(215)m=	0	0	0	0	0	0	0	-	-	•	215) _{15.10. 12}	_	0	(215)
Wator	heating										15,10. 12	2	0	
	-		ter (calc	ulated a	bove)									
oupu	164.12	143.36	149.16	132.3	128.09	112.81	108.08	120.49	121.82	138.71	148.07	160.27		
Efficie	ncy of wa	ater hea	iter	!									79.5	(216)
(217)m=	87.2	87.13	86.93	86.41	85.28	79.5	79.5	79.5	79.5	86.29	86.93	87.23		(217)
	or water h				-			-	-		-			
(219)m (219)m=	1 = (64)r 188.21	<u>n x 100</u> 164.54) ÷ (217 171.59)m 153.11	150.19	141.9	135.95	151.56	153.23	160.76	170.34	183.72		
(213)11-	100.21	104.04	171.53	155.11	150.19	141.5	133.35		I = Sum(2		170.54	103.72	1925.09	(219)
Δnnua	I totals										Wh/year		kWh/year	
		fuel use	ed, main	system	1					N.	, you		5515.86	7
Water	heating	fuel use	d										1925.09	í
	•			electric	keen-ho	t								J
		•		cicotiio		L							I	(000 -)
	al heating	••••										120		(230c)
Total e	electricity	for the	above,	kWh/yea	r			sum	of (230a)	(230g) =			120	(231)
Electri	city for lig	ghting											399.58	(232)
12a. (CO2 emi	issions -	– Individ	lual heat	ing syste	ems inclu	uding mi	cro-CHF)					
						En	ergy			Emiss	ion fac	tor	Emissions	
							/h/year			kg CO			kg CO2/yea	ar
Space	heating	(main s	ystem 1)			1) x			0.2		=	1191.42	(261)
	heating			,		(21	5) x					=		(263)
Space	noating	1000010	aary)			(<u> </u>),	/			0.5	19		0	(203)

Water heating	(219) x	0.216	=	415.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =	:		1607.25	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	62.28	(267)
Electricity for lighting	(232) x	0.519	=	207.38	(268)
Total CO2, kg/year	su	ım of (265) (271) =		1876.91	(272)
Dwelling CO2 Emission Rate	(2	72) ÷ (4) =		36.97	(273)
El rating (section 14)				74	(274)

			User D	etails:						
Assessor Name:	Oliver Morris			Stroma	a Num	ber:		STRO	025430	
Software Name:	Stroma FSAP 20 ²	12		Softwa	are Ver	sion:		Versio	n: 1.0.3.4	
		Pr	operty A	Address:	Unit 3-e	energy s	trategy			
Address :	, London, NW6 1NF	२								
1. Overall dwelling dimer	nsions:									
Ground floor			Area 52		(1a) x	Av. Hei	i ght(m) 8	(2a) =	Volume(m ³) 145.91	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e	e)+(1n)) 52	2.11	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	145.91	(5)
2. Ventilation rate:	·								<u> </u>	
		econdary neating		other		total			m ³ per hou	•
Number of chimneys	0 +	0	+	0] = [0	x 4	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent far	is					2	x 1	10 =	20	(7a)
Number of passive vents					Γ	0	x 1	10 =	0	(7b)
Number of flueless gas fir	es					0	x 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney	s. flues and fans = (6	6b)+(6b)+(7a	a)+(7b)+(7	⁷ C) =	Г	20	<u> </u>	÷ (5) =	0.14	(8)
If a pressurisation test has be					ontinue fro	-		. (0)	0.14	
Number of storeys in th	e dwelling (ns)								1	(9)
Additional infiltration							[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0.2					•	uction			0.35	(11)
if both types of wall are pre deducting areas of opening		sponding to	the greate	er wall area	a (after					
If suspended wooden fl		led) or 0. ⁻	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter 0								0	(13)
Percentage of windows	and doors draught s	tripped							5	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0.24	(15)
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) +	+ (15) =	(.7270726766616 [.]	15 <mark>(16)</mark>
Air permeability value, o			•	•	•	etre of e	nvelope	area	0	(17)
If based on air permeabilit	-								0.73	(18)
Air permeability value applies		s been done	e or a deg	ree air per	meability i	is being us	sed			
Number of sides sheltered Shelter factor	L			(20) = 1 - [0.075 x (1	9)] =			3 0.78	(19) (20)
Infiltration rate incorporati	ng shelter factor			(21) = (18)		/-			0.78	(20)
Infiltration rate modified for	0	Ч		((- /				0.50	_(21)
	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe		• •		-					1	
	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
		. I							I	
Wind Factor (22a)m = (22	, T T		0.05	0.02	4	1 00	1 1 2	1 4 0		
(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		

Adjust	ed infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
	0.72	0.7	0.69	0.62	0.61	0.54	0.54	0.52	0.56	0.61	0.63	0.66		
			change i	rate for t	he appli	cable ca	se		-					
	echanica		using Appe	andix N (2	3h) - (23g	a) x Emv (e	auation (N5)) othe	nuise (23k	(232)			0	(23a)
			overy: effici		, ,	, ,	• •	<i>,,</i> .	`) – (23a)			0	(23b)
			-	-	-					26)m i (00h) v [1 (22a)	0	(23c)
a) II (24a)m=								$\frac{\Pi R}{0}$	$\frac{1}{0} = \frac{1}{2}$	$\frac{20}{10} + (0)$	230) × [1 – (23c) 0	- 100j	(24a)
		-	_	÷	-		÷		, ,	÷	Ů	0	l	(210)
(24b)m=			anical ve	0				0	0 = (2)		230)	0	1	(24b)
	-		tract ven		-			-		Ŭ	Ŭ	Ů	l	()
,			< (23b), t		•	•				.5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If	natural	ventilati	on or wh	ole hous	e positiv	ve input	ventilati	on from	I loft	Į		Į	1	
			en (24d)							0.5]				
(24d)m=	0.76	0.75	0.74	0.69	0.68	0.64	0.64	0.64	0.66	0.68	0.7	0.72		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	o) or (24	c) or (24	ld) in bo	x (25)	-	-			
(25)m=	0.76	0.75	0.74	0.69	0.68	0.64	0.64	0.64	0.66	0.68	0.7	0.72		(25)
3. He	at losse	s and he	eat loss p	paramete	er:									
ELEN		Gro		Openin		Net Ar	ea	U-val	ue	ΑXU		k-value	9	AXk
		area	(m²)	m		A ,r	n²	W/m2	2K	(W/	K)	kJ/m²∙I	K	kJ/K
Windo	ws Type	e 1				1.44	x1	/[1/(4.8)+	0.04] =	5.8				(27)
Windo	ws Type	2				1.2	x1	/[1/(4.8)+	0.04] =	4.83				(27)
Windo	ws Type	93				1.91	x1	/[1/(1.8)+	0.04] =	3.21				(27)
Windo	ws Type	9 4				2.94	x1	/[1/(1.8)+	0.04] =	4.94				(27)
Floor						52.11	x	0.25	=	13.027	5			(28)
Walls -	Type1	42.6	62	4.08	;	38.54	1 X	0.3	=	11.56				(29)
Walls -	Type2	6.5	5	4.85	5	1.7	x	0.28	=	0.48			$\exists \Box$	(29)
Roof		28.6	68	0		28.68	3 X	0.18		5.16			7 6	(30)
Total a	rea of e	lements	s, m²			129.9	6				I			(31)
Party v	vall					10.5	×	0		0				(32)
Party v	vall					19.32		0.2	=	3.86			= =	(32)
Party v						8.02	x	0.2		1.6			\dashv	(32)
Party v						13.41		0.2	=	0			\dashv	(32)
Party of										0	I 		\dashv	
	-	roof wind	lows use e	iffective wi	ndow I I-w	52.11		n formula 1	1/[(1/ _veli	ر 14) مراح	as aiven ir	paragraph		(32b)
			sides of in					g ionnuid I	/(// O-vai	,,,+0.0 4] c	o given II.	ραιαγιαρι	, 0.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26) (30) + (32) =				60.27	(33)
Heat c	apacity	Cm = S	(A x k)						((28)	(30) + (32	2) + (32a)	(32e) =	17913.2	23 (34)

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

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

(35)

250

Indicative Value: Medium

can be ι	ised inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	<						19.49	(36)
if details	of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			79.76	(37)
Ventila	tion hea	at loss ca	alculated	monthl	y		-		(38)m	= 0.33 × ((25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	36.5	36.02	35.55	33.32	32.91	30.97	30.97	30.62	31.72	32.91	33.75	34.63]	(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	116.26	115.78	115.31	113.09	112.67	110.74	110.74	110.38	111.48	112.67	113.51	114.39		
						<u>.</u>				-	Sum(39)1	12 /12=	113.09	(39)
	<u> </u>	imeter (H	r - '	r		i	i			= (39)m ÷	1	i	1	
(40)m=	2.23	2.22	2.21	2.17	2.16	2.13	2.13	2.12	2.14	2.16	2.18	2.2		
Numbe	er of day	/s in moi	nth (Tab	le 1a)					,	Average =	: Sum(40)₁	₁₂ /12=	2.17	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	1	(41)
											-	•		
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
													1	
if TF				[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0)013 x (⁻	TFA -13		75]	(42)
		,	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		75	.82	1	(43)
		-				-	-	to achieve	a water us	se target o	of		1	
not more	e that 125	litres per j	person pe	r day (all w	ater use, l	not and co	ld)					r	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)		-		-		
(44)m=	83.4	80.37	77.33	74.3	71.27	68.24	68.24	71.27	74.3	77.33	80.37	83.4		
Energy	content of	hot water	used - cal	culated m	onthly — A	190 v Vd r	п v nm v Г)Tm / 360(ım <mark>(44)</mark> 1 12 = ables 1b, 1		909.81	(44)
		· · · · ·	r		-	1	1	r			1	, 1	1	
(45)m=	123.68	108.17	111.62	97.31	93.38	80.58	74.67	85.68	86.7	101.04	110.3 Im(45) _{1 12} =	119.78	1192.9	(45)
lf instan	taneous v	/ater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46				-	1102.0	
(46)m=	18.55	16.23	16.74	14.6	14.01	12.09	11.2	12.85	13.01	15.16	16.54	17.97		(46)
	storage		المرابع المرابع		- \ \								1	
0		,					•	within sa	ame ves	sei		0	J	(47)
	•	-			/elling, e			(47) mbi boil	ora) onto	or (0) in 1	(47)			
	storage		not wate		iciuues i	nstantai					(47)			
	•		eclared I	oss facto	or is kno	wn (kWł	n/dav):					0	1	(48)
,		actor fro				,	,					0]	(49)
		m water			ear			(48) x (49)	=			0]	(50)
			-	-	loss fact	or is not	known:					•	1	
		-			le 2 (kW	h/litre/da	ıy)					0]	(51)
	-	eating s		on 4.3									1	
		from Ta actor fro		2h								0		(52)
rombe				20							1	0		(53)

•		om water	-	e, kWh/ye	ear			(47) x (51) x (52) x (53) =		0		(54)
	. ,	(54) in (5			_							0	İ	(55)
Water	storage	loss cal	culated	for each	month			((56)m = ((55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylind	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	57)m = (56)	m where (H11) is fro	m Append	lix H -	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primai	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month ((59)m = ((58) ÷ 36	65 × (41))m					
(mo	dified by	/ factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	a cylinde	r thermo	stat)		1	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 3	65 × (41))m		-	-	-	_	
(61)m=	42.5	36.99	39.41	36.64	36.32	33.65	34.77	36.32	36.64	39.41	39.63	42.5		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	166.18	145.16	151.03	133.96	129.69	114.23	109.44	122	123.34	140.45	149.93	162.28		(62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter 'C)' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter					-	-	-	-	-	_	
(64)m=	166.18	145.16	151.03	133.96	129.69	114.23	109.44	122	123.34	140.45	149.93	162.28		_
								Out	put from w	ater heate	r (annual)₁	12	1647.68	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 >	۲ ((46)m	+ (57)m	+ (59)m]	
(65)m=	51.75	45.21	46.97	41.52	40.13	35.2	33.52	37.57	37.99	43.45	46.58	50.45		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gair	ns (Table	e 5), Wat	ts									_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	23.61	20.97	17.06	12.91	9.65	8.15	8.81	11.45	15.36	19.51	22.77	24.27		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	o see Ta	ble 5				
(68)m=	152.71	154.3	150.3	141.8	131.07	120.98	114.25	112.66	116.65	125.16	135.89	145.97		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)), also se	ee Table	5			•	
(69)m=	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76		(69)
Pumps	s and fa	ns gains	(Table :	5a)									I	
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losse	s e.g. ev	, aporatic	n (nega	tive valu	es) (Tab	le 5)			1				I	
(71)m=	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09		(71)
Water	heating	gains (T	Table 5)	•	•	•							I	
(72)m=	69.55	67.28	63.13	57.66	53.93	48.89	45.05	50.49	52.76	58.4	64.7	67.81		(72)
Total i	internal	gains =	:	!	!	(66)	ı)m + (67)m	• • + (68)m ·	+ (69)m +	(70)m + (7	1)m + (72)	m	I	
(73)m=	305.16	301.84	289.77	271.66	253.94	237.31	227.39	233.89	244.07	262.35	282.64	297.34		(73)
	lar gains	s:	1	1	1	1	1	1	1	1	1	1		

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	2.94	×	11.28	x	0.63	x	0.7	=	10.14	(75)
Northeast 0.9x	0.77	x	2.94	x	22.97	x	0.63	x	0.7	=	20.64	(75)
Northeast 0.9x	0.77	x	2.94	×	41.38	x	0.63	x	0.7	=	37.18	(75)
Northeast 0.9x	0.77	x	2.94	x	67.96	x	0.63	x	0.7	=	61.06	(75)
Northeast 0.9x	0.77	x	2.94	x	91.35	x	0.63	x	0.7	=	82.07	(75)
Northeast 0.9x	0.77	x	2.94	x	97.38	x	0.63	x	0.7	=	87.5	(75)
Northeast 0.9x	0.77	x	2.94	x	91.1	x	0.63	x	0.7	=	81.85	(75)
Northeast 0.9x	0.77	x	2.94	×	72.63	x	0.63	x	0.7	=	65.26	(75)
Northeast 0.9x	0.77	x	2.94	×	50.42	x	0.63	x	0.7	=	45.3	(75)
Northeast 0.9x	0.77	x	2.94	x	28.07	x	0.63	x	0.7	=	25.22	(75)
Northeast 0.9x	0.77	x	2.94	×	14.2	x	0.63	x	0.7	=	12.76	(75)
Northeast 0.9x	0.77	x	2.94	x	9.21	x	0.63	x	0.7	=	8.28	(75)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.85	x	0.7	=	43.69	(77)
Southeast 0.9x	0.77	x	1.2	×	36.79	x	0.85	x	0.7	=	18.21	(77)
Southeast 0.9x	0.77	x	1.91	x	36.79	x	0.63	x	0.7	=	21.48	(77)
Southeast 0.9x	0.77	x	1.44	x	62.67	x	0.85	x	0.7	=	74.43	(77)
Southeast 0.9x	0.77	x	1.2	x	62.67	x	0.85	x	0.7	=	31.01	(77)
Southeast 0.9x	0.77	x	1.91	x	62.67	x	0.63	x	0.7	=	36.58	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.85	x	0.7	=	101.83	(77)
Southeast 0.9x	0.77	x	1.2	×	85.75	x	0.85	x	0.7	=	42.43	(77)
Southeast 0.9x	0.77	x	1.91	x	85.75	x	0.63	x	0.7	=	50.06	(77)
Southeast 0.9x	0.77	x	1.44	x	106.25	x	0.85	x	0.7	=	126.18	(77)
Southeast 0.9x	0.77	x	1.2	x	106.25	x	0.85	x	0.7	=	52.57	(77)
Southeast 0.9x	0.77	x	1.91	×	106.25	x	0.63	x	0.7	=	62.02	(77)
Southeast 0.9x		x	1.44	x	119.01	x	0.85	x	0.7	=	141.33	(77)
Southeast 0.9x	0.77	x	1.2	x	119.01	x	0.85	x	0.7	=	58.89	(77)
Southeast 0.9x	0.77	x	1.91	x	119.01	x	0.63	x	0.7	=	69.47	(77)
Southeast 0.9x	0.77	x	1.44	×	118.15	x	0.85	x	0.7	=	140.31	(77)
Southeast 0.9x	0.77	x	1.2	×	118.15	x	0.85	x	0.7	=	58.46	(77)
Southeast 0.9x	0.77	x	1.91	x	118.15	x	0.63	x	0.7	=	68.97	(77)
Southeast 0.9x		x	1.44	x	113.91	x	0.85	x	0.7	=	135.27	(77)
Southeast 0.9x	0.77	x	1.2	×	113.91	x	0.85	x	0.7	=	56.36	(77)
Southeast 0.9x	-	x	1.91	x	113.91	x	0.63	x	0.7	=	66.49	(77)
Southeast 0.9x	0.77	x	1.44	×	104.39	x	0.85	x	0.7	=	123.97	(77)
Southeast 0.9x	0.77	x	1.2	x	104.39	x	0.85	x	0.7	=	51.65	(77)
Southeast 0.9x		x	1.91	x	104.39	x	0.63	x	0.7	=	60.93	(77)
Southeast 0.9x		x	1.44	×	92.85	x	0.85	x	0.7	=	110.26	(77)
Southeast 0.9x	-	x	1.2	×	92.85	x	0.85	x	0.7	=	45.94	(77)
Southeast 0.9x	0.77	x	1.91	×	92.85	x	0.63	x	0.7	=	54.2	(77)

						_										
Southeas	st 0.9x	0.77	×	1.4	4	×	6	9.27	x		0.85	x	0.7	=	82.26	(77)
Southeas	st <mark>0.9x</mark>	0.77	x	1.:	2	×	6	9.27	x		0.85	x	0.7	=	34.27	(77)
Southeas	st 0.9x	0.77	x	1.9)1	×	6	9.27	x		0.63	_ x [0.7	=	40.43	(77)
Southeas	st <u>0.9</u> x	0.77	x	1.4	4	× [4	4.07	x		0.85	_ × [0.7	=	52.33	(77)
Southeas	st 0.9x	0.77	x	1.:	2	×	4	4.07	x		0.85	× [0.7	=	21.81	(77)
Southeas	st 0.9x	0.77	x	1.9)1	×	4	4.07	x		0.63	_ × [0.7	=	25.72	(77)
Southeas	st 0.9x	0.77	x	1.4	4	×	3	1.49	x		0.85	_ × [0.7	=	37.39	(77)
Southeas	st <u>0.9</u> x	0.77	x	1.:	2	×Ī	3	1.49	x		0.85		0.7	=	15.58	(77)
Southeas	st <u>0.9</u> x	0.77	x	1.9)1	×Г	3	1.49	x		0.63		0.7	=	18.38	(77)
						-										
Solar ga	ins in w	vatts, ca	alculated	for eacl	h month				(83)m	ı = Sı	um(74)m	(82)m				
T T		162.66	231.5	301.83	351.76	35	5.23	339.98	301	.81	255.71	182.18	112.62	79.63]	(83)
Total gai	ins – int	ternal a	nd solar	(84)m =	- (73)m ·	+ (8	3)m ,	watts							4	
(84)m= 3	398.68	464.49	521.27	573.49	605.7	59	2.55	567.37	535	5.7	499.78	444.53	395.26	376.97]	(84)
7. Mear	n intern	al temp	erature ((heating	season)			-						-	
			eating p	, J		, 	area f	rom Tab	ole 9.	Th	1 (°C)				21	(85)
		-	ains for li			-				,	. (0)					(00)
	Jan	Feb	Mar	Apr	May	<u> </u>	Jun	Jul	A	ug	Sep	Oct	Nov	Dec]	
(86)m=	0.99	0.99	0.98	0.96	0.92		.82	0.7	0.7	-	0.89	0.97	0.99	0.99		(86)
															1	
_		18.88	ature in I	-	· · ·	· · · ·	— i		20.8		i	19.87	10.2	10.00	1	(87)
(87)m=	18.67	10.00	19.25	19.76	20.25	20	0.66	20.86	20.0	03	20.51	19.87	19.2	18.66		(07)
Temper	rature d	luring h	eating p	eriods ir	n rest of	dwe	elling	from Ta	able 9	9, Th	n2 (°C)		-	-	•	
(88)m=	19.18	19.19	19.2	19.22	19.23	19	9.25	19.25	19.	26	19.24	19.23	19.22	19.21		(88)
Utilisati	on facto	or for ga	ains for r	est of d	welling,	h2,r	m (se	e Table	9a)							
(89)m=	0.99	0.99	0.97	0.94	0.87	0).7	0.48	0.5	54	0.81	0.95	0.99	0.99]	(89)
Mean ir	nternal	temper	ature in t	he rest	of dwelli	na -	T2 (fc	ollow ste	ens 3	to 7	' in Tabl	e 9c)			-	
_	17.17	17.39	17.75	18.27	18.74	<u> </u>	9.1	19.22	19.2		18.98	18.39	17.72	17.17	1	(90)
, , L							I				f	LA = Livii	ng area ÷ (·	4) =	0.54	(91)
																`´´
			ature (for			<u> </u>	<u> </u>		<u> </u>	- 1	<i>.</i>	10.10	1 40 50	47.00	1	(02)
	17.98	18.2	18.56	19.07	19.56		9.95	20.11	20.0		19.81	19.19	18.52	17.98		(92)
· · · · -	<u> </u>		ne mean		<u> </u>				r —	-	<u> </u>	·	10.50	47.00	1	(02)
	17.98	18.2	18.56	19.07	19.56	19	9.95	20.11	20.	09	19.81	19.19	18.52	17.98		(93)
			uirement			1	-1 -1 -		Tabl	- 04	41	4 T :	(70)			
			ernal ten or gains ι			iea a	at ste	ep 11 of	Tadi	e 90	, so tha	t 11,m=	(76)m an	d re-cal	culate	
Г	Jan	Feb	Mar	Apr	May	J	Jun	Jul	A	ug	Sep	Oct	Nov	Dec]	
L Utilisati			ains, hm:	•	may			• • •		-9	000	•••			1	
	0.99	0.98	0.97	0.94	0.88	0.	.76	0.6	0.6	5	0.84	0.95	0.98	0.99]	(94)
	gains, h	mGm ,	W = (94		4)m	I	I		I				1		J	
	- 1	456.37	505.31	539.1	, 532.38	45	0.56	342.36	347	.45	421.04	422.82	388.5	373.6]	(95)
ے Monthl	y avera	ge exte	rnal tem	perature	from Ta	able	8		I	1			1	1	J	
(96)m=	4.3	4.9	6.5	8.9	11.7		4.6	16.6	16.	.4	14.1	10.6	7.1	4.2]	(96)
Heat lo	ss rate	for mea	an interna	al tempe	erature,	Lm	, W =	=[(39)m :	x [(93	3)m-	- (96)m]	1		1	
	591.07	1	T	1150.64	885.09	r	2.06	388.67	407	· 1	636.35	968.23	1296.38	1576]	(97)
L	!								I				1	L	J	

							ergy /h/year			Emiss kg CO2	ion fac 2/kWh	tor	Emissions kg CO2/yea	r
12a. C	O2 emi	issions -	– Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHP						
Electricit	ty for lig	ghting											417.04	(232)
Total ele	ectricity	for the	above, I	kWh/yea	ır			sum	of (230a)	(230g) =		[120	(231)
central	heatin	g pump:										120		(230c)
Electricit	ty for p	umps, fa	ans and	electric	keep-ho	t								
Water he	eating	fuel use	d									[1949.11]
Space h	eating	fuel use	ed, main	system	1						2	[5555.84]
Annual	totals								,		Wh/year	. l	kWh/year	Γ(=)
		100.00							l = Sum(2			100.00	1949.11	(219)
Fuel for (219)m = (219)m=	= (64)r	•			151.7	143.68	137.66	153.46	155.15	162.93	172.53	186.03		
(217)m=	87.2	87.11	86.9	86.44	85.49	79.5	79.5	79.5	79.5	86.21	86.9	87.23		(217)
Efficienc	cy of wa	ater hea	ter										79.5	(216)
· -	rom wa 166.18	ater heat 145.16	ter (calc 151.03	ulated a 133.96	bove) 129.69	114.23	109.44	122	123.34	140.45	149.93	162.28		
Water h	-							Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,10. 12}	=	0	(215)
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		٦.
Space = {[(98)n				y), kWh/)8)	month									J
L	I							Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	5555.84	(211)
· · –	002.59		741.83	495.84	295.52	0	0	0	0	456.97	736.12	1007.41		(211)
L				00 ÷ (20		Ů	Ů	Ŭ	Ŭ	100.10	000.01	001100		(211)
· –	890.3	727.77	658.75	440.31	d above) 262.42	0	0	0	0	405.79	653.67	894.58		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Efficien				<u> </u>	y heating		i						0	(208)
		-		ing syste									88.8	(206)
			-	main sys				(204) = (20	02) × [1 –	(203)] =			1	(204)
Fractio	n of sp	ace hea	it from m	nain syst	tem(s)			(202) = 1 -					1	(202)
Space	heatin	g:					v system					[0	(201)
9a. Ener	rav rea	uiremen	nts – Ind	ividual h	eating s	vstems i	ncluding	micro-C	CHP)			l		J
Space	heating	g require	ement in	kWh/m²	²/year								94.68	(99)
					_			Tota		(kWh/year			4933.59	(98)
· –	890.3	727.77	658.75	440.31	262.42	0	0			405.79	653.67	894.58		

(211) x	0.216	=	1200.06	(261)
(215) x	0.519	=	0	(263)
(219) x	0.216	=	421.01	(264)
(261) + (262) + (263) + (264) =			1621.07	(265)
(231) x	0.519	=	62.28	(267)
(232) x	0.519	=	216.45	(268)
sum	of (265) (271) =		1899.79	(272)
(272	(4) ÷ (4) =		36.46	(273)
			74	(274)
	(215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x sum	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccc} (215) & x & & & & & & & \\ \hline 0.210 & x & & & & & \\ (219) & x & & & & & \\ (219) & x & & & & & \\ (261) + (262) + (263) + (264) = & & & & \\ (261) + (262) + (263) + (264) = & & & & \\ (231) & x & & & & & \\ (231) & x & & & & & \\ (232) & x & & & & & \\ (232) & x & & & & & \\ (232) & x & & & & & \\ (232) & x & & & & & \\ (232) & x & & \\ (232) & x & & & \\ (232) & x & & & \\ (232) & x & & \\$

			User D	etails:						
Assessor Name:	Oliver Morris			Stroma	a Num	ber:		STRO	025430	
Software Name:	Stroma FSAP 207	12		Softwa	are Ver	sion:		Versio	on: 1.0.3.4	
		Pr	operty A	Address:	Unit 4-e	energy s	trategy			
Address :	, London, NW6 1NF	२								
1. Overall dwelling dimer	nsions:									
Ground floor			Area		(1a) x	Av. He	i ght(m) .96	(2a) =	Volume(m³) 211.43) (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e	e)+(1n)) 7	1.43	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	211.43	(5)
2. Ventilation rate:	·								<u> </u>	
		econdary heating	/	other		total			m ³ per hou	r
Number of chimneys	0 +	0] + [0] = [0	x 4	= 0	0	(6a)
Number of open flues	0 +	0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent far	IS L					3	x 1	0 =	30	(7a)
Number of passive vents					Γ	0	x 1	0 =	0	(7b)
Number of flueless gas fir	es					0	x 4	- 0	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney	s. flues and fans = (6)	6b)+(6b)+(7a	a)+(7b)+(7	7c) =	Г	30		÷ (5) =	0.14	(8)
If a pressurisation test has be					ontinue fro			(-)	0.14	
Number of storeys in th	e dwelling (ns)								1	(9)
Additional infiltration							[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0.2					•	uction			0.35	(11)
if both types of wall are pre deducting areas of opening		sponding to	the greate	er wall area	a (after					
If suspended wooden fl		led) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter 0								0	(13)
Percentage of windows	and doors draught s	tripped							5	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0.24	(15)
Infiltration rate				(8) + (10) -	+ (11) + (1	2) + (13) +	+ (15) =	d	.7318890516760	12(16)
Air permeability value, o			•	•	•	etre of e	nvelope	area	0	(17)
If based on air permeabilit	•								0.73	(18)
Air permeability value applies		s been done	e or a deg	ree air per	meability i	is being us	sed			
Number of sides sheltered Shelter factor	L			(20) = 1 - [0.075 x (1	9)] =			2 0.85	(19) (20)
Infiltration rate incorporati	ng shelter factor			(21) = (18)		/-			0.62	(21)
Infiltration rate modified for	0	Ч		(0.62	(21)
	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7									
	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4	• •								
	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
		0.00	0.00	0.02	•		2		l	

Adjuste	ed infiltra	ation rate	e (allowi	ng for sh	elter an	d wind s	peed) =	(21a) x	(22a)m					
	0.79	0.78	0.76	0.68	0.67	0.59	0.59	0.58	0.62	0.67	0.7	0.73		
	ate effec echanica		-	rate for t	ne appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If bala	nced with	heat reco	overy: effic	iency in %	allowing f	or in-use fa	actor (fron	n Table 4h) =				0	(23c)
a) If	balance	d mecha	anical ve	entilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [⁻	1 – (23c)	÷ 100]	
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	overy (N	MV) (24t)m = (22	2b)m + (23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,				ntilation c hen (24c	•	•				.5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,				ole hous m = (22t	•	•				0.5]				
(24d)m=	0.81	0.8	0.79	0.73	0.72	0.67	0.67	0.67	0.69	0.72	0.74	0.77		(24d)
Effec	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in bo	x (25)					
(25)m=	0.81	0.8	0.79	0.73	0.72	0.67	0.67	0.67	0.69	0.72	0.74	0.77		(25)
3. Hea	at losses	s and he	at loss p	paramete	er:									
ELEN	IENT	Gros area	-	Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²⋅ł		A X k kJ/K
Window	ws Type	1				0.98	x1	/[1/(1.8)+	0.04] =	1.65				(27)
Window	ws Type	2				2.17	x1	/[1/(1.8)+	0.04] =	3.64				(27)
Window	ws Type	3				3.96	x1	/[1/(1.8)+	0.04] =	6.65				(27)
Window	ws Type	4				1.4	x1	/[1/(1.8)+	0.04] =	2.35				(27)
Window	ws Type	5				1.4	x1	/[1/(4.8)+	0.04] =	5.64				(27)
Rooflig	hts					0.3	x1	/[1/(5.3) +	0.04] =	1.59				(27b)
Walls 7	Гуре1	11.5	6	0		11.56	i x	0.3	=	3.47				(29)
Walls 7	Гуре2	12.3	4	7.91		4.43	x	0.28	=	1.24				(29)
Walls 7	ГуреЗ	34.4	4	3.96		30.44	x	0.28	=	8.52				(29)
Walls 7	Гуре4	2.33	3	1.4		0.93	x	0.3	=	0.28				(29)
Roof T	ype1	34.6	5	0		34.65	x	0.18	=	6.24				(30)
Roof T	ype2	19.1	4	0		19.14	x	0.18	=	3.45				(30)
Roof T	уре3	1.59	Э	0		1.59	x	0.18	=	0.29				(30)
Roof T	ype4	15.4	.9	0.6		14.89	x	0.18	=	2.68				(30)
Roof T	ype5	16.4	7	0		16.47	× x	0.18	=	2.96				(30)
Total a	rea of el	ements	, m²			147.9	7				-			(31)
Party w	vall					34.54	x	0	=	0				(32)
Party w	vall					5.22	x	0.2	=	1.04				(32)
Party fl	oor					73.1					[(32a)

				effective wi nternal wal			ated using	formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	3.2	
		s, W/K =			,			(26) (30)	+ (32) =				58.36	(33)
Heat c	apacity	Cm = S(Axk)						((28)	(30) + (3	2) + (32a)	(32e) =	10704.06	(34)
					- TFA) ir	ר kJ/m²K			Indica	tive Value	: Medium		250	(35)
For des	gn assess	•	ere the de	tails of the				ecisely the	e indicative	e values of	f TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	<						22.2	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			80.56	(37)
Ventila	tion hea	at loss ca	alculated	monthl	y	-	-	-	(38)m	= 0.33 × ((25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	56.83	55.98	55.15	51.22	50.49	47.07	47.07	46.44	48.39	50.49	51.97	53.53		(38)
Heat ti	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	137.39	136.54	135.7	131.78	131.04	127.63	127.63	126.99	128.94	131.04	132.53	134.08		
Heat lo	oss para	meter (H	HLP), W/	/m²K	1	1	1	1		Average = = (39)m ÷	Sum(39)₁ - (4)	₁₂ /12=	131.78	(39)
(40)m=	1.92	1.91	1.9	1.84	1.83	1.79	1.79	1.78	1.81	1.83	1.86	1.88		
										Average =	Sum(40)1	₁₂ /12=	1.84	(40)
Numbe	er of day	/s in mor	nth (Tab	le 1a)						1			1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
		ting ener		irement:								kWh/ye	ear:	
if TF				[1 - exp	(-0.0003	349 x (TF	-A -13.9)2)] + 0.0	0013 x (⁻	TFA -13		28		(42)
Annua	l averag	e hot wa		ge in litre usage by	•	-	-	· ,		se target c		.36		(43)
not mor	e that 125	litres per p	person per	r day (all w	ater use, l	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	97.19	93.66	90.13	86.59	83.06	79.52	79.52	83.06	86.59	90.13	93.66	97.19		
_											im(44) _{1 12} =		1060.3	(44)
Energy	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	0Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	144.14	126.06	130.08	113.41	108.82	93.9	87.02	99.85	101.04	117.76	128.54	139.59		_
lf instan	taneous w	ater heatii	ng at point	of use (no	hot wate	r storage),	enter 0 in	boxes (46		Total = Su	Im(45) _{1 12} =	=	1390.21	(45)
(46)m=	21.62	18.91	19.51	17.01	16.32	14.09	13.05	14.98	15.16	17.66	19.28	20.94		(46)
Water	storage	loss:		Į							1			
Storag	e volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	•	•		nk in dw	•			` '						
			hot wate	er (this ir	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
	storage		clared I	oss facto	nr is kno	wn (k\//	n/dav).					0		(48)
a) II II							"uuy).					0		
Tomno	erature f	actor fro	m Tahla	2h								0		(49)

			storage	•		_		(48) x (49)) =			0		(50)
,			eclared of	•								_	l	(54)
		•	factor fr		ie z (kvv	n/iitie/ua	iy)					0		(51)
		from Ta		011 4.0								0	l	(52)
			m Table	2b								0		(53)
Energy	/ lost fro	m water	⁻ storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
		(54) in (5	-									0		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	er contain	L s dedicate	L d solar sto	rage, (57)	l m = (56)m	x [(50) – (L H11)] ÷ (5	1 0), else (5	1 7)m = (56)	I m where (L H11) is fro	m Append	l lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
						Ů	Ů	Ů	ů	Ů				
	•	•	nnual) fro			E0)m	(50) . 20	25 ~ (11)	~			0		(58)
	•		culated from Tab			,	. ,	. ,		r thermo	stat)			
(59)m=		0									0	0		(59)
									Ĵ	Ů	Ů	Ŭ		
	r	i	for each	i	,	· ,	· · · ·	, 	40.7	45.00	40.40	40.50		(04)
(61)m=	49.53	43.11	45.93	42.7	42.32	39.22	40.52	42.32	42.7	45.93	46.19	49.53		(61)
	· · ·	· · · · · ·	r		i	1	i	<u>, ,</u>	1	, <i>,</i>	, , I	· ,	(59)m + (61)m	
(62)m=	193.66	169.17	176.01	156.11	151.15	133.12	127.54	142.18	143.75	163.68	174.73	189.12		(62)
			using App							r contribut	ion to wate	er heating)		
•	r	· · · · · ·	FGHRS	1	i	· · ·	· ·	i – – –	ŕ				I	()
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter	-		-							I	
(64)m=	193.66	169.17	176.01	156.11	151.15	133.12	127.54	142.18	143.75	163.68	174.73	189.12		-
								Outp	out from w	ater heate	r (annual)₁	12	1920.22	(64)
-			heating,			_			-			+ (59)m]	
(65)m=	60.31	52.69	54.73	48.38	46.76	41.03	39.06	43.78	44.27	50.64	54.29	58.8		(65)
inclu	ıde (57)	m in cale	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	and 5a):									
Metab	olic gair	ıs (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see [·]	Table 5					
(67)m=	30.41	27.01	21.97	16.63	12.43	10.5	11.34	14.74	19.79	25.12	29.32	31.26		(67)
Applia	nces ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	200.61	202.69	197.45	186.28	172.18	158.93	150.08	148	153.25	164.41	178.51	191.76		(68)
	L gains	i (calcula	ted in A	n Dendix	L equat	ion I 15	u or I 15a') also se	e Table	.5				
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4		(69)
			(Table 5		L	L		I		l				
(70)m=	10	10 10		10	10	10	10	10	10	10	10	10		(70)
								10	10	10				()
	<u> </u>	· ·	on (negat	i	· · ·	· · · · · · · · · · · · · · · · · · ·	04.04	04.04	04.04	04.04	04.04	04.04		(71)
(71)m=	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21		(71)

Water heating gains (Table 5)							
(72)m= 81.06 78.41 73.57	67.2 62.85	56.98 52.5	58.85 61.49	68.06 75.4	79.03		(72)
Total internal gains =		(66)m + (67)m	n + (68)m + (69)m +	(70)m + (71)m + (72)	m		
(73)m= 379.29 375.32 360.19	337.32 314.67	293.62 281.13	288.79 301.73	324.8 350.44	369.25		(73)
6. Solar gains:	•	•	•				
Solar gains are calculated using sola	r flux from Table 6a a	nd associated equa	ations to convert to t	he applicable orientat	ion.		
Orientation: Access Factor	Area	Flux	_ g_	FF		Gains	
Table 6d	m²	Table 6a	Table 6b	Table 6c		(W)	
Northeast 0.9x 0.77 x	3.96	11.28	× 0.85	× 0.7	=	18.42	(75)
Northeast 0.9x 0.77 x	1.4	11.28	× 0.85	× 0.7	=	13.03	(75)
Northeast 0.9x 0.77 x	1.4	11.28	× 0.85	× 0.7	=	6.51	(75)
Northeast 0.9x 0.77 x	3.96	22.97	× 0.85	× 0.7	=	37.5	(75)
Northeast 0.9x 0.77 x	1.4	22.97	× 0.85	× 0.7	=	26.52	(75)
Northeast 0.9x 0.77 x	1.4	22.97	× 0.85	× 0.7	=	13.26	(75)
Northeast 0.9x 0.77 x	3.96	41.38	× 0.85	× 0.7	=	67.57	(75)
Northeast 0.9x 0.77 x	1.4	41.38	× 0.85	× 0.7	=	47.77	(75)
Northeast 0.9x 0.77 x	1.4	41.38	× 0.85	× 0.7	=	23.89	(75)
Northeast 0.9x 0.77 x	3.96	67.96	× 0.85	× 0.7	=	110.96	(75)
Northeast 0.9x 0.77 x	1.4	67.96	× 0.85	× 0.7	=	78.46	(75)
Northeast 0.9x 0.77 x	1.4	67.96	× 0.85	× 0.7	=	39.23	(75)
Northeast 0.9x 0.77 x	3.96	91.35	× 0.85	× 0.7	=	149.15	(75)
Northeast 0.9x 0.77 x	1.4	91.35	× 0.85	× 0.7	=	105.46	(75)
Northeast 0.9x 0.77 x	1.4	91.35	× 0.85	× 0.7	=	52.73	(75)
Northeast 0.9x 0.77 x	3.96	97.38	× 0.85	× 0.7	=	159.01	(75)
Northeast 0.9x 0.77 x	1.4	97.38	× 0.85	× 0.7	=	112.43	(75)
Northeast 0.9x 0.77 x	1.4	97.38	× 0.85	× 0.7	=	56.22	(75)
Northeast 0.9x 0.77 x	3.96	91.1	× 0.85	× 0.7	=	148.75	(75)
Northeast 0.9x 0.77 x	1.4	91.1	× 0.85	× 0.7	=	105.18	(75)
Northeast 0.9x 0.77 x	1.4	91.1	× 0.85	x 0.7	=	52.59	(75)
Northeast 0.9x 0.77 x	3.96	72.63	× 0.85	× 0.7	=	118.59	(75)
Northeast 0.9x 0.77 x	1.4	72.63	× 0.85	× 0.7	=	83.85	(75)
Northeast 0.9x 0.77 x	1.4	72.63	× 0.85	x 0.7	=	41.93	(75)
Northeast 0.9x 0.77 x	3.96	50.42	× 0.85	× 0.7	=	82.33	(75)
Northeast 0.9x 0.77 x	1.4	50.42	× 0.85	× 0.7	=	58.21	(75)
Northeast 0.9x 0.77 x	1.4	50.42	× 0.85	× 0.7	=	29.11	(75)
Northeast 0.9x 0.77 x	3.96	28.07	× 0.85	× 0.7	=	45.83	(75)
Northeast 0.9x 0.77 x	1.4	28.07	× 0.85	× 0.7	=	32.4	(75)
Northeast 0.9x 0.77 x	1.4	28.07	× 0.85	× 0.7	=	16.2	(75)
Northeast 0.9x 0.77 x	3.96	14.2	× 0.85	× 0.7	=	23.18	(75)
Northeast 0.9x 0.77 x	1.4	14.2	× 0.85	x 0.7	=	16.39	(75)

Northeast 0.9x	0.77) ×	1.4	×	14.2	×	0.85	x	0.7	=	8.2	(75)
Northeast 0.9x	0.77	^ x	3.96	x	9.21	x	0.85	x	0.7	 =	15.05	(75)
Northeast 0.9x	0.77) ^ x	1.4	x x	9.21	x x	0.85	x	0.7	=	10.64	(75)
Northeast 0.9x	0.77] x	1.4	l x	9.21	 x	0.85	x	0.7	 =	5.32	(75)
Southeast 0.9x	0.77] x	0.98	l x	36.79	l X	0.85	x	0.7	 =	44.6] (77)
Southeast 0.9x	0.77	x	2.17	x	36.79	x	0.85	x	0.7	=	32.92	
Southeast 0.9x	0.77	x	0.98	x	62.67	x	0.85	x	0.7	=	75.98](77)
Southeast 0.9x	0.77	x	2.17	x	62.67	x	0.85	x	0.7	=	56.08	(77)
Southeast 0.9x	0.77	x	0.98	x	85.75	x	0.85	x	0.7	=	103.95	(77)
Southeast 0.9x	0.77	x	2.17	x	85.75	×	0.85	x	0.7	=	76.73	(77)
Southeast 0.9x	0.77	x	0.98	x	106.25	×	0.85	x	0.7	=	128.81	(77)
Southeast 0.9x	0.77	x	2.17	x	106.25	x	0.85	x	0.7	=	95.07	(77)
Southeast 0.9x	0.77	x	0.98	×	119.01	×	0.85	x	0.7	=	144.27	(77)
Southeast 0.9x	0.77	x	2.17	x	119.01	×	0.85	x	0.7	=	106.49	(77)
Southeast 0.9x	0.77	x	0.98	x	118.15	x	0.85	x	0.7	=	143.23	(77)
Southeast 0.9x	0.77	x	2.17	x	118.15	×	0.85	x	0.7	=	105.72	(77)
Southeast 0.9x	0.77	x	0.98	x	113.91	×	0.85	x	0.7	=	138.09	(77)
Southeast 0.9x	0.77	x	2.17	x	113.91	×	0.85	x	0.7	=	101.92	(77)
Southeast 0.9x	0.77	x	0.98	x	104.39	×	0.85	x	0.7	=	126.55	(77)
Southeast 0.9x	0.77	x	2.17	x	104.39	x	0.85	x	0.7	=	93.41	(77)
Southeast 0.9x	0.77	×	0.98	x	92.85	x	0.85	x	0.7	=	112.56	(77)
Southeast 0.9x	0.77	x	2.17	x	92.85	x	0.85	x	0.7	=	83.08	(77)
Southeast 0.9x	0.77	×	0.98	x	69.27	x	0.85	x	0.7	=	83.97	(77)
Southeast 0.9x	0.77	×	2.17	×	69.27	×	0.85	x	0.7	=	61.98	(77)
Southeast 0.9x	0.77	x	0.98	x	44.07	×	0.85	x	0.7	=	53.43	(77)
Southeast 0.9x	0.77	x	2.17	x	44.07	x	0.85	x	0.7	=	39.43	(77)
Southeast 0.9x	0.77	×	0.98	x	31.49	x	0.85	x	0.7	=	38.17	(77)
Southeast 0.9x	0.77	×	2.17	x	31.49	x	0.85	x	0.7	=	28.17	(77)
Rooflights 0.9x	1	x	0.3	×	26	×	0.85	x	0.7	=	8.35	(82)
Rooflights 0.9x	1	×	0.3	×	54	×	0.85	x	0.7	=	17.35	(82)
Rooflights 0.9x	1	x	0.3	x	96	x	0.85	x	0.7	=	30.84	(82)
Rooflights 0.9x	1	×	0.3	x	150	×	0.85	x	0.7	=	48.2	(82)
Rooflights 0.9x	1	×	0.3	x	192	×	0.85	x	0.7	=	61.69	(82)
Rooflights 0.9x	1	×	0.3	x	200	X	0.85	x	0.7	=	64.26	(82)
Rooflights 0.9x	1	x	0.3	X	189	×	0.85	x	0.7	=	60.73	(82)
Rooflights 0.9x	1	×	0.3	X	157	X	0.85	x	0.7	=	50.44	(82)
Rooflights 0.9x	1	×	0.3	×	115	×	0.85	x	0.7	=	36.95	(82)
Rooflights 0.9x	1	×	0.3	×	66	×	0.85	x	0.7	=	21.21	(82)
Rooflights 0.9x	1	×	0.3	×	33	×	0.85	x	0.7	=	10.6	(82)
Rooflights 0.9x	1	×	0.3	×	21	X	0.85	x	0.7	=	6.75	(82)

Solar g	Solar gains in watts, calculated for each month							(83)m = S	um(74)m	(82)m			
(83)m=	123.84	226.68	350.75	500.72	619.8	640.87	607.26	514.76	402.24	261.59	151.23	104.1	(83)

(84)m=	503.13	602	710.94	838.03	934.47	934.49	888.39	803.55	703.97	586.39	501.66	473.34		(84)
7. Me	an inter	nal temp	erature	(heating	season)								
							rom Tab	ole 9, Th	1 (°C)				21	(85)
		tor for g	• •			-								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.95	0.87	0.73	0.58	0.65	0.86	0.97	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	bllow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	18.93	19.15	19.53	20.07	20.52	20.84	20.95	20.92	20.67	20.07	19.43	18.93		(87)
Temp	erature	durina h	eating p	eriods ir	n rest of	dwellina	from Ta	ble 9, Tł	n2 (°C)					
(88)m=	19.38	19.39	19.4	19.44	19.45	19.48	19.48	19.49	19.47	19.45	19.43	19.42		(88)
l Itilisa	tion fac	tor for g	ains for	rest of d	welling	h2 m (se	e Table	9a)						
(89)m=	0.99	0.99	0.97	0.92	0.81	0.61	0.4	0.47	0.77	0.95	0.99	1		(89)
	interne	L tompor				ng T2 (f		ps 3 to 7						
(90)m=	17.57	17.79	18.18	18.72	19.14	19.41	19.47	19.47	19.29	18.74	18.11	17.59		(90)
()						_	_	-			g area ÷ (4		0.51	(91)
			-1		ala akwal	() () () () () () () () () () () () () (Δ	. (4 6)	A) T O					
Iviean (92)m=	Interna 18.27	18.49	ature (fo 18.87	19.41	0IE GWE	20.14	_A × 11 20.23	+ (1 – fL 20.21	A) × 12 20	19.43	18.79	18.28		(92)
								4e, whe			10.79	10.20		(52)
(93)m=	18.27	18.49	18.87	19.41	19.85	20.14	20.23	20.21	20	19.43	18.79	18.28		(93)
8. Sp	ace hea	ting requ	uirement											
					re obtain	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	ble 9a						,			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
		tor for g		i										(2.1)
(94)m=	0.99	0.99	0.97	0.92	0.83	0.66	0.5	0.56	0.81	0.95	0.99	0.99		(94)
		hmGm ,	````	ŕ	<i>,</i>	619.86	440.54	450.06	570.22	558.71	405.02	470.41		(95)
(95)m=		593.31 age exte	689.08	774.74	773.68		440.04	450.00	570.32	000.71	495.03	470.41		(00)
(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)
								∟ x [(93)m-						` ,
(97)m=		1855.77		1385.35		, 707.63	463.02	484.46	760.73	1156.64	1548.98	1888.14		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	h = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	1056.72	848.38	736.4	439.64	219.32	0	0	0	0	444.86	758.85	1054.79		
														(98)
Snace								Tota	l per year	(kWh/year) = Sum(98	8)15,912 =	5558.95	(00)
Opaci	e heatin	g require	ement in	kWh/m²	/year			Tota	l per year	(kWh/year) = Sum(98	8)15,912 =	77.82	(99)
•					•	ystems ii	ncluding	Tota micro-C		(kWh/year	i) = Sum(98	8)15,912 =		
9a. En		luiremer			•	ystems i	ncluding			(kWh/year) = Sum(98	8)15,912 =		
9a. En Spac	ergy rec e heatir	luiremer	ıts – Indi	ividual h	eating sy					(kWh/year) = Sum(9	8)15,912 =		
9a. En Spac Fracti	ergy rec e heatir ion of sp	luiremen ng:	n <mark>ts – Indi</mark> It from se	ividual h econdar	eating sy y/supple		system		CHP)	(kWh/year) = Sum(9	8)15,912 =	77.82	(99)
9a. En Spac Fracti Fracti	ergy rec e heatir ion of sp ion of sp	uiremer ng: bace hea	nts – Indi at from se at from m	ividual h econdar <u>:</u> nain syst	eating sy y/supple em(s)		system	micro-C	- (201) =) = Sum(9	8)15,912 =	77.82 0](99)](201)

Efficie	ncy of I	main spa	ace heat	ing syste	em 1								88.8	(206)
Efficie	ncy of s	seconda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	heatin	g require	ement (o	alculate	d above))								
	1056.72	848.38	736.4	439.64	219.32	0	0	0	0	444.86	758.85	1054.79		
(211)m	= {[(98)m x (20	4)] } x ^	00 ÷ (20	06)		·			-				(211)
	1190	955.38	829.28	495.09	246.98	0	0	0	0	500.96	854.56	1187.83		_
_								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	6260.08	(211)
•		• ·		y), kWh/	month									
= {[(90) (215)m=	<u>111 X (2(</u> 0	01)] } x 1	00 ÷ (20	0	0	0	0	0	0	0	0	0		
(210)11-	0	0	0	0	0	0	0	-	-		215) _{15,10. 12}	-	0	(215)
Water	heating	r									- 15,10. 12		0	(=,
		-	ter (calc	ulated a	bove)									
	193.66	169.17	176.01	156.11	151.15	133.12	127.54	142.18	143.75	163.68	174.73	189.12		
Efficien	cy of w	ater hea	iter										79.5	(216)
(217)m=	87.22	87.11	86.84	86.16	84.75	79.5	79.5	79.5	79.5	86.09	86.9	87.25		(217)
		heating,												
(219)m (219)m=	<u>= (64)</u> 222.04	m x 100) ÷ (217 202.68)m 181.19	178.33	167.45	160.43	178.84	180.81	190.13	201.08	216.76		
(,				101110					I = Sum(2				2273.95	(219)
Annua	l totals										Wh/year		kWh/yea	
Space	heating	fuel use	ed, main	system	1								6260.08	
Water I	neating	fuel use	d										2273.95	Ī
Electric	ity for p	oumps, f	ans and	electric	keep-ho	t								
centra	l heatir	ng pump	:									120		(230c)
Total el	ectricit	y for the	above,	kWh/yea	r			sum	of (230a)	(230g) =			120	(231)
Electric	ity for l	ighting		-									537.1	(232)
12a. C	CO2 em	nissions ·	– Individ	ual heat	ina svste	ems incl	udina mi	cro-CHP)					
							lergy /h/year			kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	
Space	heating	ı (main s	ystem 1)		(21	1) x			0.2	16	=	1352.18	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water I	neating					(21	9) x			0.2	16	=	491.17	(264)
Space	and wa	ter heati	ng			(26	1) + (262)	+ (263) + (264) =				1843.35	(265)
Electric	ity for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	62.28	(267)
Electric	ity for l	ighting				(23	2) x			0.5	19	=	278.75	(268)
Total C	O2, kg/	/year							sum o	f (265) (2	271) =		2184.38	(272)
Dwellir	ng CO2	2 Emissi	on Rate	•					(272)	÷ (4) =			30.58	(273)
EI ratin	g (secti	ion 14)											75	(274)

		User De	etails:				
Assessor Name: Software Name:	Oliver Morris Stroma FSAP 2012	:	Stroma Num Software Vei	rsion:	Ve	RO025430 rsion: 1.0.3.4	
A dalace e		Property A	Address: Unit 5-	energy stra	itegy		
	, London, NW6 1NR						
1. Overall dwelling dimens	SIONS.	Area	(m²)	Av. Heigh	t(m)	Volume(m ³	\
Ground floor			3.1 (1a) x	2.91	(2a)) (3a)
Total floor area TFA = (1a)	+(1b)+(1c)+(1d)+(1e)+.	(1n) 7	3.1 (4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3	3e)+(3n)	= 212.79	(5)
2. Ventilation rate:						<u> </u>	
		ondary o ting	other	total		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 fans	; ;			3	x 10 =	30	(7a)
Number of passive vents			Г	0	x 10 =	0	(7b)
Number of flueless gas fire	S		Ē	0	x 40 =	0	(7c)
					Ai	r changes per ho	our
Infiltration due to chimneys	, flues and fans = $(6a)$ +	(6b)+(7a)+(7b)+(7	′c) =	30	÷ (5) =	= 0.14	(8)
If a pressurisation test has bee	en carried out or is intended, µ	proceed to (17), o	therwise continue fr	rom (9) to (16)	_		
Number of storeys in the	dwelling (ns)					1	(9)
Additional infiltration				_	[(9)-1]x0.	1 = 0	(10)
Structural infiltration: 0.2 if both types of wall are pres deducting areas of openings	sent, use the value correspon			ruction		0.35	(11)
If suspended wooden flo) or 0.1 (sealed	d), else enter 0			0	(12)
If no draught lobby, ente	r 0.05, else enter 0					0	(13)
Percentage of windows a	and doors draught strip	ped				5	(14)
Window infiltration		(0.25 - [0.2 x (14) ÷ 1	= [00]		0.24	(15)
Infiltration rate		((8) + (10) + (11) + (1	12) + (13) + (15	5) =	0.7309813546927	25 <mark>(16)</mark>
Air permeability value, q	•	•	• •	etre of enve	elope area	a 0	(17)
If based on air permeability	,					0.73	(18)
Air permeability value applies i Number of sides sheltered	t a pressurisation test has be	en done or a deg	ree air permeability	is being used			(19)
Shelter factor		((20) = 1 - [0.075 x (1	[9)] =		2 0.85	(19)
Infiltration rate incorporatin	g shelter factor	((21) = (18) x (20) =			0.62	(21)
Infiltration rate modified for	monthly wind speed						
Jan Feb M	lar Apr May	Jun Jul	Aug Sep	Oct	Nov D	ec	
Monthly average wind spee	ed from Table 7						
(22)m= 5.1 5 4.	9 4.4 4.3	3.8 3.8	3.7 4	4.3	4.5 4.	7	
Wind Factor $(22a)m = (22)$	m ÷ 4						
(22a)m= 1.27 1.25 1.2	23 1.1 1.08 (0.95 0.95	0.92 1	1.08 1	1.12 1.1	18	

	ed infiltr	ation rat	e (allow	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.79	0.78	0.76	0.68	0.67	0.59	0.59	0.57	0.62	0.67	0.7	0.73		
	<i>ate effec</i> echanica		-	rate for t	he appli	cable ca	se					-		(23a)
				endix N, (2	3b) = (23a	ı) × Fmv (e	equation (N	(5)) other	rwise (23b) = (23a)		l	0	(23a) (23b)
			• • • •	iency in %	, ,				,	, (,		l	0	(230) (23c)
			-		-					2h)m + ('	23h) x [l 1 – (23c)	-	(230)
(24a)m=	0	0		0	0	0	0	0	0	0	0	0	. 100]	(24a)
b) If	balance	u d mech	ı anical ve	entilation	without	heat rec	overv (N	//V) (24b	m = (22)	1 2b)m + (2	 23b)	1		
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	use ex	tract ver	ntilation of	or positiv	ve input v	/entilatio	n from c	outside			II		
í	if (22b)n	n < 0.5 ×	< (23b), t	then (24	c) = (23b); otherv	vise (24	c) = (22b	o) m + 0.	.5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,				ole hous		•								
	<u>, ,</u>	· · · · · ·	<u>1 </u>	m = (22	<i>.</i>	<u>`</u>	·		<u> </u>	- 1	0.74			
(24d)m=		0.8	0.79	0.73	0.72	0.67	0.67	0.67	0.69	0.72	0.74	0.77		(24d)
		<u> </u>	1	nter (24a		, <u> </u>	, <u>,</u>	· · · · · ·	r <u>, </u>	0.70	0.74	0.77		(25)
(25)m=	0.81	0.8	0.79	0.73	0.72	0.67	0.67	0.67	0.69	0.72	0.74	0.77		(25)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	IENT	Gros area		Openin rr		Net Ar A ,n		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²⋅ł		A X k kJ/K
Windo	ws Type	e 1				1.17	x1/	/[1/(4.8)+	0.04] =	4.71				(27)
Windo	ws Type	2				1.17	x1/	/[1/(4.8)+	0.04] =	4.71				(27)
Rooflig	ghts					0.26	x1/	/[1/(5.3) +	0.04] =	1.378				(27b)
Walls 7	Type1	34.3	33	0		34.33	x	0.3	=	10.3				(29)
Walls 7	Type2	12.2	29	5.85	;	6.44	x	0.3	=	1.93				(29)
Roof 1						-								
	Гуре1	39.9	93	0.26	5	39.67	×	0.18	=	7.14				(30)
Roof 1		39.9 26.9		0.26				0.18						(30)
	Туре2		97			39.67	×		= 1	7.14				
Roof 7 Roof 7	Туре2	26.9 10.6	97 62	0		39.67 26.97	· ×	0.18	=	7.14 4.85				(30)
Roof 7 Roof 7	Type2 Type3 area of e	26.9 10.6	97 62	0		39.67 26.97 10.62	x x	0.18	=	7.14 4.85				(30)
Roof T Roof T Total a	Type2 Type3 area of e wall	26.9 10.6	97 62	0		39.67 26.97 10.62 124.14	- x - x 4 x	0.18		7.14 4.85 1.91				(30) (30) (31)
Roof T Roof T Total a Party v	Type2 Type3 area of e wall wall	26.9 10.6	97 62	0		39.67 26.97 10.62 124.14 34.37	4 X	0.18		7.14 4.85 1.91 0				(30) (30) (31) (32)
Roof T Roof T Total a Party v Party v	Type2 Type3 area of e wall wall wall	26.9 10.6	97 62	0		39.67 26.97 10.62 124.14 34.37 19.62		0.18 0.18 0 0		7.14 4.85 1.91 0 3.92				(30) (30) (31) (32) (32)
Roof T Roof T Total a Party v Party v Party v	Type2 Type3 area of e wall wall wall	26.9 10.6	97 62	0		39.67 26.97 10.62 124.14 34.37 19.62 14.13		0.18 0.18 0 0		7.14 4.85 1.91 0 3.92				(30) (30) (31) (32) (32) (32) (32)

Fabric heat loss, $W/K = S (A \times U)$ (26) (30) + (32) =54.76(33)Heat capacity $Cm = S(A \times k)$ ((28) (30) + (32) + (32a) (32e) =15449.13(34)Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m²KIndicative Value: Medium250(35)

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

can be ι	ised inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	<						18.62	(36)
if details	of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			73.38	(37)
Ventila	tion hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	57.15	56.29	55.45	51.51	50.78	47.34	47.34	46.71	48.67	50.78	52.27	53.83		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	130.52	129.67	128.83	124.89	124.15	120.72	120.72	120.09	122.04	124.15	125.64	127.2		
					I	I	I			-	Sum(39)1	₁₂ /12=	124.89	(39)
	· · ·	Imeter (H	r - '	r						= (39)m ÷		<i>i</i> = <i>i</i>	1	
(40)m=	1.79	1.77	1.76	1.71	1.7	1.65	1.65	1.64	1.67	1.7	1.72	1.74		
Numbe	er of day	/s in moi	nth (Tab	le 1a)					,	Average =	Sum(40)₁	₁₂ /12=	1.71	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
								•						
4. Wa	ater hea	ting enei	rav reau	irement:								kWh/ye	ear:	
			3)											
		upancy, l 9, N = 1		: [1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0)013 x (⁻	TFA -13.		32		(42)
	A £ 13.													
								(25 x N) to achieve		se tarnet o		.28		(43)
		-			ater use, l	-	-		a mator at	jo larger e				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate				· · ·	Vd,m = fa				000			200		
(44)m=	98.2	94.63	91.06	87.49	83.92	80.35	80.35	83.92	87.49	91.06	94.63	98.2		
										L Total = Su	m(44) _{1 12} =		1071.31	(44)
Energy	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x D	0Tm / 3600			ables 1b, 1			
(45)m=	145.63	127.37	131.44	114.59	109.95	94.88	87.92	100.89	102.09	118.98	129.88	141.04		
										Total = Su	m(45) _{1 12} =		1404.65	(45)
lf instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)	-			_	
(46)m=	21.84	19.11	19.72	17.19	16.49	14.23	13.19	15.13	15.31	17.85	19.48	21.16		(46)
	storage									1			I	
-		. ,					-	within sa	ame ves	sei		0		(47)
	•	-			velling, e			• •	oro) ont	or (0) in (47)			
	storage		not wate		iciudes i	nstantai	leous co	mbi boil	ers) ente		47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/dav):					0		(48)
,		actor fro					, , , .					0		(49)
		om water			ar			(48) x (49)	1 =					(50)
			-	-	oss fact	or is not		(40) X (40)	-			0		(30)
,				•	e 2 (kW							0		(51)
	•	neating s		on 4.3										
		from Ta										0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)

0.			•	e, kWh/y	ear			(47) x (51) x (52) x (53) =		0	ļ	(54)
	. ,	(54) in (8	•									0	J	(55)
Water	storage	loss cal	culated	for each	month		_	((56)m = ((55) × (41)	m	-	-	_	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylind	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	57)m = (56)	m where (H11) is fro	om Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Prima	y circuit	loss (ar	nnual) fro	om Table	e 3							0]	(58)
Primar	y circuit	loss cal	lculated	for each	month (59)m = ((58) ÷ 36	65 × (41))m					
(mo	dified by	factor f	rom Tab	le H5 if t	there is s	solar wat	ter heatii	ng and a	a cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41))m						
(61)m=	50.04	43.56	46.4	43.15	42.76	39.62	40.94	42.76	43.15	46.4	46.67	50.04		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	195.68	170.93	177.84	157.73	152.71	134.5	128.86	143.65	145.24	165.38	176.54	191.08		(62)
Solar DI	HW input	calculated	using App	endix G o	r 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 \	WWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	iter	-	-		-	-	-	-	-	-		
(64)m=	195.68	170.93	177.84	157.73	152.71	134.5	128.86	143.65	145.24	165.38	176.54	191.08		
			•		•	•		Out	put from w	ater heate	r (annual)₁	12	1940.16	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)n	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	1]	
(65)m=	60.93	53.24	55.3	48.89	47.25	41.45	39.47	44.24	44.73	51.16	54.85	59.41	1	(65)
inclu	ude (57)	m in cal	culation	• of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. In	ternal ga	ains (see	e Table s	5 and 5a):	-		-				•	-	
		is (Table			/									
metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
(66)m=				115.95	<u> </u>			-	115.95			115.95		(66)
			1	ı ppendix	1								1	
(67)m=	36.17	32.13	26.13	19.78	14.79	12.48	13.49	17.53	23.53	29.88	34.87	37.18	1	(67)
Applia	nces da	ins (calc	ulated ir	n Append	dix L. ea	uation L	13 or L1	i 3a), also	see Ta	ble 5	1	1	1	
(68)m=	204.42	206.54	201.2	189.82	175.45	161.95	152.93	150.81	156.16	167.54	181.9	195.4	1	(68)
									ı ee Table				1	
(69)m=	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	1	(69)
		ns gains	I (Table :	1 5a)									1	
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	1	(70)
		I vaporatio	n (nega	ı tive valu	i ies) (Tab	l Je 5)	I		I				1	
(71)m=	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76		(71)
		I gains (1	Į	I	I	I			I				1	
(72)m=	81.9	79.23	74.33	67.9	63.51	57.57	53.05	59.46	62.13	68.77	76.18	79.85		(72)
		gains =			<u> </u>				+ (69)m +				1	
(73)m=	390.28	385.68	369.44	345.28	321.53	299.79	287.25	295.58	309.6	333.96	360.74	380.21]	(73)
	lar gains		1	1	L		I		L		I			• •

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

Orientation:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	1.17	x	11.28	x	0.85	x	0.7	=	5.44	(75)
Northeast 0.9x	0.77	x	1.17	x	22.97	×	0.85	x	0.7	=	11.08	(75)
Northeast 0.9x	0.77	x	1.17	x	41.38	x	0.85	x	0.7	=	19.96	(75)
Northeast 0.9x	0.77	x	1.17	x	67.96	×	0.85	x	0.7	=	32.78	(75)
Northeast 0.9x	0.77	x	1.17	x	91.35	x	0.85	x	0.7	=	44.07	(75)
Northeast 0.9x	0.77	x	1.17	x	97.38	x	0.85	x	0.7	=	46.98	(75)
Northeast 0.9x	0.77	x	1.17	x	91.1	x	0.85	x	0.7	=	43.95	(75)
Northeast 0.9x	0.77	x	1.17	x	72.63	x	0.85	x	0.7	=	35.04	(75)
Northeast 0.9x	0.77	x	1.17	x	50.42	x	0.85	x	0.7	=	24.32	(75)
Northeast 0.9x	0.77	x	1.17	x	28.07	x	0.85	x	0.7	=	13.54	(75)
Northeast 0.9x	0.77	x	1.17	x	14.2	x	0.85	x	0.7	=	6.85	(75)
Northeast 0.9x	0.77	x	1.17	x	9.21	x	0.85	x	0.7	=	4.45	(75)
Northwest 0.9x	0.77	x	1.17	x	11.28	x	0.85	x	0.7	=	21.77	(81)
Northwest 0.9x	0.77	x	1.17	x	22.97	x	0.85	x	0.7	=	44.32	(81)
Northwest 0.9x	0.77	x	1.17	x	41.38	x	0.85	x	0.7	=	79.85	(81)
Northwest 0.9x	0.77	x	1.17	x	67.96	x	0.85	x	0.7	=	131.14	(81)
Northwest 0.9x	0.77	x	1.17	x	91.35	x	0.85	x	0.7	=	176.27	(81)
Northwest 0.9x	0.77	x	1.17	x	97.38	x	0.85	x	0.7	=	187.93	(81)
Northwest 0.9x	0.77	x	1.17	x	91.1	x	0.85	x	0.7	=	175.8	(81)
Northwest 0.9x	0.77	x	1.17	x	72.63	x	0.85	x	0.7	=	140.15	(81)
Northwest 0.9x	0.77	x	1.17	x	50.42	x	0.85	x	0.7	=	97.3	(81)
Northwest 0.9x	0.77	x	1.17	x	28.07	x	0.85	x	0.7	=	54.16	(81)
Northwest 0.9x	0.77	x	1.17	x	14.2	x	0.85	x	0.7	=	27.4	(81)
Northwest 0.9x	0.77	x	1.17	x	9.21	x	0.85	x	0.7	=	17.78	(81)
Rooflights 0.9x	1	x	0.26	x	26	x	0.85	x	0.7	=	3.62	(82)
Rooflights 0.9x	۲ ۲	x	0.26	×	54	x	0.85	x	0.7	=	7.52	(82)
Rooflights 0.9x	1	x	0.26	x	96	x	0.85	x	0.7	=	13.37	(82)
Rooflights 0.9x	۲ ۲	x	0.26	x	150	x	0.85	x	0.7	=	20.88	(82)
Rooflights 0.9x	1	x	0.26	×	192	×	0.85	x	0.7	=	26.73	(82)
Rooflights 0.9x	1	x	0.26	x	200	x	0.85	x	0.7	=	27.85	(82)
Rooflights 0.9x	۲ ۲	x	0.26	x	189	x	0.85	x	0.7	=	26.31	(82)
Rooflights 0.9x	۲ ۲	x	0.26	×	157	x	0.85	x	0.7	=	21.86	(82)
Rooflights 0.9x	1	x	0.26	x	115	x	0.85	x	0.7	=	16.01	(82)
Rooflights 0.9x	1	x	0.26	x	66	×	0.85	x	0.7	=	9.19	(82)
Rooflights 0.9x	1	x	0.26	x	33	x	0.85	x	0.7	=	4.59	(82)
Rooflights 0.9x	1	x	0.26	x	21	x	0.85	x	0.7	=	2.92	(82)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m	(82)m				
(83)m=	30.84	62.92	113.18	184.8	247.07	262.75	246.07	197.05	137.63	76.89	38.84	25.15	(83)	
Total g	$rac{1}{1}$ or $rac{$													
(84)m=	421.11	448.6	482.62	530.09	568.6	562.54	533.32	492.63	447.23	410.86	399.58	405.36	(84)	

7. Me	an inter	nal temp	perature	(heating	season)								
Temp	erature	during h	neating p	eriods ir	n the livi	ng area t	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.99	0.96	0.9	0.79	0.84	0.95	0.99	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	18.97	19.11	19.4	19.85	20.29	20.68	20.87	20.83	20.51	19.97	19.43	18.99		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)		•			
(88)m=	19.48	19.49	19.5	19.53	19.54	19.58	19.58	19.58	19.56	19.54	19.53	19.51		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina.	h2.m (se	e Table	9a)			•			
(89)m=	1	1	0.99	0.98	0.94	0.82	0.62	0.68	0.91	0.98	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ina T2 (f	n Now ste	eps 3 to 3	7 in Tahl	e 9c)				
(90)m=	17.68	17.82	18.11	18.59	19.03	19.41	19.54	19.53	19.26	18.72	18.17	17.72		(90)
									lf	L iLA = Livin	ig area ÷ (·	4) =	0.5	(91)
Moon	intorna	l tompor	aturo (fo	r the wh	olo dwo	llina) – fl	ΙΛ γ Τ1	+ (1 – fL	Δ) x T2					
(92)m=	18.33	18.47	18.76	19.22	19.66	20.05	20.21	20.18	19.89	19.34	18.8	18.36		(92)
								4e, whe						
(93)m=	18.33	18.47	18.76	19.22	19.66	20.05	20.21	20.18	19.89	19.34	18.8	18.36		(93)
8. Spa	ace hea	iting requ	uirement								1			
						ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	culate	
the ut		1	<u> </u>	using Ta							<u> </u>		l	
Litilion	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=		tor for g	ains, nm 0.99	0.98	0.94	0.85	0.71	0.76	0.93	0.98	0.99	1		(94)
	-			4)m x (84		0.00	0.71	0.70	0.00	0.00	0.00			
(95)m=	419.46	446.19	478.05	518.36	535.4	477.51	376.13	374.03	414.28	403.95	397.21	404.02		(95)
	L hly aver	i age exte	rnal tem	perature	e from Ta	able 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	e for me	an interr	al tempe	erature,	Lm , W =	- =[(39)m	x [(93)m	– (96)m]				
(97)m=	1831.32	1759.21	1579.15	1289.13	988.51	657.86	435.56	454.35	706.51	1085.7	1470.54	1801.01		(97)
•		ř		i		Wh/mon	th = 0.02	24 x [(97)m – (95	<u> </u>	r –		1	
(98)m=	1050.43	882.35	819.22	554.96	337.11	0	0	0	0	507.22	772.8	1039.36		_
								Tota	l per year	(kWh/yea	r) = Sum(9	8)15,912 =	5963.45	(98)
Space	e heatin	g require	ement in	kWh/m ²	/year								81.58	(99)
9a. En	ergy reo	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heati	-												
				econdar		mentary			(201)				0	(201)
				nain syst	. ,			(202) = 1		/ _			1	(202)
			•	main sys				(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								88.8	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heatin	g system	ז, %						0	(208)

_				-										
[Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	i		r ·	r	d above)					507.00	770.0	4000.00		
	1050.43		819.22	554.96	337.11	0	0	0	0	507.22	772.8	1039.36		
(211)m]	= {[(98) 1182.91)m x (20 993.64	4)] } x 1 922.55	00 ÷ (20)6) 379.63	0	0	0	0	571.2	870.27	1170.45		(211)
l	1102.91	333.04	922.00	024.95	579.00	0	0			ar) = Sum(2)			6715.59	(211)
Space	e heating	a fuel (s	econdar	y), kWh/	month						1		01.000	
•			00 ÷ (20	• ·					-	-		-		
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		-
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
	heating		tor (colo	ulated a	hovo)									
Output	195.68	170.93	177.84	ulated a	152.71	134.5	128.86	143.65	145.24	165.38	176.54	191.08		
Efficien	icy of wa	ater hea	iter	1	I								79.5	(216)
(217)m=	87.2	87.15	86.99	86.56	85.68	79.5	79.5	79.5	79.5	86.32	86.91	87.22		(217)
			kWh/m											
(219)m (219)m=	224.4	<u>m x 100</u> 196.14) <u>÷ (217)</u> 204.45)m 182.23	178.25	169.19	162.09	180.7	182.69	191.6	203.14	219.09		
Ĺ								Tota	l = Sum(2 ⁻	19a) ₁₁₂ =			2293.96	(219)
Annua	I totals									k	Wh/year		kWh/year	_
Space	heating	fuel use	ed, main	system	1								6715.59	
Water I	neating	fuel use	d										2293.96	
Electric	ity for p	umps, fa	ans and	electric	keep-hot	t								
centra	I heatin	g pump:	:									120		(230c)
Total e	lectricity	for the	above, l	kWh/yea	r			sum	of (230a)	(230g) =			120	(231)
Electric	ity for li	ghting											638.77	(232)
12a. C	CO2 em	issions -	– Individ	ual heat	ing syste	ms inclu	uding mi	cro-CHP)					-1
						F				F urles		1	F ordersteiner	
							ergy /h/year			kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	ır
Space	heating	(main s	ystem 1)		(21	1) x			0.2	16	=	1450.57	(261)
•	•	(second	-	,		(21	5) x			0.5		=	0	(263)
Water I	•	(,			(219	9) x			0.2		=	495.5	(264)
	Ũ	ter heati	na			(26	1) + (262) -	+ (263) + (264) =	0.2			1946.06	(265)
•			•	electric	keep-hot	(23	1) x			0.5	10	=		(267)
		•		cicotrio			2) x			0.5		=	62.28	-
	ity for li					(202	-, ^		0.100 -	0.5 ⁻		-	331.52	(268)
	02, kg/	-	_							f (265) (2	=		2339.87	(272)
	-		on Rate	•					(272)	÷ (4) =			32.01	(273)
EI ratin	g (sectio	on 14)											73	(274)



Appendix Energy Assessment 40-42 Mill Lane

LEAN Scenario

		User	Details:						
Assessor Name: Software Name:	Oliver Morris Stroma FSAP 2012		Stroma Softwa	are Ver	sion:			025430 n: 1.0.3.4	
A dalar e e	Landan NIMC AND	Propert	/ Address:	Unit 1 p	proposec				
Address : 1. Overall dwelling dimen	, London, NW6 1NR								
Ground floor				(1a) x	Av. Hei	ght(m) .8	(2a) =	Volume(m ³, 156.41) (3a)
Total floor area TFA = (1a))+(1b)+(1c)+(1d)+(1e)	+(1n)	55.86	(4)					
Dwelling volume				(3a)+(3b)	+(3c)+(3d))+(3e)+	.(3n) =	156.41	(5)
2. Ventilation rate:							-		
Number of chimneys Number of open flues Number of intermittent fan Number of passive vents Number of flueless gas fire	heating he 0 + 0 + S	condary eating 0 + 0 +	0 0		total 0 0 0 0 0 0 0	×2 ×2 ×2	40 = [20 = [10 = [10 = [10 = 10]]	m³ per hou 0 0 0 0 0 0 0 0 0	r (6a) (6b) (7a) (7b) (7c)
j.				L			l	Ŭ	
							Air ch	anges per ho	ur
Infiltration due to chimneys If a pressurisation test has been Number of storeys in the Additional infiltration	en carried out or is intended			continue fro	0 om (9) to (16)	÷ (5) =	0	(8) (9) (10)
Structural infiltration: 0.2 if both types of wall are pre deducting areas of opening If suspended wooden flo	sent, use the value corresp ns); if equal user 0.35	onding to the gre	ater wall area	a (after	uction	((*)	[0	(10) (11)
If no draught lobby, ente							l	0	(12)
Percentage of windows		ipped						0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	= [00		l	0	(15)
Infiltration rate			(8) + (10) -	+ (11) + (1	2) + (13) +	- (15) =		0	(16)
Air permeability value, q	50, expressed in cubi	c metres per l	nour per so	quare me	etre of e	nvelope	area	5	(17)
If based on air permeabilit	y value, then (18) = [(17) ÷ 20]+(8), other	wise (18) = (16)			ĺ	0.25	(18)
Air permeability value applies		been done or a c	legree air per	rmeability i	is being us	ed			_
Number of sides sheltered			(20) = 1 - [0 075 v (1	0)1 -			1	(19)
Shelter factor	a abaltar faatar		$(20) = 1^{-1}$ (21) = (18)		5)] –		l	0.92	(20)
Infiltration rate incorporatin	-		(21) = (10)	r (20) –				0.23	(21)
Infiltration rate modified fo		Jun Jul		Sep	Oct	Nov	Dec		
			Aug	Och		1100			
Monthly average wind spe (22)m= 5.1 5 4	.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
		0.0 0.0	0.7	т	- T. U	- 1 .J	- - '		
Wind Factor $(22a)m = (22)$)m ÷ 4								
(22a)m= 1.27 1.25 1.	23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	id wind s	peed) =	= (21a) x	(22a)m				-	
0-11	0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27		
		<i>ctive air</i> al ventila	-	rate for t	ne appli	cable ca	se						0.5	(23a)
				endix N, (2	23b) = (23a	a) × Fmv (e	equation (N5)) , othe	rwise (23t	o) = (23a)			0.5	(23b)
								m Table 4h		, , ,			76.5	(23c)
			-	-	-			HR) (24a		2b)m + (23b) × [⁻	1 – (23c		(200)
(24a)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39]	(24a)
b) If	balance	d mech	I anical ve	entilation	without	heat rec	ı :overy (MV) (24t)m = (2	1 2b)m + (i	23b)		1	
, (24b)m=		0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If	whole h	ouse ex	tract ver	ntilation of	r positiv	/e input v	ventilati	on from a	outside			<u>.</u>	4	
					-	-		lc) = (22		.5 × (23b)		_	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,					•	•		on from		a - 1				
	r í í	r	<u>r</u>	<u> </u>	ŕ	r ·	<u> </u>	0.5 + [(2	<u> </u>	T			1	(244)
(24d)m=		0	0	0	0	0	0	0	0	0	0	0		(24d)
		<u> </u>	· · · · · ·	· · ·	í .	<u>, ,</u>	, <u>,</u>	4d) in box	<u>1 / / / / / / / / / / / / / / / / / / /</u>	0.07	0.20	0.20	1	(25)
(25)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39]	(25)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	IENT	Gros area		Openin rr		Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-valu kJ/m²•		A X k kJ/K
Doors						1.79	x	1.5	=	2.685				(26)
Windo	ws Type	e 1				2.48	x	1/[1/(1.4)+	0.04] =	3.29				(27)
Windo	ws Type	2				3.63	x	1/[1/(1.4)+	0.04] =	4.81				(27)
Windo	ws Type	e 3				2.9	x	1/[1/(1.4)+	0.04] =	3.84				(27)
Windo	ws Type	94				2.94	x	1/[1/(1.4)+	0.04] =	3.9				(27)
Floor						55.56	3 x	0.25	=	13.89				(28)
Walls -	Type1	47.5	59	18.0	6	29.53	3 X	0.25	=	7.38				(29)
Walls -	Type2	11.5	56	0		11.56	3 X	0.25	=	2.89				(29)
Walls -	ТуреЗ	4.7	9	1.79)	3	x	0.25	=	0.76				(29)
Total a	area of e	elements	, m²			119.5	5							(31)
Party v	wall					30.81	x	0	=	0				(32)
Party o	ceiling					55.88	3				[(32b)
				effective wi nternal wal			ated usin	g formula 1	l/[(1/U-vali	ue)+0.04] a	as given in	paragrapi	h 3.2	
Fabric	heat los	ss, W/K	= S (A x	U)				(26) (30) + (32) =				51.55	(33)
Heat c	apacity	Cm = S	(A x k)						((28)	(30) + (32	2) + (32a)	(32e) =	13028.6	7 (34)
Therm	al mass	parame	ter (TM	P = Cm +	÷ TFA) iı	n kJ/m²K			Indica	ative Value	: Medium		250	(35)
	-		nere the de tailed calc		construct	ion are not	t known p	recisely the	e indicativo	e values of	TMP in T	able 1f		_
Therm	al bridg	es : S (L	x Y) cal	lculated	using Ap	opendix ł	<						17.93	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	31)								

Total f	abric he	at loss							(33) +	(36) =			69.47	(37)
Ventila	tion hea	t loss ca	alculated	monthly	y	-	-		(38)m	= 0.33 × (25)m x (5)	-	_	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	21.28	20.98	20.69	19.19	18.9	17.4	17.4	17.11	18	18.9	19.49	20.09		(38)
Heat ti	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	90.75	90.46	90.16	88.67	88.37	86.87	86.87	86.58	87.47	88.37	88.96	89.56		
11				/21/			-			Average =		₁₂ /12=	88.59	(39)
	oss para	1.62	HLP), W/		1 5 9	1.56	1 56	1 55	. ,	= (39)m ÷	· · ·	1.6	1	
(40)m=	1.02	1.02	1.01	1.59	1.58	1.56	1.56	1.55	1.57	1.58 Average =	1.59	1.6	1.59	(40)
Numbe	er of day	s in moi	nth (Tab	le 1a)						Average –	Sum(40)1	12/12-	1.00	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
													1	
4. Wa	ater heat	ing ener	rav requ	irement:								kWh/y	ear:	
													1	
				[1 - exn	(-0.0003	849 x (TF	- Δ -13 Q)2)] + 0.0)013 x (⁻	TFA -13		86		(42)
	A £ 13.9		1.70	i ovb	(0.0000	, , , , , , , , , , , , , , , , , , ,	10.0	/2/] 1 0.0		1177 10.	.0)			
								(25 x N)				.43]	(43)
		-		usage by : r day (all w		-	-	to achieve	a water us	se target o	t			
						i			Can	Ort	Nev	Dee	1	
Hot wat	Jan er usage in	Feb	Mar dav for ea	Apr ach month	May Vd.m = fa	Jun ctor from	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec	J	
(44)m=	86.28	83.14	80	76.87	73.73	70.59	70.59	73.73	76.87	80	83.14	86.28	1	
(++)///=	00.20	00.14	00	10.01	10.10	10.00	10.00	10.10		Total = Su			941.22	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	OTm / 3600					041.22	
(45)m=	127.95	111.9	115.47	100.67	96.6	83.36	77.24	88.64	89.7	104.53	114.11	123.91]	
										Total = Su	m(45) _{1 12} =	=	1234.08	(45)
lf instan	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46)	to (61)		-	-	_	
(46)m=	19.19	16.79	17.32	15.1	14.49	12.5	11.59	13.3	13.45	15.68	17.12	18.59		(46)
	storage		includir		alar ar M		etorado	within sa	mayas	col			1	(47)
-		. ,		• •			-		ine ves	501		250	J	(47)
	•	-		nk in dw er (this in	-			ombi boile	ers) ente	er '0' in (47)			
	storage			. (,	e. e (,			
a) If m	nanufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	89]	(48)
Tempe	erature fa	actor fro	m Table	2b							0.	54]	(49)
			-	, kWh/ye				(48) x (49)	=		1.	02]	(50)
,				cylinder l									1	
		-	ee secti	om Tabl	e z (kvv	n/litre/da	iy)					0		(51)
	e factor	-		0.1-1.0								0	1	(52)
			m Table	2b								0	1	(53)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0	i	(54)
•••	(50) or (-	,								02	1	(55)

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where ((H11) is fro	m Append	lix H	
(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64		(57)
Primar	ry circuit	loss (ar	nual) fro	om Table	e 3	-						0		(58)
	•	•		for each		59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	i loss ca	lculated	for each	n month ((61)m =	(60) ÷ 30	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat requ	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	182.85	161.49	170.38	153.8	151.5	136.49	132.14	143.54	142.83	159.43	167.24	178.81		(62)
				endix G o						r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WHRS	applies	, see Ap	pendix C	G)	i	i			
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter	-			-			-	-			
(64)m=	182.85	161.49	170.38	153.8	151.5	136.49	132.14	143.54	142.83	159.43	167.24	178.81		-
								Outp	out from w	ater heate	r (annual)₁	12	1880.5	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	86.46	76.88	82.32	75.98	76.04	70.22	69.6	73.39	72.33	78.68	80.44	85.12		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gain	s (Table	5) Wot											
			5), vvai	<u>tts</u>										
	Jan	Feb	Mar	tts Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	Jan 93.13	Feb 93.13			May 93.13	Jun 93.13	Jul 93.13	Aug 93.13	Sep 93.13	Oct 93.13	Nov 93.13	Dec 93.13		(66)
Lightin	93.13 g gains	93.13 (calcula	Mar ^{93.13} ted in Aj	Apr	93.13	93.13	93.13	93.13	93.13					(66)
Lightin	93.13 g gains	93.13	Mar ^{93.13} ted in Aj	Apr 93.13	93.13	93.13	93.13	93.13	93.13					(66) (67)
Lightin (67)m=	93.13 ng gains 18.1	93.13 (calcula 16.07	Mar 93.13 ted in Aj 13.07	Apr 93.13 ppendix	93.13 L, equat 7.4	93.13 ion L9 o 6.25	93.13 r L9a), a 6.75	93.13 Iso see 8.77	93.13 Table 5 11.77	93.13 14.95	93.13	93.13		
Lightin (67)m=	93.13 ng gains 18.1	93.13 (calcula 16.07	Mar 93.13 ted in Aj 13.07	Apr 93.13 ppendix 9.9	93.13 L, equat 7.4	93.13 ion L9 o 6.25	93.13 r L9a), a 6.75	93.13 Iso see 8.77	93.13 Table 5 11.77	93.13 14.95	93.13	93.13		
Lightin (67)m= Appliat (68)m=	93.13 ng gains 18.1 nces ga 162.4	93.13 (calcula 16.07 ins (calc 164.08	Mar 93.13 ted in Ap 13.07 ulated ir 159.84	Apr 93.13 ppendix 9.9 Append	93.13 L, equat 7.4 dix L, eq 139.38	93.13 ion L9 of 6.25 uation L 128.66	93.13 r L9a), a 6.75 13 or L1 121.49	93.13 Iso see 8.77 3a), also 119.81	93.13 Table 5 11.77 see Ta 124.06	93.13 14.95 ble 5 133.1	93.13 17.45	93.13 18.6		(67)
Lightin (67)m= Appliat (68)m=	93.13 ng gains 18.1 nces ga 162.4	93.13 (calcula 16.07 ins (calc 164.08	Mar 93.13 ted in Ap 13.07 ulated ir 159.84	Apr 93.13 ppendix 9.9 Append 150.8	93.13 L, equat 7.4 dix L, eq 139.38	93.13 ion L9 of 6.25 uation L 128.66	93.13 r L9a), a 6.75 13 or L1 121.49	93.13 Iso see 8.77 3a), also 119.81	93.13 Table 5 11.77 see Ta 124.06	93.13 14.95 ble 5 133.1	93.13 17.45	93.13 18.6		(67)
Lightin (67)m= Appliat (68)m= Cookir (69)m=	93.13 ng gains 18.1 nces ga 162.4 ng gains 32.31	93.13 (calcula 16.07 ins (calc 164.08 (calcula	Mar 93.13 ted in Ay 13.07 ulated ir 159.84 ted in A 32.31	Apr 93.13 ppendix 9.9 Append 150.8 ppendix 32.31	93.13 L, equat 7.4 dix L, eq 139.38 L, equat	93.13 ion L9 o 6.25 uation L 128.66 tion L15	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a)	93.13 Iso see ⁻ 8.77 3a), also 119.81 , also se	93.13 Table 5 11.77 9 see Ta 124.06 ee Table	93.13 14.95 ble 5 133.1 5	93.13 17.45 144.51	93.13 18.6 155.23		(67)
Lightin (67)m= Appliat (68)m= Cookir (69)m=	93.13 ng gains 18.1 nces ga 162.4 ng gains 32.31	93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31	Mar 93.13 ted in Ay 13.07 ulated ir 159.84 ted in A 32.31	Apr 93.13 ppendix 9.9 Append 150.8 ppendix 32.31	93.13 L, equat 7.4 dix L, eq 139.38 L, equat	93.13 ion L9 o 6.25 uation L 128.66 tion L15	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a)	93.13 Iso see ⁻ 8.77 3a), also 119.81 , also se	93.13 Table 5 11.77 9 see Ta 124.06 ee Table	93.13 14.95 ble 5 133.1 5	93.13 17.45 144.51	93.13 18.6 155.23		(67)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	93.13 ng gains 18.1 nces ga 162.4 ng gains 32.31 s and fai 3	93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3	Mar 93.13 ted in Ap 13.07 ulated in 159.84 ted in A 32.31 (Table \$ 3	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a)	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31	93.13 Iso see 8.77 3a), also 119.81), also se 32.31	93.13 Table 5 11.77 see Ta 124.06 ee Table 32.31	93.13 14.95 ble 5 133.1 5 32.31	93.13 17.45 144.51 32.31	93.13 18.6 155.23 32.31		(67) (68) (69)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	93.13 ng gains 18.1 nces ga 162.4 ng gains 32.31 s and fai 3	93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3	Mar 93.13 ted in Ap 13.07 ulated in 159.84 ted in A 32.31 (Table \$ 3	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31	93.13 Iso see 8.77 3a), also 119.81), also se 32.31	93.13 Table 5 11.77 see Ta 124.06 ee Table 32.31	93.13 14.95 ble 5 133.1 5 32.31	93.13 17.45 144.51 32.31	93.13 18.6 155.23 32.31		(67) (68) (69)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	93.13 ng gains 18.1 nces ga 162.4 ng gains 32.31 s and fai 3 s e.g. ev -74.5	93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3 raporatic	Mar 93.13 ted in Ap 13.07 ulated in A 159.84 ted in A 32.31 (Table \$ 3 on (nega -74.5	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3 tive valu	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31 3 es) (Tab	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31 3 le 5)	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31 3	93.13 Iso see 8.77 3a), also 119.81), also se 32.31 3	93.13 Table 5 11.77 9 see Ta 124.06 9e Table 32.31 3	93.13 14.95 ble 5 133.1 5 32.31 3	93.13 17.45 144.51 32.31 3	93.13 18.6 155.23 32.31 3		(67) (68) (69) (70)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	93.13 ng gains 18.1 nces ga 162.4 ng gains 32.31 s and fai 3 s e.g. ev -74.5	93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3 raporatic -74.5	Mar 93.13 ted in Ap 13.07 ulated in A 159.84 ted in A 32.31 (Table \$ 3 on (nega -74.5	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3 tive valu	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31 3 es) (Tab	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31 3 le 5)	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31 3	93.13 Iso see 8.77 3a), also 119.81), also se 32.31 3	93.13 Table 5 11.77 9 see Ta 124.06 9e Table 32.31 3	93.13 14.95 ble 5 133.1 5 32.31 3	93.13 17.45 144.51 32.31 3	93.13 18.6 155.23 32.31 3		(67) (68) (69) (70)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	93.13 93.13 ag gains 18.1 nces ga 162.4 ng gains 32.31 s and far 3 s e.g. ev -74.5 heating 116.21	93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3 raporatic -74.5 gains (T	Mar 93.13 ted in Ap 13.07 ulated in 159.84 ted in A 32.31 (Table 5 able 5) 110.64	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3 tive valu -74.5	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31 3 es) (Tab -74.5	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31 3 le 5) -74.5 97.53	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31 3 -74.5 93.55	93.13 Iso see 8.77 3a), also 119.81 0, also se 32.31 3 -74.5 98.65	93.13 Table 5 11.77 9 see Ta 124.06 9 Table 32.31 3 -74.5 100.46	93.13 14.95 ble 5 133.1 5 32.31 3 -74.5 105.75	93.13 17.45 144.51 32.31 3 -74.5	93.13 18.6 155.23 32.31 3 -74.5 114.41		(67)(68)(69)(70)(71)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	93.13 93.13 ag gains 18.1 nces ga 162.4 ng gains 32.31 s and far 3 s e.g. ev -74.5 heating 116.21	93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3 raporatic -74.5 gains (T 114.4	Mar 93.13 ted in Ap 13.07 ulated in 159.84 ted in A 32.31 (Table 5 able 5) 110.64	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3 tive valu -74.5	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31 3 es) (Tab -74.5	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31 3 le 5) -74.5 97.53	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31 3 -74.5 93.55	93.13 Iso see 8.77 3a), also 119.81 3, also se 32.31 3 -74.5 98.65	93.13 Table 5 11.77 9 see Ta 124.06 9 Table 32.31 3 -74.5 100.46	93.13 14.95 ble 5 133.1 5 32.31 3 -74.5 105.75	93.13 17.45 144.51 32.31 3 -74.5 111.73	93.13 18.6 155.23 32.31 3 -74.5 114.41		(67)(68)(69)(70)(71)

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	3.63	x	11.28	x	0.57	x	0.7	=	22.65	(75)
Northeast 0.9x	0.77	x	2.9	x	11.28	x	0.57	x	0.7	=	9.05	(75)
Northeast 0.9x	0.77	x	3.63	x	22.97	x	0.57	x	0.7	=	46.1	(75)
Northeast 0.9x	0.77	x	2.9	x	22.97	x	0.57	x	0.7	=	18.42	(75)
Northeast 0.9x	0.77	x	3.63	x	41.38	x	0.57	x	0.7	=	83.07	(75)
Northeast 0.9x	0.77	x	2.9	x	41.38	x	0.57	x	0.7	=	33.18	(75)
Northeast 0.9x	0.77	x	3.63	x	67.96	x	0.57	x	0.7	=	136.42	(75)
Northeast 0.9x	0.77	x	2.9	x	67.96	x	0.57	x	0.7	=	54.49	(75)
Northeast 0.9x	0.77	x	3.63	x	91.35	x	0.57	x	0.7	=	183.37	(75)
Northeast 0.9x	0.77	x	2.9	x	91.35	x	0.57	x	0.7	=	73.25	(75)
Northeast 0.9x	0.77	x	3.63	x	97.38	x	0.57	x	0.7	=	195.49	(75)
Northeast 0.9x	0.77	x	2.9	x	97.38	x	0.57	x	0.7	=	78.09	(75)
Northeast 0.9x	0.77	x	3.63	x	91.1	x	0.57	x	0.7	=	182.88	(75)
Northeast 0.9x	0.77	x	2.9	x	91.1	x	0.57	x	0.7	=	73.05	(75)
Northeast 0.9x	0.77	x	3.63	x	72.63	x	0.57	x	0.7	=	145.79	(75)
Northeast 0.9x	0.77	x	2.9	x	72.63	x	0.57	x	0.7	=	58.24	(75)
Northeast 0.9x	0.77	x	3.63	x	50.42	x	0.57	x	0.7	=	101.22	(75)
Northeast 0.9x	0.77	x	2.9	x	50.42	x	0.57	x	0.7	=	40.43	(75)
Northeast 0.9x	0.77	x	3.63	x	28.07	x	0.57	x	0.7	=	56.34	(75)
Northeast 0.9x	0.77	x	2.9	x	28.07	x	0.57	x	0.7	=	22.51	(75)
Northeast 0.9x	0.77	x	3.63	x	14.2	x	0.57	x	0.7	=	28.5	(75)
Northeast 0.9x	0.77	x	2.9	x	14.2	x	0.57	x	0.7	=	11.38	(75)
Northeast 0.9x	0.77	x	3.63	x	9.21	x	0.57	x	0.7	=	18.5	(75)
Northeast 0.9x	0.77	x	2.9	x	9.21	x	0.57	x	0.7	=	7.39	(75)
Southeast 0.9x	0.77	x	2.94	x	36.79	x	0.57	x	0.7	=	29.91	(77)
Southeast 0.9x	0.77	x	2.94	x	62.67	x	0.57	x	0.7	=	50.95	(77)
Southeast 0.9x	0.77	x	2.94	x	85.75	x	0.57	x	0.7	=	69.71	(77)
Southeast 0.9x	0.77	x	2.94	x	106.25	x	0.57	x	0.7	=	86.38	(77)
Southeast 0.9x	0.77	x	2.94	×	119.01	x	0.57	x	0.7	=	96.75	(77)
Southeast 0.9x	0.77	x	2.94	x	118.15	x	0.57	x	0.7	=	96.05	(77)
Southeast 0.9x		x	2.94	x	113.91	x	0.57	x	0.7	=	92.6	(77)
Southeast 0.9x		x	2.94	×	104.39	x	0.57	x	0.7	=	84.86	(77)
Southeast 0.9x		x	2.94	x	92.85	x	0.57	x	0.7	=	75.48	(77)
Southeast 0.9x	0.77	x	2.94	x	69.27	x	0.57	x	0.7	=	56.31	(77)
Southeast 0.9x	0.77	x	2.94	x	44.07	x	0.57	x	0.7	=	35.83	(77)
Southeast 0.9x	••••	x	2.94	×	31.49	x	0.57	x	0.7	=	25.6	(77)
Northwest 0.9x		x	2.48	×	11.28	x	0.57	x	0.7	=	15.47	(81)
Northwest 0.9x		x	2.48	×	22.97	x	0.57	x	0.7	=	31.5	(81)
Northwest 0.9x	0.77	x	2.48	x	41.38	x	0.57	x	0.7	=	56.75	(81)

					-										_
Northwest 0.9	× 0.77	x	2.4	8	×	67	.96	X		0.57	_ × [0.7	=	93.2	(81)
Northwest 0.9	× 0.77	x	2.4	8	×	91	.35	×		0.57	x	0.7	=	125.28	(81)
Northwest 0.9	× 0.77	x	2.4	8	×	97	.38	x		0.57	x	0.7	=	133.56	(81)
Northwest 0.9	× 0.77	x	2.4	8	×	91	1.1	x		0.57	x	0.7	=	124.94	(81)
Northwest 0.9	× 0.77	x	2.4	8	x	72	2.63	x		0.57	_ x [0.7	=	99.61	(81)
Northwest 0.9	× 0.77	x	2.4	8	× [50	.42	x		0.57	x	0.7	=	69.15	(81)
Northwest 0.9	× 0.77	x	2.4	8	× [28	3.07	x		0.57	×	0.7	=	38.49	(81)
Northwest 0.9	x 0.77	x	2.4	8	×	14	4.2	x		0.57	x	0.7	=	19.47	(81)
Northwest 0.9	× 0.77	x	2.4	8	×	9.	.21	x		0.57	_ x [0.7	=	12.64	(81)
					_										
Solar gains i	n watts, c	alculated	for eac	h month				(83)m	i = Su	ım(74)m	(82)m				
(83)m= 77.08	3 146.97	242.71	370.48	478.65	50)3.19	473.47	388	3.5	286.28	173.65	95.18	64.12		(83)
Total gains -	- internal a	and solar	(84)m =	= (73)m	+ (8	33)m ,	watts	-					-		
(84)m= 427.7	3 495.47	580.19	690.64	781.57	78	39.56	749.21	669.	.66	576.5	481.38	422.8	406.3		(84)
7. Mean int	ernal tem	oerature	(heating	season)			•		-		•		-	
Temperatu			` č		<i>.</i>	area fr	om Tab	ole 9.	Th1	(°C)				21	(85)
Utilisation f	0	0.			Ũ			,		(-)					
Jar		Mar	Apr	May	<u>r`</u>	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m= 0.99		0.98	0.93	0.82).64	0.49	0.5	<u> </u>	0.82	0.96	0.99	1		(86)
Mean interr		rature in	living ar				e 3 to 7	I 7 in T				1	I	1	
(87)m= 19.3 ⁴		19.85	20.33	20.71	1	0.92	20.98	20.9	-	20.79	20.29	19.73	19.29]	(87)
		1			I						20.20	10.70	10.20		()
Temperatu		1			1	<u> </u>		î 👘	-	. ,				1	(00)
(88)m= 19.6	19.6	19.6	19.62	19.63	19	9.65	19.65	19.6	65	19.64	19.63	19.62	19.61		(88)
Utilisation f	actor for g	ains for	rest of d	welling,	h2,r	m (see	e Table	9a)				_			
(89)m= 0.99	0.99	0.97	0.9	0.75	0).53	0.35	0.4	1	0.72	0.94	0.99	0.99		(89)
Mean interr	nal tempei	rature in	the rest	of dwelli	ing [·]	T2 (fol	llow ste	eps 3	to 7	in Tabl	e 9c)				
(90)m= 17.4 ⁻		18.19	18.87	19.37	ب ر	9.6	19.64	19.6	-	19.48	, 18.84	18.03	17.39		(90)
										f	LA = Livii	ng area ÷ (4) =	0.54	(91)
Mean interr	al tompo	ratura (fo	r tho wh	olo dwo	Illing		Λ ~ Τ1	. (1	fl /	∧) ~ то					
(92)m= 18.43		19.08	19.65	20.09	<u> </u>	0.31	20.36	20.3		20.18	19.61	18.94	18.41		(92)
Apply adjus												10.04	10.41		(0-)
(93)m= 18.28	-	18.93	19.5	19.94	-	0.16	20.21	20.		20.03	19.46	18.79	18.26]	(93)
8. Space h				10.01			20.21		- 1	20.00	10.10	10.10	10.20		()
Set Ti to the				re obtair	ned	at ster	n 11 of	Tabl	e 9h	so tha	t Ti m=	(76)m an	d re-calo	culate	
the utilisation			•		icu			Tubl	0.00	, 50 110	C 11,111—	(ro)m an			
Jar	n Feb	Mar	Apr	May		Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
Utilisation f	actor for g	ains, hm	:										-		
(94)m= 0.99	0.98	0.96	0.9	0.77	0).57	0.41	0.4	8	0.75	0.94	0.98	0.99		(94)
Useful gain	s, hmGm	, W = (94	4)m x (8-	4)m	-							-			
(95)m= 423.3	9 486.53	557.35	620.45	600.08	45	53.83	307.57	318.	.76	434.9	451.22	415.25	402.9		(95)
Monthly av		1	·		1	1				1		1	i	1	/
(96)m= 4.3	4.9	6.5	8.9	11.7		4.6	16.6	16.		14.1	10.6	7.1	4.2		(96)
Heat loss ra	1	r	· · ·		1		- ,	<u> </u>	ŕ	, ,		1		1	
(97)m= 1268.0	67 1231.23	1120.73	940.04	727.99	48	32.88	313.34	328.	.88	519.09	783.37	1039.88	1259.02		(97)

							l ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	
- 12a. (502 em	issions -	- Individ	lual heati	ing syste		uaing mi							
	city for li		ا من المراجع ا		ing a set			oro OLIE				l	319.61	(232)
	-		above, l	kWh/yea	ır			sum	of (230a)	(∠30g) =			173.11	(231)
		ig pump							of (000-)	(220~)		30		(230c)
				nced, ext	ract or p	ositive i	nput fror	n outside	9			143.11		(230a)
		•		electric	•								1	
	-	fuel use											2210.94	
•	•			system	1								3524.77	ļ
	l totals		al main	o voto m	4					k	Wh/year	r I	kWh/year	- -
ľ								Tota	I = Sum(2	19a) ₁₁₂ =			2210.94	(219)
(219)m=		m x 100 183.23	194.44	178.04	180.11	169.97	164.56	178.75	177.87	184.36	190.41	202.24		
		heating,												
(217)m= 88.35 88.13 87.63 86.39 84.12 80.3 80.3 80.3 80.3 86.48 87.83 88.42												(217)		
Efficiency of water heater												80.3	(216)	
Water heating Output from water heater (calculated above) 182.85 161.49 170.38 151.5 136.49 132.14 143.54 142.83 159.43 167.24 178.81														
Wator	hoating							Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	2=	0	(215)
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		-
•		g fuel (s)1)] } x 1		ry), kWh/ 08)	month					, ,	× 15,10. 12	<u>-</u>], ,
l	691.08	549.93	460.61	252.86	104.58	0	0	0 Tota	0 II (kWh/yea	271.56 ar) =Sum(2	494.21	699.95 =	3524.77	(211)
(211)m				100 ÷ (20	1					074 50	404.04	000.05		(211)
	628.88	500.43	419.15	230.1	95.17	0	0	0	0	247.12	449.73	636.95	I	
Space		<u> </u>	· · · ·	calculate	1	Í			i	·		· · · · · ·	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g systen	า, %					İ	0	(208)
Efficie	ency of I	main spa	ace heat	ting syste	em 1								91	(206)
				main sys				(204) = (2	02) × [1 –	(203)] =			1	(204)
				nain syst		,	-	(202) = 1 ·	– (201) =				1	(202)
Space	e heatir	ng:		econdar			Ĩ		,				0	(201)
		• •		lividual h	•	vstems i	ncluding	umicro-C	HP)					
Space	e heatin	a require	ement in	n kWh/m²	²/vear					(,(-	-)	57.42	`´´](99)
(30)11-	020.00	300.43	413.13	230.1	33.17	0	0		l per year				3207.54	(98)
(98)m=	628.88	500.43	419.15	230.1	95.17	0				247.12	449.73	636.95		

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

(211) x	0.216	=	761.35	(261)
(215) x	0.519	=	0	(263)
(219) x	0.216	=	477.56	(264)
(261) + (262) + (263) + (264) =			1238.91	(265)
(231) x	0.519	=	89.85	(267)
(232) x	0.519	=	165.88	(268)
sum	of (265) (271) =		1494.63	(272)
(272)) ÷ (4) =		26.76	(273)
			80	(274)
	(215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x sum	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccc} (215) & x & & & & & & & & & & & & & & & & & $

		User De	etails:				
Assessor Name: Software Name:	Oliver Morris Stroma FSAP 2012	:	Stroma Num Software Vei	rsion:		025430 on: 1.0.3.4	
A dalace e		Property A	Address: Unit 2 p	proposed			
Address : 1. Overall dwelling dimens	, London, NW6 1NR						
T. Overall dwelling dimens	SIONS:	Area	(m²)	Av. Height	t(m)	Volume(m ³	\
Ground floor).77 (1a) x	2.8	(2a) =	142.16	(3a)
Total floor area TFA = (1a)	+(1b)+(1c)+(1d)+(1e)+	(1n) 50).77 <mark>(4)</mark>				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3d	e)+(3n) =	142.16	(5)
2. Ventilation rate:				4 - 4 - 1			
	main secor heating heati		other	total		m ³ per hou	r
Number of chimneys	0 + (o +	0 =	0	x 40 =	0	(6a)
Number of open flues	0 + (о + С	0 =	0	x 20 =	0	(6b)
Number of intermittent fans				0	x 10 =	0	(7a)
Number of passive vents			Г	0	x 10 =	0	(7b)
Number of flueless gas fire	S			0	x 40 =	0	(7c)
					Air ch	anges per ho	our
Infiltration due to chimneys	, flues and fans = $(6a)+(6a)$	6b)+(7a)+(7b)+(7	′c) =	0	÷ (5) =	0	(8)
If a pressurisation test has bee				-			
Number of storeys in the	dwelling (ns)					0	(9)
Additional infiltration					[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.2 if both types of wall are pres deducting areas of openings	sent, use the value correspond			ruction		0	(11)
If suspended wooden flo		or 0.1 (sealed	d), else enter 0			0	(12)
If no draught lobby, ente	r 0.05, else enter 0					0	(13)
Percentage of windows a	and doors draught stripp	ed				0	(14)
Window infiltration		(0.25 - [0.2 x (14) ÷ 1	= [00		0	(15)
Infiltration rate		((8) + (10) + (11) + (1	2) + (13) + (15	5) =	0	(16)
Air permeability value, q	•	•	• •	etre of enve	lope area	5	(17)
If based on air permeability						0.25	(18)
Air permeability value applies i Number of sides sheltered	t a pressurisation test has bee	n done or a deg	ree air permeability	is being used		3	(19)
Shelter factor		((20) = 1 - [0.075 x (1	9)] =		0.78	(13)
Infiltration rate incorporatin	g shelter factor	((21) = (18) x (20) =			0.19	(21)
Infiltration rate modified for	monthly wind speed						
		un Jul	Aug Sep	Oct N	Nov Dec]	
Monthly average wind spee	ed from Table 7					_	
(22)m= 5.1 5 4.	9 4.4 4.3 3	.8 3.8	3.7 4	4.3 4	4.5 4.7		
Wind Factor $(22a)m = (22)$	m ÷ 4						
(22a)m= 1.27 1.25 1.2	23 1.1 1.08 0.4	95 0.95	0.92 1	1.08 1	.12 1.18		

Adjusted	d infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m						
	0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23			
		<i>tive air</i> Il ventila	-	rate for t	he appli	cable ca	se						0.5		(23a)
				endix N. (2	3b) = (23a	a) × Fmv (e	equation (N	N5)), othe	rwise (23b) = (23a)			0.5		(23b)
						or in-use f				, (,			0.5 76.5		(23c)
			•		U	at recove	,		, ,	2b)m + ('	23h) x [[,]	1 _ (23c))	(230)
(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	÷ 100]		(24a)
						heat rec						0.00			(/
(24b)m=				0	0				0	0	0	0	l		(24b)
	-			-	-	l ve input v		-	-	Ů		Ů			
,					•); otherv				5 × (23b))				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
	atural v	ventilatio	n or wh	ole hous	e positiv	l ve input v	ventilatio	I on from I	oft						
,						erwise (2				0.5]					
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24d)
Effect	ive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	x (25)	-	_		-		
(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35			(25)
3 Hoo	tlosso	e and he	eat loss p	aramot	or.	•		•				•	•		
ELEM		Gros		Openin		Net Ar	ea	U-valı	IP	AXU		k-value	2	ΑX	k
		area		m		A ,r		W/m2		(W/I	<)	kJ/m²·l		kJ/K	
Doors						1.79	x	1.5	=	2.685					(26)
Window	'S					2.48	x1,	/[1/(1.4)+	0.04] =	3.29	_				(27)
Floor						50.77	, x	0.25		12.6925	5				(28)
Walls Ty	vpe1	26.7	75	9.92	,	16.83	3 X	0.25		4.21	= i		\dashv		(29)
Walls Ty		20.0		1.79		18.26		0.25	╡╻	4.6	= 7		4 2](29)
Total are						97.57		0.20	[1.0	L				(31)
Party wa			,				x			0	r				י <i>י</i>
-						3.89		0		0	╡╏		\dashv		(32)
Party wa						20.38		0	= [0	L		\dashv		(32)
Party ce	•			((50.77		. (<i>K(A)</i>						(32b)
			ows, use e sides of in			alue calcul titions	atea using	Tormula 1	/[(1/ U- valu	ie)+0.04j a	is given in	paragrapr	1 3.2		
Fabric h	eat los	s, W/K :	= S (A x	U)				(26) (30)	+ (32) =				37.3	3	(33)
Heat ca	pacity (Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	13232	.56	(34)
Thermal	l mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250		(35)
For desig	n assess	ments wh	ere the de	tails of the	construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f]
			tailed calc												-
	-	•	,		• •	pendix ł	<						14.6	4	(36)
if details of Total fat			are not kn	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			54.0		
			alculator	lmonthly							25)m v (5)		51.9	1	(37)
Ventilati	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	= 0.33 × (Oct	Nov	Dec	l		
(38)m=	17.1	16.87	16.65	Арі 15.51	15.28	14.15	14.15	13.92	Зер 14.6	15.28	15.74	16.19			(38)
				10.01	10.20	14.10	17.10	.0.02				10.10	l		= /
Heat tra			r	67.40	67.05	60.40	60.40	65.00		=(37) + (37)		60.40	l		
(39)m=	69.07	68.84	68.62	67.48	67.25	66.12	66.12	65.89	66.57	67.25	67.71	68.16			п

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Average = Sum(39)_{1 12} /12= $67.4 \rho_{age 2} \phi^{(39)}$

(40)me 1.36 1.35 1.33 1.32 1.3 1.3 1.31 1.31 1.31 1.34 1.33 1.34 1.33 1.34 1.33 1.34 1.30 31 <	Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)					
Number of days in month (Table 1a)(1) $\frac{3n}{128}$ Number of days in month (Table 1a)(4) $\frac{3n}{128}$ Name of days in month (Table 1a)(4) $\frac{3n}{128}$ Name of days in month (Table 1a)(4) $\frac{3n}{128}$ Name of days in month (Table 1a)(4) $\frac{3n}{128}$ Name of days in month (Table 1a)(4) $\frac{3n}{128}$ Name of days in the month of days in the month of days in the month of days in the month of days in the days in	(40)m=	· ·	,	, , , , , , , , , , , , , , , , , , ,	1	1.32	1.3	1.3	1.3	r	<u> </u>	<u> </u>	1.34				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Numbe			nth (Tab						,	Average =	Sum(40)₁	₁₂ /12=	1.33	(40)		
(41)ma 31 28 31 30 31 31 31 31 31 31 31	Numbe	-		<u> </u>	1	May	lun	Iul	Δυα	Sen	Oct	Nov	Dec				
4. Water heating energy requirement: kWh/year: Assumed occupancy, N 1.71 (42) if TFA > 13.9, N = 1 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) (7FA - 13.9) Annual average hot water usage in litres per day Vd.average = (25 x N) + 36 74.86 (43) Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 12% titres per person day (14) waters use, hot and cold) (44) (42) Lan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd.m = factor from Table 1c x (43) Total = Sum(44), = 988.54 (44) (44)me 92.37 76.38 73.38 70.39 73.9 70.39 73.81 76.38 79.37 82.37 Total = Sum(44), = 988.54 (44) 118.29 Total = Sum(45), = 1178.13 (45) # Instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (49) to (61) Total = Sum(45), = 1178.13 (45) Korage Volume (litres) including any solar or WWHRS storage within same vessel 0 (47) Water storage loss: 0	(41)m=				· · ·					<u> </u>					(41)		
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)2]] + 0.0013 x (TFA - 13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day. Vd, average = $(25 x N) + 36$ Reduce the annual average hot water usage by 5% if the diveling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Lan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd.m = factor from Table to x (43) (44)m= 82.37 79.37 76.38 73.38 70.39 67.39 67.39 70.39 73.38 76.38 79.37 82.37 Total = Sum(44) · = 898.54 (44) Freqry content of hot water used - calculated monthly = 4.190 x Vd.m x nm x DTm / 3600 kWM/month (see Tables 15b, 1c, 1d) (46)m= 122.15 106.83 110.24 96.11 92.22 79.58 73.74 84.62 85.63 99.79 108.93 118.29 Total = Sum(45), · = 1178.13 (45) if instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (48) to (61) (46)m= 18.32 16.02 16.54 14.42 13.83 11.94 11.06 12.69 12.84 14.97 16.34 17.74 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) Water storage loss: Storage loss: a) If monufacturer's declared los factor is known (kWh/day): 0 (Cherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b (49) x (49) = 0 (49) x (49) = 0 (49) x (49) x (49) = 0 (49) x (49) x (49) = 0 (49) x (49) x (49) = 0 (41) terminal vessel (41) x (51) x (52) x (53) = 0 (52) Water storage loss factor from Table 2 (kWh/litre/day) if f community heating ge exciton 4.3 Volume factor from Table 2b Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (53) Water storage loss calculated for each month ((56)m = (56)m + (50)m = (56)m where (H11) is from Appendix H (56)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(,																
if TFA > 13.9; N = 1 $1 + 1.76 \times [1 - exp(-0.000349 \times (TFA - 13.9)2] + 0.0013 \times (TFA - 13.9)if TFA F 13.9; N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36(43)Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of(43)not more that 125 litres per person per day (all water use, hot and cold)(44)(44)m=82.3776.3873.3870.3967.3967.3970.3870.3879.3782.37Total = Sum(44), =898.54(44)Energy content of hot water used - calculated monthly = 4.190 x Vd, m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)(45)(45)m=122.15106.83110.2496.1192.2279.5873.7484.6285.6399.79108.93118.29If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)Total = Sum(45), =1178.13(45)(46)m=18.3216.0216.5414.4213.8311.9411.0612.6912.8414.9716.3417.74(46) Water storage loss:Including any solar or WWHRS storage within same vessel0(47)If community heating and no tank in dwelling, enter 110 litres in (47)0(49)Otherwise if no stored hot water (this includes instantaneous combi bioliers) enter '0' in (47)(49)Water storage loss:0(49)0(51)If community heating see section 4.3(49) (49) =0(51)If anducturer's declared loss facto$	4. Wa	iter heat	ting ene	rgy requ	irement:								kWh/ye	ear:			
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd.m = factor from Table 1c x (43) Total = Sum(44), u = 898.54 (44) Energy content of hot water used - calculated monthly = 4.190 X Vd.m x nm x DTm / 3600 KWh/month (see Tables tb. 1c, 1d) (45) (46)m= 122.15 106.83 110.24 96.11 92.22 79.58 73.74 84.62 85.63 99.79 108.93 118.29 Total = Sum(45), u = 1178.13 (45) 1177.4 (46) 12.84 14.97 16.34 17.74 (46) Water storage loss: 16.02 16.54 14.42 13.83 11.94 11.06 12.69 12.84 14.97 16.34 17.74 (46) Water storage loss: a) 16 on totaki in dwelling, enter 110 litres in (47) 0 (47) 0 (47)	if TF	A > 13.9	9, N = 1		([1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	TFA -13		71		(42)		
Hot water usage in littes per day for each month Vd,m = factor from Table 1c x (43) (44)me $\begin{bmatrix} 82.37 & 79.37 & 76.38 & 73.38 & 70.39 & 67.39 & 67.39 & 70.39 & 73.38 & 76.38 & 79.37 & 82.37 \\ Total = Sum(44): \omega = \\ 100 \\ $	Reduce	the annua	al average	hot water	usage by	5% if the c	welling is	designed			se target o		.88		(43)		
(44)me 82.37 79.37 76.38 73.38 70.39 67.39 70.39 70.38 76.38 79.37 82.37 Total = Sum(44):		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
Total = Sum(44) =898.54(44)Total = Sum(44) =898.54(44)Total = Sum(44) =898.54(44)Total = Sum(45) =(44)Total = Sum(45) =(45)Total = Sum(45) =(47)Total = Sum(45) =(47)(46)(47)(46)(47)(47)(47)(47)(47)(48)(49)(48) <th <="" colspan="2" td=""><td>Hot wate</td><td>er usage i</td><td>n litres pei</td><td>r day for ea</td><td>ach month</td><td>Vd,m = fa</td><td>ctor from</td><td>Table 1c x</td><td>(43)</td><td></td><td></td><td></td><td></td><td></td><td></td></th>	<td>Hot wate</td> <td>er usage i</td> <td>n litres pei</td> <td>r day for ea</td> <td>ach month</td> <td>Vd,m = fa</td> <td>ctor from</td> <td>Table 1c x</td> <td>(43)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>		Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
Energy content of hot water used - calculated monthly = 4.190 x Vd.m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) Total = Sum(45), $u = 1178.13$ (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)me 18.32 16.02 16.54 14.42 13.83 11.94 11.06 12.69 12.84 14.97 16.34 17.74 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b (49) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) If community heating see section 4.3 Volume factor from Table 2a (47) x (51) x (52) x (53) = 0 (52) Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (52) Calculated for each month ((56)m = (55) × (41)m (56)m (56)m where (H11) is from Appendix H	(44)m=	82.37	79.37	76.38	73.38	70.39	67.39	67.39	70.39	73.38	76.38	79.37	82.37		_		
(45)m= 122.15 106.83 110.24 96.11 92.22 79.58 73.74 84.62 85.63 99.79 108.83 118.29 Total = Sum(45); $p =$ 1178.13 (45) if instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46) (45)m= 18.32 16.02 16.54 14.42 13.83 11.94 11.06 12.69 12.84 14.97 16.34 17.74 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Colspan="4">(48) × (49) = 0 (49) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2b 0 (50) (51) (52) (53) (52) (53) (54) (54) (52) (53)	Enerav (content of	hot water	used - ca	lculated m	onthly – 4	190 x Vd r	m y nm y l) Tm / 3600			· · · ·	L	898.54	(44)		
Total = Sum(45): $z =$ 1178.13(45)If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)(46)(45)(45)(46)(45)(45)(45)(45)(45)(46)(45)(45)(46)(45)(46)(47)(46)(47)(46)(47)(47)(47)(47)(47)(47)(47)(47)(47)(47)(47)(47)(47)(47)(47)(47)(48)(49)(48)(49)(48)(49)(48)(49)(48)(49)(49)(49)(49)(49)(49)(49)(49)(49)				. <u> </u>		-		. <u> </u>	i		-		· ·				
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)me 18.32 16.02 16.54 14.42 13.83 11.94 11.06 12.69 12.84 14.97 16.34 17.74 (46) Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) Temperature factor from Table 2b (49) (48) (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) If community heating see section 4.3 Volume factor from Table 2b (51) Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (52) Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (52) Temperature factor from Table 2b (53) Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (52) Water storage loss calculated for each month ((56)m = (55) × (41)m (56)me 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(43)11=	122.15	100.05	110.24	90.11	92.22	79.50	73.74	04.02					1178,13	(45)		
Water storage loss: 0 (47) Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) If community heating and no tank in dwelling, enter 110 litres in (47) 0 (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: 0 (48) a) If manufacturer's declared loss factor is known (kWh/day): 0 0 (49) Temperature factor from Table 2b 0 (49) Energy lost from water storage, kWh/year (48) × (49) = 0 (49) b) If manufacturer's declared cylinder loss factor is not known: 0 (50) (51) Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) (52) If community heating see section 4.3 0 (52) (53) Volume factor from Table 2a 0 (52) (53) (53) Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54) Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54) Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (56) <	lf instant	taneous w	ater heati	ng at poin	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46			m(10)1 12 -	L				
Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47) If community heating and no tank in dwelling, enter 110 litres in (47) 0 (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: 0 (48) a) If manufacturer's declared loss factor is known (kWh/day): 0 (48) (49) (49) Temperature factor from Table 2b 0 (49) (40) (40) (40) Energy lost from water storage, kWh/year (48) × (49) = 0 (50) (50) (51) If ommunity heating see section 4.3 0 (51) (52) × (53) = 0 (52) (53) Volume factor from Table 2a 0 0 (47) × (51) × (52) × (53) = 0 (53) Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54) (55) Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54) (55) Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (56) (56) If cylinder contains dedicated for each month ((56)m = (55) × (41)m (56)m = (56	· · ·			16.54	14.42	13.83	11.94	11.06	12.69	12.84	14.97	16.34	17.74		(46)		
If community heating and no tank in dwelling, enter 110 litres in (47)Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)Water storage loss:a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)Temperature factor from Table 2b 0 Energy lost from water storage, kWh/year(48) × (49) = 0 (50)b) If manufacturer's declared cylinder loss factor is not known:Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)If community heating see section 4.3Volume factor from Table 2a 0 <		-		. in aludi		- 		-	within or								
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day):0(48)Temperature factor from Table 2b0(49)Energy lost from water storage, kWh/year(48) x (49) =0b) If manufacturer's declared cylinder loss factor is not known:0(51)Hot water storage loss factor from Table 2 (kWh/litre/day)0(51)If community heating see section 4.30(52)Volume factor from Table 2a0(53)Energy lost from water storage, kWh/year(47) x (51) x (52) x (53) =0Energy lost from water storage, kWh/year(47) x (51) x (52) x (53) =0(54)00000(56)m=00000(56)m=00000(56)m=00000(56)m=00000(56)m=00000(56)m=00000If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H	-		. ,		• •			-		ame ves	sei		0		(47)		
Water storage loss:0(48)a) If manufacturer's declared loss factor is known (kWh/day):0(48)Temperature factor from Table 2b0(49)Energy lost from water storage, kWh/year(48) x (49) =0b) If manufacturer's declared cylinder loss factor is not known:0(50)Hot water storage loss factor from Table 2 (kWh/litre/day)0(51)If community heating see section 4.30(52)Volume factor from Table 2a0(52)Temperature factor from Table 2b0(53)Energy lost from water storage, kWh/year(47) x (51) x (52) x (53) =0Energy lost from water storage, kWh/year(47) x (51) x (52) x (53) =0Energy lost from water storage, kWh/year(56)m = (55) × (41)m(56)m =(56)m =0000000000(56)m =00000If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H		•	-			-			. ,	ers) ente	er '0' in ((47)					
Temperature factor from Table 2b0(49)Energy lost from water storage, kWh/year(48) x (49) =0(50)b) If manufacturer's declared cylinder loss factor is not known:0(51)Hot water storage loss factor from Table 2 (kWh/litre/day)0(51)If community heating see section 4.30(52)Volume factor from Table 2a0(52)Temperature factor from Table 2b0(53)Energy lost from water storage, kWh/year(47) × (51) × (52) × (53) =0Enter (50) or (54) in (55)000Water storage loss calculated for each month((56)m = (55) × (41)m(56)(56)m=00000If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H(56)					,					,	,						
Energy lost from water storage, kWh/year (48) \times (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51) If community heating see section 4.3 Volume factor from Table 2a 0 (52) Temperature factor from Table 2b (53) Energy lost from water storage, kWh/year (47) \times (51) \times (52) \times (53) = 0 (53) Energy lost from water storage, kWh/year (47) \times (51) \times (52) \times (53) = 0 (54) Enter (50) or (54) in (55) (55) Water storage loss calculated for each month ((56)m = (55) \times (41)m (56)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a) If m	anufact	urer's de	eclared I	loss fact	or is kno	wn (kWł	n/day):					0		(48)		
b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) If community heating see section 4.3 Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage, kWh/year Enter (50) or (54) in (55) Water storage loss calculated for each month ((56)m = 0 0 0 0 0 0 0 0 0 0	Tempe	erature f	actor fro	m Table	e 2b								0		(49)		
Hot water storage loss factor from Table 2 (kWh/litre/day)0(51)If community heating see section 4.30(52)Volume factor from Table 2a0(52)Temperature factor from Table 2b0(53)Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ 0Enter (50) or (54) in (55)0(55)Water storage loss calculated for each month $((56)m = (55) \times (41)m$ (56)(56)m =00000If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H(56)	•••			-	•		or in not	known	(48) x (49)) =			0		(50)		
If community heating see section 4.3 Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage, kWh/year Enter (50) or (54) in (55) Water storage loss calculated for each month $((56)m = (55) \times (41)m$ (56)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					•								0		(51)		
Temperature factor from Table 2bEnergy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ 0(53)Enter (50) or (54) in (55)000(54)Water storage loss calculated for each month $((56)m = (55) \times (41)m$ (56)m=0(56)m=(56)m=00000000(56)m=0000000(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(56)m			•			,							-				
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ 0(54)Enter (50) or (54) in (55)0000(55)Water storage loss calculated for each month $((56)m = (55) \times (41)m$ (56)m(56)m(56)m =0000000(56)m =0000000If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H(56)m												(0		(52)		
Enter (50) or (54) in (55)0Water storage loss calculated for each month $((56)m = (55) \times (41)m$ $(56)m =$ 0000 $(56)m =$ 0000 $(56)m =$ 0000 $(56)m =$ 0000 $(56)m =$ 0000 $(56)m =$ 0000 $(56)m =$ 0000 $(56)m =$ (57)m =(56)m × [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H													0		(53)		
Water storage loss calculated for each month $((56)m = (55) \times (41)m$ $(56)m =$ 0000000 $(56)m =$ 00000000If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where $(H11)$ is from Appendix H(56)				•	e, kWh/y	ear			(47) x (51)) x (52) x (53) =				(54)		
(56)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		. ,	. , .		for oach	month			((56)m - (55) x (41)	m		0		(55)		
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		-							1		1				(56)		
	· · ·	-	•	-	-	-				•	-		-	ix H	(00)		
	(57)m=				- · ·	· · ·	1		1	· · ·		 			(57)		
				I Doubly fre	I om Toble	۰ <u>ـــــ</u>	I	I	1	I	I]		(58)		
Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) \div 365 × (41)m		•	•				59)m = ((58) ÷ 3(65 × (41)	m		L'	~		(00)		
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)											r thermo	ostat)					
(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (59)	(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)		

Combi	loss ca	lculated	for eac	ch	month (61)m =	= (60	0) ÷ 30	65 × (41))m								
(61)m=	41.97	36.53	38.92	2	36.19	35.87	:	33.23	34.34	35.	87	36.19	38.92	39.14	4 4 [.]	1.97		(61)
Total h	eat req	uired for	water	he	ating ca	alculate	ed fo	or eac	h month	(62)	m =	0.85 × (45)m	+ (46)m	+ (57	')m +	(59)m + (61)m	
(62)m=	164.12	143.36	149.1	6	132.3	128.09	1	12.81	108.08	120	.49	121.82	138.7	1 148.0	7 16	60.27		(62)
Solar DH	W input	calculated	using A	ppe	endix G or	Append	ix H	(negati	ve quantity	/) (ent	er '0	' if no solar	r contrib	ution to w	ater he	eating)		
(add ad	dditiona	al lines if	FGHR	Sa	and/or V	VWHR	S a	pplies	, see Ap	penc	dix C	G)						
(63)m=	0	0	0		0	0		0	0	0)	0	0	0		0		(63)
Output	from w	ater hea	ter															
(64)m=	164.12	143.36	149.1	6	132.3	128.09	1	12.81	108.08	120	.49	121.82	138.7	1 148.0	7 16	60.27		
I											Outp	out from wa	ater hea	ter (annua	al) _{1 12}		1627.28	(64)
Heat g	ains fro	m water	heatin	g,	kWh/mo	onth 0.2	25 ´	[0.85	× (45)m	+ (6	51)m	n] + 0.8 x	: [(46)r	m + (57)	m + (59)m]	
(65)m=	51.11	44.65	46.38	3	41	39.63		34.77	33.1	37	.1	37.52	42.91	46.01	1 49	9.83		(65)
inclu	de (57)	m in calc	ulatio	n o	f (65)m	only if	cyli	nder i	s in the o	dwell	ing	or hot w	ater is	from co	mmu	nity h	eating	
	. ,	ains (see			. ,		,				U					,	0	
	Ŭ	ns (Table																
Melabl	Jan	Feb	Ma		Apr	May	,	Jun	Jul	Α	ug	Sep	Oct	No		Dec		
(66)m=	85.64	85.64	85.64	-	85.64	85.64	-	35.64	85.64	85.	<u> </u>	85.64	85.64	_	_	5.64		(66)
		I (calcula [:]								ا ادم د	ee -							
(67)m=	16.79	14.91	12.13	<u> </u>	9.18	6.86	-	5.79	6.26	8.1		10.92	13.87	16.19	9 1	7.26	l	(67)
				_														(-)
	149.23	ins (calc 150.78	146.8	_	138.57	128.09	<u>.</u>	18.23	111.64	3a), 11(114	122.3	1 132.7	0 14	2.65		(68)
(68)m=														1 132.7	9 14	2.00		(00)
1		s (calcula		-i			_		· · · · · ·			· · · · ·		04.50		4 50	I	(60)
(69)m=	31.56	31.56	31.56		31.56	31.56		31.56	31.56	31.	90	31.56	31.56	31.56	5 3	1.56		(69)
		ns gains I	r`	€ 5						1							I	
(70)m=	10	10	10		10	10		10	10	1	0	10	10	10		10		(70)
Losses		/aporatio	<u> </u>		ve valu	es) (Ta	ble	5)	r								I	
(71)m=	-68.51	-68.51	-68.5	1	-68.51	-68.51	-	68.51	-68.51	-68	.51	-68.51	-68.5	1 -68.5	1 -6	8.51		(71)
Water		gains (T	able 5	5)						-								
(72)m=	68.69	66.45	62.35	;	56.95	53.27	4	48.29	44.5	49.	87	52.11	57.68	63.9	60	6.97		(72)
Total i	nterna	gains =	:					(66)	m + (67)m	n + (68	3)m +	+ (69)m + (70)m +	(71)m + (1	72)m			
(73)m=	293.41	290.84	280.0	5	263.4	246.91		231	221.09	226	6.8	235.72	252.5	4 271.5	7 28	85.57		(73)
6. Sol	ar gain	s:																
•		calculated	•	olar	flux from	Table 6a	a and	assoc	iated equa	tions	to co	onvert to the	e applic		tation.			
Orienta		Access F			Area			Flu			-	g_		FF Table C	_		Gains	
	_	Table 6d			m²				ole 6a			able 6b		Table 6	С	_	(W)	_
Northwe	L	0.77		x	2.4	8	x	1	1.28	x		0.57	×	0.7	7	=	30.95	(81)
Northwe	est <mark>0.9x</mark>	0.77		x	2.4	8	x	2	2.97	×		0.57	×	0.7	/] =	63	(81)
Northwe	est <mark>0.9</mark> x	0.77		x	2.4	8	x	4	1.38	x		0.57	x	0.7	7	=	113.5	(81)
Northwe	est <mark>0.9x</mark>	0.77		x	2.4	8	x	6	57.96	×		0.57	×	0.7	7] =	186.4	(81)
Northwe	est <mark>0.9</mark> x	0.77		x	2.4	8	x	g	1.35	x		0.57	x	0.7	7	=	250.56	(81)

Northwest 0.9x	0.11	×	2.4	8	x	97	.38	×	0.57	×	0.7	=	267.12	(81)
Northwest 0.9x	0.77	x	2.4	8	x	91	1.1	x	0.57	x	0.7	=	249.89	(81)
Northwest 0.9x	0.77	x	2.4	8	x	72	.63	x	0.57	x	0.7	=	199.21	(81)
Northwest 0.9x	0.77	X	2.4	8	x	50	.42	x	0.57	×	0.7	=	138.3	(81)
Northwest 0.9x	0.77	x	2.4	8	x	28	.07	x	0.57	×	0.7	=	76.99	(81)
Northwest 0.9x	0.77	x	2.4	8	x	14	1.2	x	0.57	x	0.7	=	38.94	(81)
Northwest 0.9x	0.77	x	2.4	8	x	9.:	21	x	0.57	×	0.7	=	25.27	(81)
Solar gains ir	watts, ca	lculated	for eac	h month				(83)m =	= Sum(74)m	(82)m		-		
(83)m= 30.95	63	113.5	186.4	250.56			249.89	199.2	1 138.3	76.99	38.94	25.27		(83)
Total gains –	internal a	nd solar	(84)m =	= (73)m	+ (8	83)m , '	watts							
(84)m= 324.36	353.83	393.55	449.79	497.46	4	98.13	470.98	426.0	374.02	329.53	310.51	310.84		(84)
7. Mean inte	rnal temp	erature	(heating	season)									
Temperature	e during h	eating p	eriods ir	n the livi	ng	area fro	om Tab	ole 9, [·]	Th1 (°C)				21	(85)
Utilisation fa	ctor for ga	ains for li	iving are	ea, h1,m	ı (s	ee Tab	le 9a)							
Jan	Feb	Mar	Apr	May		Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.97	0.9	(0.75	0.59	0.66	0.89	0.98	1	1		(86)
Mean interna	al tempera	ature in l	iving ar	ea T1 (fe	ollo	w step	s 3 to 7	' in Ta	ble 9c)		-			
(87)m= 19.52	19.65	19.92	20.32	20.68	T	20.91	20.98	20.9		20.33	19.87	19.51		(87)
Temperature		I	oriode ir	roct of	dw	ulling f			 		_		1	
(88)m= 19.79	19.8	19.8	19.82	19.82	T	9.84	19.84	19.8		19.82	19.81	19.81]	(88)
	<u> </u>				I				10.00	10.02	10.01	10.01		()
Utilisation fa	<u> </u>				T	<u> </u>		,		0.07			1	(80)
(89)m= 1	0.99	0.99	0.95	0.85		0.65	0.45	0.52	0.83	0.97	0.99	1		(89)
Mean interna	<u> </u>	ature in t		of dwell	<u> </u>	<u> </u>			-	le 9c)		1	1	
(90)m= 17.84	18.04	18.43	19.01	19.5	1	9.78	19.83	19.8		19.03	18.37	17.83		(90)
									1	fLA = Liv	ing area ÷ (4) =	0.47	(91)
Mean interna	al tempera	ature (fo	r the wh	ole dwe	llin	g) = fL/	A × T1	+ (1 –	fLA) × T2	_			_	
(92)m= 18.64	18.8	19.13	19.63	20.06	2	20.31	20.37	20.3	6 20.18	19.64	19.08	18.63		(92)
Apply adjust	ment to th	ne mean	interna	temper	atu	ire from	n Table	4e, w	here appro	opriate			-	
(93)m= 18.49	18.65	18.98	19.48	19.91	2	20.16	20.22	20.2	1 20.03	19.49	18.93	18.48		(93)
8. Space he	· · ·													
Set Ti to the the utilisation			•		ned	at step	o 11 of	Table	9b, so tha	it Ti,m=	(76)m an	d re-calo	culate	
Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	Au	g Sep	Oct	Nov	Dec	1	
Utilisation fa			•	iviay			Jui	Au	g Ocp			Dee		
(94)m= 0.99	0.99	0.98	0.95	0.86	(0.68	0.5	0.57	0.84	0.97	0.99	1		(94)
Useful gains	, hmGm ,	W = (94)m x (8	4)m	<u> </u>	I			I	I	_		1	
(95)m= 322.69	1	386.64	427	426.77	3	338.1	233.94	241.4	6 314.33	318.99	307.75	309.52		(95)
Monthly ave	rage exter	rnal tem	perature	from T	abl	e 8					-		1	
(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 ra	te for mea	an intern	al tempe	erature,	Lm			x [(93))m– (96)m]				
<mark>(97)m=</mark> 979.92	946.64	856.62	713.84	552.08	3	67.76	239.47	251.2	394.59	598.2	800.74	973.03		(97)
Space heati		1			Wh				-í · ·	ŕ	- <u>ŕ</u>		1	
(98)m= 488.98	400.31	349.66	206.52	93.24		0	0	0	0	207.73	354.95	493.65		

								Tota	l per year	(kWh/yea	r) = Sum(9	8)15,912 =	2595.06	(98)
Space	e heatin	g require	ement ir	n kWh/m²	²/year								51.11	(99)
9a. En	ergy reo	quiremer	nts – Ind	lividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heati	•												
				econdar		mentary	-	(202) = 1	(201) -				0	(201)
				nain syst	. ,			(202) = 1 - (204) =		(202)1			1	(202)
			0	main sys				(204) = (2)	02) * [1 –	(203)] =			1	(204)
		•		ting syste			- 0/						90.9	(206)
ETTICI				ementar	-						1		0	(208)
Snac	Jan	Feb	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	488.98	400.31	349.66	206.52	93.24	0	0	0	0	207.73	354.95	493.65		
(211)m				100 ÷ (20			-							(211)
(211)11	537.94	440.39	384.67	227.2	102.57	0	0	0	0	228.53	390.49	543.07		(2)
			I	<u>I</u>				Tota	l (kWh/yea	ar) =Sum(2	1 211) _{15,10. 12}	I	2854.85	(211)
Space	e heatin	g fuel (s	econdar	ry), kWh/	month									
= {[(98)m x (20	01)]}x 1	00 ÷ (20)8)	i					1	1	i	L	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		-
								lota	I (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	F	0	(215)
	heating	-	ter (calc	ulated a	hove)									
Output	164.12		149.16	132.3	128.09	112.81	108.08	120.49	121.82	138.71	148.07	160.27		
Efficie	ncy of w	ater hea	iter										80.8	(216)
(217)m=	88.13	88	87.62	86.67	84.77	80.8	80.8	80.8	80.8	86.57	87.67	88.2		(217)
		heating,												
(219)m (219)m=		m x 100 162.91	$\frac{1}{170.23}$)m 152.65	151.1	139.62	133.77	149.12	150.76	160.24	168.89	181.71		
. ,								Tota	I = Sum(2	19a) ₁₁₂ =			1907.22	(219)
Annua	I totals	;								k	Wh/year		kWh/year	_
Space	heating	fuel use	ed, main	system	1								2854.85	
Water	heating	fuel use	d										1907.22	
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								
mech	anical v	entilatio	n - balar	nced, ext	ract or p	ositive i	nput from	n outside	Э			130.07		(230a)
centra	al heatir	ng pump	:									120		(230c)
Total e	lectricit	y for the	above,	kWh/yea	ır			sum	of (230a)	(230g) =	:		250.07	(231)
Electri	city for I	ighting											296.54	(232)
12a. (CO2 err	nissions ·	– Individ	lual heat	ing syste	ems inclu	uding mi	cro-CHF)					
						En	ergy			Emiss	ion fac	tor	Emissions	
						kΜ	/h/year			kg CO	2/kWh		kg CO2/yea	ar
Space	heating) (main s	ystem 1)		(217	1) x			0.2	16	=	616.65	(261)

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	411.96	(264)
Space and water heating	(261) + (262) + (263)	+ (264) =		1028.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	129.79	(267)
Electricity for lighting	(232) x	0.519	=	153.9	(268)
Total CO2, kg/year		sum of (265) (271) =		1312.3	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		25.85	(273)
EI rating (section 14)				82	(274)

		User	Details:					
Assessor Name: Software Name:	Oliver Morris Stroma FSAP 2012			e Version:			025430 n: 1.0.3.4	
A dalara e e	Landan NIMC AND	Property	Address: U	nit 3 propose	d			
Address : 1. Overall dwelling dimen	, London, NW6 1NR							
Ground floor					2.8	(2a) =	Volume(m ³) 145.91) (3a)
Total floor area TFA = (1a))+(1b)+(1c)+(1d)+(1e)	+(1n)	52.11 (4)					
Dwelling volume			(3:	a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	145.91	(5)
2. Ventilation rate:								
Number of chimneys Number of open flues Number of intermittent fan Number of passive vents	$ \begin{array}{c} \text{heating} & \text{he} \\ \hline 0 & + \\ \hline 0 & + \\ \hline \end{array} $	condary eating 0 + [0 + [other 0	total = 0 = 0 0 0 0	x 2	40 = [20 = [10 = [10 = [m³ per hou 0 0 0 0 0 0	r (6a) (6b) (7a) (7b)
Number of flueless gas fire	es			0	x 4	40 =	0	(7c)
Infiltration due to chimney	flues and fans - (63)+(6h)+(7a)+(7h)+	(7c) -			r	anges per ho	_
If a pressurisation test has be Number of storeys in the Additional infiltration	en carried out or is intended			0 tinue from (9) to	(16)	÷ (5) = -1]x0.1 =	0 0 0	(8) (9) (10)
Structural infiltration: 0.2 if both types of wall are pre deducting areas of opening If suspended wooden flo	sent, use the value corresp gs); if equal user 0.35	onding to the grea	ater wall area (a	after]	0	(11)
If no draught lobby, ente	er 0.05, else enter 0						0	(13)
Percentage of windows	and doors draught str	ipped					0	(14)
Window infiltration			0.25 - [0.2 x (· •			0	(15)
Infiltration rate				1) + (12) + (13)			0	(16)
Air permeability value, q		•	• •		envelope	area	5	(17)
If based on air permeabilit Air permeability value applies	-				and	l	0.25	(18)
Number of sides sheltered			egree all perme	ability is being u	seu	ſ	3	(19)
Shelter factor	•		(20) = 1 - [0.0	75 x (19)] =			0.78	(20)
Infiltration rate incorporatir	ng shelter factor		(21) = (18) x ((20) =			0.19	(21)
Infiltration rate modified fo	r monthly wind speed					L		
Jan Feb M	Mar Apr May	Jun Jul	Aug	Sep Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7		•					
· · · · · · · · · · · · · · · · · · ·	4.4 4.3	3.8 3.8	3.7	4 4.3	4.5	4.7		
Wind Factor (22a)m = (22))m ÷ 4	I	· ·		·	·		
(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		

Adjuste	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se					Г		(23a)
				endix N. (2	3b) = (23a	a) × Fmv (e	auation (N	N5)) . othe	rwise (23b) = (23a)		Ĺ	0.5	(23a)
						or in-use fa				, (,		L	0.5	(230)
			-	-	-					2h)m + (23h) x ['	L 1 – (23c)		(200)
(24a)m=		0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	. 100]	(24a)
b) If	balance	ed mecha		ntilation	without	heat rec	overv (N	I MV) (24b	m = (22)	1 2b)m + (;	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,					•	ve input v); otherv				.5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,					•	ve input v erwise (2				0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (240	c) or (24	d) in box	x (25)					
(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35		(25)
3. He	at losse	es and he	eat loss p	paramete	ər:									
ELEN		Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	<)	k-value kJ/m²⋅k		X k J/K
Doors						1.79	x	4.5						(26)
Windo.						1.79	^	1.5	=	2.685				
vvindov	ws Type	e 1				1.79		1.5 /[1/(1.4)+	!	2.685 1.91				(27)
	ws Type ws Type						x1		0.04] =					
Window		e 2				1.44	x1.	/[1/(1.4)+	0.04] =	1.91				(27)
Windov Windov	ws Type	e 2 e 3				1.44	x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] =	1.91 1.59				(27) (27)
Windov Windov	ws Type ws Type	e 2 e 3				1.44 1.2 1.91	x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] =	1.91 1.59 2.53			-] [(27) (27) (27)
Windov Windov Windov	ws Type ws Type ws Type	e 2 e 3	52	4.08		1.44 1.2 1.91 2.94	x1. x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] = 0.04] =	1.91 1.59 2.53 3.9				(27) (27) (27) (27)
Window Window Window Floor	ws Type ws Type ws Type Type1	e 2 e 3 e 4		4.08		1.44 1.2 1.91 2.94 52.11	x1. x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25	0.04] = 0.04] = 0.04] = 0.04] = =	1.91 1.59 2.53 3.9 13.0275				(27) (27) (27) (27) (27) (28)
Window Window Floor Walls	ws Type ws Type ws Type Fype1 Fype2	e 2 e 3 e 4 <u>42.6</u>	5			1.44 1.2 1.91 2.94 52.11 38.54	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25	0.04] = 0.04] = 0.04] = 0.04] = = = =	1.91 1.59 2.53 3.9 13.0275 9.63				(27) (27) (27) (27) (28) (28) (29)
Window Window Floor Walls T Walls T	ws Type ws Type ws Type Fype1 Fype2	e 2 e 3 e 4 <u>42.6</u> <u>6.5</u>	5	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25	0.04] = 0.04] = 0.04] = 0.04] = = = = = =	1.91 1.59 2.53 3.9 13.027! 9.63 0.43				(27) (27) (27) (27) (27) (28) (29) (29)
Window Window Floor Walls T Walls T Walls T Roof	ws Type ws Type ws Type Type1 Type2 Type3	e 2 e 3 e 4 <u>42.6</u> <u>19.3</u>	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ [0.25] 0.25 0.25 0.25	0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = =	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41				(27) (27) (27) (27) (28) (29) (29) (29)
Window Window Floor Walls T Walls T Walls T Roof	ws Type ws Type ws Type Type1 Type2 Type3	e 2 e 3 e 4 <u>42.6</u> <u>6.5</u> <u>19.3</u> <u>28.6</u>	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ [0.25] 0.25 0.25 0.25	0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = = = = =	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41				(27) (27) (27) (27) (28) (29) (29) (29) (29) (30)
Window Window Floor Walls T Walls T Walls T Roof Total a	ws Type ws Type ws Type Type1 Type2 Type3 rea of e vall	e 2 e 3 e 4 <u>42.6</u> <u>6.5</u> <u>19.3</u> <u>28.6</u>	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.24	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25 0.25 0.25	0.04] = 0.04] = 0.04] = 0.04] = = 0.04] = = = = = = = =	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41 4.59				(27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31)
Window Window Floor Walls T Walls T Walls T Roof Total a Party w	ws Type ws Type ws Type Type1 Type2 Type3 rea of e vall vall	e 2 e 3 e 4 <u>42.6</u> <u>6.5</u> <u>19.3</u> <u>28.6</u>	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.24 10.5	x1. x1. x1. x1. x1. x1. x1. x1. x2. x3. x4. x4. x4. x4. x4. x4. x4. x4. x4. x4	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25 0.25 0.25 0.16	0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = =	1.91 1.59 2.53 3.9 13.027 9.63 0.43 4.41 4.59 0				(27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (32)
Window Window Floor Walls T Walls T Roof Total a Party w Party w	ws Type ws Type ws Type Type1 Type2 Type3 rea of e vall vall	e 2 e 3 e 4 <u>42.6</u> <u>6.5</u> <u>19.3</u> <u>28.6</u>	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.24 10.5 8.02	x1. x1. x1. x1. x1. x1. x1. x x x x x x	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25 0.25 0.25 0.25 0.25	0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = =	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41 4.59 0 1.6				(27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (32) (32)
Window Window Floor Walls T Walls T Walls T Roof Total a Party w Party w Party o * for window	ws Type ws Type ws Type Type1 Type2 Type3 rea of e vall vall vall ceiling dows and	e 2 e 3 e 4 <u>42.6</u> <u>19.3</u> <u>28.6</u> elements	5 32 38 3, m ²	4.85 1.79 0	ndow U-ve	1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.24 10.5 8.02 13.41 52.11	x1. x1. x1. x1. x1. x1. x x x x x x x x	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25	0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = =	1.91 1.59 2.53 3.9 13.027! 9.63 0.43 4.41 4.59 0 1.6 0		paragraph		(27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (32) (32) (32)
Window Window Floor Walls T Walls T Walls T Roof Total a Party w Party w Party w Party o * for window	ws Type ws Type ws Type Type1 Type2 Type3 rea of e vall vall vall ceiling dows and te the area	e 2 e 3 e 4 <u>42.6</u> <u>6.5</u> <u>19.3</u> <u>28.6</u> elements	5 32 38 38 38 39, m ²	4.85 1.79 0	ndow U-ve	1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.24 10.5 8.02 13.41 52.11	x1. x1. x1. x1. x1. x1. x x x x x x x x	$ \begin{bmatrix} 1/(1.4) + \\ /[1/(1.4) + \\ /[1/(1.4) + \\ /[1/(1.4) + \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.26 \\ 0.25 \\ 0.26 \\ 0.26 \\ 0.26 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ $	0.04] = 0.04] = 0.04] = 0.04] = = = = = = = = = =	1.91 1.59 2.53 3.9 13.027! 9.63 0.43 4.41 4.59 0 1.6 0		paragraph		(27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (32) (32) (32)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

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

Indicative Value: Medium

250

(35)

can be i	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated (using Ap	pendix l	<						22.39	(36)
		al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
	abric he								(33) +	(36) =			70.61	(37)
Ventila	ation hea	at loss ca	alculated	monthl	/	-	-		(38)m	= 0.33 × (25)m x (5)		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	17.55	17.32	17.09	15.92	15.69	14.52	14.52	14.29	14.99	15.69	16.15	16.62		(38)
Heat t	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	88.16	87.93	87.7	86.53	86.3	85.13	85.13	84.9	85.6	86.3	86.76	87.23		
										-	Sum(39)1	₁₂ /12=	86.47	(39)
	<u> </u>	ameter (H	r - '	i		i	i			= (39)m ÷		i	1	
(40)m=	1.69	1.69	1.68	1.66	1.66	1.63	1.63	1.63	1.64	1.66	1.66	1.67		(
Numb	er of day	/s in moi	nth (Tab	le 1a)					/	Average =	Sum(40)1	₁₂ /12=	1.66	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
													1	
4 Wa	ater hea	ting enei	rav reau	irement [.]								kWh/ye	ear:	
			igy ioqu											
		upancy, l		1 4	(0 0000	ио (тг	- 40.0		040/			75		(42)
	A > 13. A £ 13.		+ 1.76 x	[1 - exp	(-0.0003	549 X (1F	-A -13.9)2)] + 0.0	JU13 X (IFA -13.	9)			
			ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		75	.82		(43)
		-				-	-	to achieve	a water us	se target o	f		1	
not mor	e that 125	litres per p	oerson pei I	r day (all w	ater use, i	not and co I	ia) I				·		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres per	I	acn montn I		i — — —	i — — —	 					1	
(44)m=	83.4	80.37	77.33	74.3	71.27	68.24	68.24	71.27	74.3	77.33	80.37	83.4		
Energy	content of	^f hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D)))))))))))))))))))			m(44) _{1 12} = ables 1b, 1		909.81	(44)
(45)m=	123.68	108.17	111.62	97.31	93.38	80.58	74.67	85.68	86.7	101.04	110.3	119.78		
											m(45)1 12 =		1192.9	(45)
lf instan	taneous v	vater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46					L	
(46)m=	18.55	16.23	16.74	14.6	14.01	12.09	11.2	12.85	13.01	15.16	16.54	17.97		(46)
	storage													
-							-	within sa	ime ves	sel		0		(47)
	•	neating a			•			• •			47)			
	storage		not wate	er (this in	iciudes i	nstantar	ieous co	mbi boil	ers) ente	er u in (47)			
	-	turer's de	eclared I	oss facto	or is kno	wn (kWł	n/dav):					0	1	(48)
		actor fro				(, a.a.j / .					0]	(49)
		om water			ar			(48) x (49)	_					(50)
		turer's de				or is not		(40) x (40)	-			0		(30)
		age loss		•								0		(51)
		neating s		on 4.3										
		from Ta										0		(52)
lempe	erature f	actor fro	m Table	2b								0		(53)

			-	e, kWh/y	ear			(47) x (51) x (52) x (53) =		0		(54)
	. ,	(54) in (5							·			0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = ((55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	57)m = (56)	m where (H11) is fro	om Append	lix H -	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41))m				-	
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	a cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 3	65 × (41))m		-	-	-		
(61)m=	42.5	36.99	39.41	36.64	36.32	33.65	34.77	36.32	36.64	39.41	39.63	42.5		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	= 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	166.18	145.16	151.03	133.96	129.69	114.23	109.44	122	123.34	140.45	149.93	162.28		(62)
Solar DI	HW input	calculated	using App	endix G o	Appendix	H (negati	ve quantity	/) (enter 'C)' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter		-	-	-	-	-	-	-	-		
(64)m=	166.18	145.16	151.03	133.96	129.69	114.23	109.44	122	123.34	140.45	149.93	162.28		_
								Out	put from w	ater heate	r (annual)₁	12	1647.68	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 >	(46)m	+ (57)m	+ (59)m]	
(65)m=	51.75	45.21	46.97	41.52	40.13	35.2	33.52	37.57	37.99	43.45	46.58	50.45		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table S	5 and 5a):									
Metab	olic gair	is (Table	e 5), Wat	tts									_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				-	
(67)m=	17.53	15.57	12.66	9.58	7.16	6.05	6.54	8.5	11.4	14.48	16.9	18.01		(67)
Applia	nces ga	ins (calc	ulated ir	n Appeno	dix L, eq	uation L	13 or L1	3a), also	o see Ta	ble 5	-			
(68)m=	152.71	154.3	150.3	141.8	131.07	120.98	114.25	112.66	116.65	125.16	135.89	145.97		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a)), also se	ee Table	5	-	-		
(69)m=	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76		(69)
Pumps	s and fa	ns gains	(Table :	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	, aporatic	n (nega	tive valu	es) (Tab	le 5)			1				1	
(71)m=	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09		(71)
Water	heating	gains (T	Table 5)	•									ı	
(72)m=	69.55	67.28	63.13	57.66	53.93	48.89	45.05	50.49	52.76	58.4	64.7	67.81		(72)
Total i	internal	gains =	:	!		(66)	ı m + (67)m	• • + (68)m ·	+ (69)m +	(70)m + (7	1)m + (72)	m	I	
(73)m=	292.08	289.43	278.37	261.33	244.45	228.21	218.12	223.94	233.1	250.32	269.77	284.08		(73)
	lar gains		1	1	1	1	1	1	1	1	1	1	1	

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	2.94	×	11.28	x	0.57	x	0.7	=	9.17	(75)
Northeast 0.9x	0.77	x	2.94	x	22.97	x	0.57	x	0.7	=	18.67	(75)
Northeast 0.9x	0.77	x	2.94	×	41.38	x	0.57	x	0.7	=	33.64	(75)
Northeast 0.9x	0.77	x	2.94	×	67.96	x	0.57	x	0.7	=	55.24	(75)
Northeast 0.9x	0.77	x	2.94	x	91.35	x	0.57	x	0.7	=	74.26	(75)
Northeast 0.9x	0.77	x	2.94	×	97.38	x	0.57	x	0.7	=	79.17	(75)
Northeast 0.9x	0.77	x	2.94	×	91.1	x	0.57	x	0.7	=	74.06	(75)
Northeast 0.9x	0.77	x	2.94	×	72.63	x	0.57	x	0.7	=	59.04	(75)
Northeast 0.9x	0.77	x	2.94	x	50.42	x	0.57	x	0.7	=	40.99	(75)
Northeast 0.9x	0.77	x	2.94	×	28.07	x	0.57	x	0.7	=	22.82	(75)
Northeast 0.9x	0.77	x	2.94	×	14.2	x	0.57	x	0.7	=	11.54	(75)
Northeast 0.9x	0.77	x	2.94	×	9.21	x	0.57	x	0.7	=	7.49	(75)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.57	x	0.7	=	29.3	(77)
Southeast 0.9x	0.77	x	1.2	×	36.79	x	0.57	x	0.7	=	12.21	(77)
Southeast 0.9x	0.77	x	1.91	x	36.79	x	0.57	x	0.7	=	19.43	(77)
Southeast 0.9x	0.77	x	1.44	×	62.67	x	0.57	x	0.7	=	49.91	(77)
Southeast 0.9x	0.77	x	1.2	×	62.67	x	0.57	x	0.7	=	20.8	(77)
Southeast 0.9x	0.77	x	1.91	×	62.67	x	0.57	x	0.7	=	33.1	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.57	x	0.7	=	68.29	(77)
Southeast 0.9x	0.77	x	1.2	×	85.75	x	0.57	x	0.7	=	28.45	(77)
Southeast 0.9x	0.77	x	1.91	×	85.75	x	0.57	x	0.7	=	45.29	(77)
Southeast 0.9x	0.77	x	1.44	×	106.25	x	0.57	x	0.7	=	84.61	(77)
Southeast 0.9x	0.77	x	1.2	×	106.25	x	0.57	x	0.7	=	35.26	(77)
Southeast 0.9x	0.77	x	1.91	x	106.25	x	0.57	x	0.7	=	56.11	(77)
Southeast 0.9x	0.77	x	1.44	×	119.01	x	0.57	x	0.7	=	94.77	(77)
Southeast 0.9x	0.77	x	1.2	×	119.01	x	0.57	x	0.7	=	39.49	(77)
Southeast 0.9x	_	x	1.91	×	119.01	x	0.57	x	0.7	=	62.85	(77)
Southeast 0.9x	0.77	x	1.44	×	118.15	x	0.57	x	0.7	=	94.09	(77)
Southeast 0.9x	0.77	x	1.2	×	118.15	x	0.57	x	0.7	=	39.2	(77)
Southeast 0.9x	0.77	x	1.91	×	118.15	x	0.57	x	0.7	=	62.4	(77)
Southeast 0.9x	0.77	x	1.44	×	113.91	x	0.57	x	0.7	=	90.71	(77)
Southeast 0.9x	0.77	x	1.2	x	113.91	x	0.57	x	0.7	=	37.8	(77)
Southeast 0.9x	_	x	1.91	x	113.91	x	0.57	x	0.7	=	60.16	(77)
Southeast 0.9x	0.77	x	1.44	×	104.39	x	0.57	x	0.7	=	83.13	(77)
Southeast 0.9x	0.77	x	1.2	×	104.39	x	0.57	x	0.7	=	34.64	(77)
Southeast 0.9x	0.1.1	x	1.91	×	104.39	x	0.57	x	0.7	=	55.13	(77)
Southeast 0.9x		x	1.44	×	92.85	x	0.57	x	0.7	=	73.94	(77)
Southeast 0.9x		x	1.2	×	92.85	x	0.57	x	0.7	=	30.81	(77)
Southeast 0.9x	0.77	x	1.91	x	92.85	x	0.57	x	0.7	=	49.04	(77)

					_										
Southeast 0.9x	0.77	×	1.4	4	x	6	9.27	X		0.57	×	0.7	=	55.16	(77)
Southeast 0.9x	0.77	x	1.	2	x	6	9.27	x		0.57	x	0.7	=	22.98	(77)
Southeast 0.9x	0.77	x	1.9	91	x	6	9.27	x		0.57	x	0.7	=	36.58	(77)
Southeast 0.9x	0.77	x	1.4	14	x [4	4.07	x		0.57	×	0.7	=	35.1	(77)
Southeast 0.9x	0.77	x	1.	2	x [4	4.07	x		0.57	×	0.7	=	14.62	(77)
Southeast 0.9x	0.77	x	1.9	91	x [4	4.07	x		0.57	×	0.7	=	23.27	(77)
Southeast 0.9x	0.77	x	1.4	14	x [3	1.49	x		0.57	×	0.7	=	25.08	(77)
Southeast 0.9x	0.77	×	1.	2	x [3	1.49	x		0.57	×	0.7	=	10.45	(77)
Southeast 0.9x	0.77	×	1.9	91	x [3	1.49	x		0.57	×	0.7	=	16.63	(77)
					-										
Solar gains in	watts, ca	alculated	for eac	h month				(83)m	າ = Sເ	ım(74)m	(82)m				
(83)m= 70.11	122.48	175.67	231.23	271.37	27	74.86	262.72	231	.94	194.78	137.54	84.53	59.64		(83)
Total gains –	internal a	nd solar	(84)m =	= (73)m ·	+ (8	33)m	, watts		•			•			
(84)m= 362.19	411.91	454.04	492.56	515.83	50	03.07	480.84	455	.88	427.88	387.86	354.3	343.72]	(84)
7. Mean inte	rnal tem	oerature	(heating	season)							•	-	-	
Temperature			`		<i>.</i>	area f	rom Tab	ole 9.	. Th′	1 (°C)				21	(85)
Utilisation fac	0	0.			Ŭ				,	(-)					
Jan	Feb	Mar	Apr	May	È	Jun	Jul	A	ug	Sep	Oct	Nov	Dec]	
(86)m= 1	0.99	0.99	0.97	0.92	-).82	0.68	0.7	<u> </u>	0.9	0.98	0.99	1		(86)
Mean interna	I al temper	atura in l	living ar	1 22 T1 (fr		w sta	ns 3 to 7	I 7 in T						1	
(87)m= 19.18	19.35	19.65	20.06	20.46	1	0.78	20.92	20.	-	20.66	20.14	19.59	19.15	1	(87)
					I						20.11	10.00	10.10]	()
Temperature	· · ·	<u> </u>		i	1				-			I		1	(00)
(88)m= 19.55	19.55	19.55	19.57	19.57	19	9.59	19.59	19.	59	19.58	19.57	19.57	19.56		(88)
Utilisation fac	ctor for g	ains for r	est of d	welling,	h2,	m (se	e Table	9a)						_	
(89)m= 0.99	0.99	0.98	0.95	0.88	0).72	0.51	0.5	56	0.83	0.96	0.99	1		(89)
Mean interna	al temper	ature in t	the rest	of dwelli	ing	T2 (fo	ollow ste	eps 3	to 7	in Tabl	e 9c)				
(90)m= 17.18	17.43	17.87	18.48	19.03	<u> </u>	9.44	19.56	19.		19.3	, 18.6	17.8	17.16]	(90)
L					1					f	LA = Livi	ng area ÷ (4) =	0.54	(91)
Maan interne	ltompor	oturo (fo	r tha wh	olo duvo	Ilina	~) fl	Λ ν Τ1	. (1	41	A) ب TO					
Mean interna (92)m= 18.26	18.47	18.83	19.33	19.81	<u> </u>) = 11 0.17	20.3	+ (1		20.04	19.44	18.77	18.24	1	(92)
. ,												10.77	10.24	J	(52)
Apply adjust	18.32	18.68	19.18	19.66	-	0.02	20.15	4e, 20.		19.89	19.29	18.62	18.09	1	(93)
8. Space hea	1			10.00		0.02	20.10		10	10.00	10.20	10.02	10.00		(00)
Set Ti to the				re obtair	bod	at sta	on 11 of	Tabl	la Oh	so tha	t Ti m-	(76)m an	d re-cal	culato	
the utilisation					ieu	aisit	50 11 01	Tabl		, so ina	t 11,111—	(70)11 an	u ie-cai	Julate	
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fa	ctor for g	ains, hm	:											•	
(94)m= 0.99	0.99	0.98	0.95	0.89	0).76	0.58	0.6	63	0.85	0.96	0.99	0.99		(94)
Useful gains	, hmGm	, W = (94	1)m x (8∙	4)m								-	-	_	
(95)m= 359.44	406.66	443.32	467.69	457.77	38	30.96	281.02	288	.08	362.04	371.83	349.74	341.57		(95)
Monthly aver	rage exte	rnal tem	perature	e from Ta	able	e 8						-		•	
(96)m= 4.3	4.9	6.5	8.9	11.7	1	4.6	16.6	16	.4	14.1	10.6	7.1	4.2	J	(96)
Heat loss rat	1	· · · · ·		r	Lm	, W =	- ,		<u> </u>	. ,]			1	
(97)m= 1217.67	1179.95	1068.29	889.79	686.63	46	61.12	302.18	316	.95	495.32	749.65	999.61	1211.3	J	(97)

(98)m=	638.53	519.66	464.98	303.91	170.27	0)iii - (33	281.1	467.91	647.07		
(50)11-	000.00	010.00	404.00	000.01	170.27	0	0	-	l per year				3493.43	(98)
Space	- hoatin	a roquir	omont ir	ı kWh/m²	2/voor			Tota	i por your	(ittiniyoui) – Oum(o	••••••••••••••••••••••••••••••••••••••		(99)
		• •			•								67.04	(99)
			nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heatiı on of sp	-	at from s	econdar	y/supple	mentary	v system						0	(201)
	-			nain syst		,	•	(202) = 1 -	– (201) =				1	(202)
	-			main sys				(204) = (2	02) × [1 –	(203)] =			1	(204)
			-	ting syste									90.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	∟ ar
Space			I	alculate									.,	
	638.53	519.66	464.98	303.91	170.27	0	0	0	0	281.1	467.91	647.07		
(211)m	n = {[(98)m x (20)4)] } x 1	100 ÷ (20	06)		•				•			(211)
	702.45	571.68	511.53	334.34	187.32	0	0	0	0	309.24	514.75	711.85		
		-		-		-		Tota	al (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	2	3843.15	(211)
•		•		∙y), kWh/	month									
		r	00 ÷ (20	T	1	1	1	1	1	1	1		1	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	<u> </u>	٦
								lota	al (kWh/yea	ar) = Sum(2)	215) _{15,10. 12}	2=	0	(215)
	heating	•	4 <i>(</i>		h a a)									
Output	166.18	ater nea 145.16	151.03	ulated a	129.69	114.23	109.44	122	123.34	140.45	149.93	162.28		
Efficier	ncy of w	ater hea	iter										80.8	(216)
(217)m=	88.61	88.48	88.2	87.55	86.24	80.8	80.8	80.8	80.8	87.27	88.22	88.68		(217)
Fuel fo	r water	heating,	kWh/m	onth										
` ') ÷ (217)	Ĩ										
(219)m=	187.53	164.05	171.24	153	150.39	141.37	135.44	150.99	152.65 al = Sum(2	160.95	169.94	183		
A								TOLA	u – Suni(z		A/lb /		1920.56	(219)
	I totals heating		ed. main	system	1					ĸ	Wh/year		kWh/year 3843.15	7
	•	fuel use		-,									1920.56	-
	-												1920.30	
		•		electric	•								1	
mech	anical v	entilatio	∩ - balar	nced, ext	ract or p	ositive i	nput fron	n outside	e			133.51		(230a)
centra	al heatir	ng pump	:									30		(230c)
Total e	lectricit	y for the	above,	kWh/yea	ır			sum	of (230a)	(230g) =			163.51	(231)
Electric	city for l	ighting											309.52	(232)
12a. (CO2 em	issions ·	– Individ	lual heat	ing sys <u>t</u> e	ems inclu	uding mi	cro-CHP						
						Γ	0.101			Emica	ion fo-	10r	Emicologia	
							e rgy /h/year			kg CO	ion fac 2/kWh		Emissions kg CO2/yea	

Space heating (main system 1)	(211) x	0.216	=	830.12	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.84	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1244.96	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	84.86	(267)
Electricity for lighting	(232) x	0.519	=	160.64	(268)
Total CO2, kg/year	sum	of (265) (271) =		1490.46	(272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =		28.6	(273)
El rating (section 14)				79	(274)

		User D	etails:					
	Oliver Morris Stroma FSAP 2012		Stroma Nun Software Ve	rsion:			025430 n: 1.0.3.4	
		Property A	Address: Unit 4	proposed				
Address : 1. Overall dwelling dimens	, London, NW6 1NR							
T. Overall dwelling dimens	sions:	Area	u(m²)	Av. Hei	aht(m)		Volume(m ³))
Ground floor			1.43 (1a) x		96	(2a) =	211.43	(3a)
Total floor area TFA = (1a)-	+(1b)+(1c)+(1d)+(1e)+	·(1n) 7	1.43 (4)					_
Dwelling volume			(3a)+(3l	o)+(3c)+(3d)	+(3e)+	.(3n) =	211.43	(5)
2. Ventilation rate:						-		_
		ondary ating	other	total			m ³ per hour	•
Number of chimneys			0 =	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0 =	0	x 2	20 =	0	(6b)
Number of intermittent fans				0	x 1	0 =	0	(7a)
Number of passive vents				0	x 1	0 =	0	(7b)
Number of flueless gas fire	S			0	x 4	40 =	0	(7c)
						Air ch	anges per ho	ur
Infiltration due to chimneys	flues and fans = $(6a)$ +	+(6b)+(7a)+(7b)+(7	7c) =	0	_	÷ (5) = [](8)
If a pressurisation test has bee				-		. (0) –	0	
Number of storeys in the	dwelling (ns)					[0	(9)
Additional infiltration					[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0.25 if both types of wall are pres deducting areas of openings	ent, use the value correspo		•	ruction		l	0	(11)
If suspended wooden floo		d) or 0.1 (seale	d), else enter 0			[0	(12)
If no draught lobby, enter	0.05, else enter 0					ĺ	0	(13)
Percentage of windows a	and doors draught strip	pped				[0	(14)
Window infiltration			0.25 - [0.2 x (14) ÷	100] =		[0	(15)
Infiltration rate			(8) + (10) + (11) + (12) + (13) +	(15) =	[0	(16)
Air permeability value, q		•	· ·	netre of ei	nvelope	area	5	(17)
If based on air permeability							0.25	(18)
Air permeability value applies in Number of sides sheltered	a pressurisation test has be	een done or a deg	ree air permeability	is being us	ea	ſ	2	(19)
Shelter factor			(20) = 1 - [0.075 x ([19)] =			0.85	(13)
Infiltration rate incorporating	g shelter factor		(21) = (18) x (20) =			Ĺ	0.21	(21)
Infiltration rate modified for	monthly wind speed					L		_
Jan Feb M	ar Apr May	Jun Jul	Aug Sep	Oct	Nov	Dec		
Monthly average wind spee	ed from Table 7							
(22)m= 5.1 5 4.1	9 4.4 4.3	3.8 3.8	3.7 4	4.3	4.5	4.7		
Wind Factor $(22a)m = (22)r$	n ÷ 4							
(22a)m= 1.27 1.25 1.2	23 1.1 1.08	0.95 0.95	0.92 1	1.08	1.12	1.18		

Adjuste	ed infiltra	tion rate	e (allowir	ng for sh	nelter an	d wind sp	peed) =	(21a) x (22a)m					
	0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25		
	<i>ate effect</i> echanical		-	ate for t	he appli	cable cas	se							(220)
	aust air hea			ndix N (2	3b) = (23a) × Fmv (er	nuation (N	(15)) other	vise (23h	(23a) = (23a)		l	0.5	(23a)
	anced with									()		L T	0.5	(23b)
	balanced		•		Ũ		,	,		2b)m + ('	22h) x [1	 1 _ (23c)	76.5 · 1001	(23c)
(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	÷ 100]	(24a)
	balanced											0.01		
(24b)m=		0		0	0		0		0		0	0		(24b)
	whole ho	use ext	ract ven	tilation o	or positiv	e input v	entilatio	n from o	utside					
,	if (22b)m				•	•				.5 × (23b)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,	natural v				•	•								
	if (22b)m	r			,	r i r		<u> </u>	2b)m² x	0.5]				
(24d)m=		0	0	0	0	0	0	0	0	0	0	0		(24d)
	ctive air c		r		, <u>,</u>	, <u> </u>	, 、	rí – r	. ,					
(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37		(25)
3. He	at losses	and he	at loss p	aramete	ər:									
ELEN	IENT	Gros area (-	Openin m		Net Are A ,m		U-valu W/m2l		A X U (W/ł	<)	k-value kJ/m²⋅k		A X k kJ/K
Doors						1.79	x	1.5	=	2.685				(26)
Windo	ws Type	1				0.98	x1.	/[1/(1.4)+	0.04] =	1.3				(27)
Window	ws Type	2				2.17	x1.	/[1/(1.4)+	0.04] =	2.88				(27)
Window	ws Type	3				3.96	x1.	/[1/(1.4)+	0.04] =	5.25				(27)
Window	ws Type	4				1.4	x1.	/[1/(1.4)+	0.04] =	1.86				(27)
Window	ws Type	5				1.4	x1.	/[1/(1.4)+	0.04] =	1.86				(27)
Rooflig	hts					0.3	x1.	/[1/(1.6) + 0	.04] =	0.48				(27b)
Walls ⁻	Гуре1	11.56	3	0		11.56	x	0.25	=	2.89	Ξ r			(29)
Walls -	Гуре2	12.34	4	7.91		4.43	×	0.28		1.24	T T		i –	(29)
Walls -	Гуре3	34.4		3.96	;	30.44	×	0.25		7.61	i r		i –	(29)
Walls -	Гуре4	2.33		1.4		0.93	×	0.28		0.26	i r		i –	(29)
Walls ⁻	Гуре5	5.22		1.79	, ,	3.43	×	0.25	=	0.86			i –	(29)
Roof 1	Гуре1	34.65	5	0		34.65	×	0.18	=	6.24			i –	(30)
Roof 1	Гуре2	19.14	4	0		19.14	×	0.18		3.45	- 7		\exists	(30)
		L		L			x	0.2	Ξ_		=		\dashv	(30)
Roof 1	ГуреЗ	1.59		0		1.59	^	0.2	=	0.32			1 1	(30)
Roof T Roof T		1.59		0.6		1.59 14.89		0.2		2.38	╡┟			(30)
	Гуре4	r)				=	0.16		-				
Roof T Roof T	Гуре4	15.49 16.47	ə 7	0.6		14.89	x x			2.38				(30)

Party f	loor					73.1					Г		-	(32a)
					indow U-va Is and part		lated using	formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	3.2	
Fabric	heat los	s, W/K =	= S (A x	U)				(26) (30)	+ (32) =]	49.39	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	9812.48	(34)
Therm	al mass	parame	ter (TMF	- = Cm -	÷ TFA) ir	n kJ/m²K	,		Indica	tive Value	: Medium	ſ	250	(35)
	•		ere the de tailed calc		construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix l	K]	22.98	(36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)						L		
Total fa	abric he	at loss							(33) +	(36) =		[72.36	(37)
Ventila	tion hea	at loss ca	alculated	monthl	у	-			(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	27.1	26.73	26.36	24.51	24.14	22.28	22.28	21.91	23.03	24.14	24.88	25.62		(38)
Heat tr	ansfer c	coefficier	nt, W/K				-	-	(39)m	= (37) + (38)m			
(39)m=	99.47	99.1	98.72	96.87	96.5	94.65	94.65	94.28	95.39	96.5	97.24	97.98		
Heat lo	oss para	meter (H	HLP), W/	/m²K	1					Average = = (39)m ÷	Sum(39)₁ · (4)	₁₂ /12=	96.78	(39)
(40)m=	1.39	1.39	1.38	1.36	1.35	1.33	1.33	1.32	1.34	1.35	1.36	1.37		
									·	Average =	Sum(40)1	₁₂ /12=	1.35	(40)
Numbe	er of day	's in moi	nth (Tab	le 1a)										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
Assum if TF	ied occu	ipancy, I 9, N = 1			(-0.0003	349 x (TF	FA -13.9)2)] + 0.()013 x (TFA -13		kWh/ye	al.	(42)
Annua <i>Reduce</i>	l averag	e hot wa al average	hot water	usage by		welling is	designed	(25 x N) to achieve		se target o		.36		(43)
Hot wate	Jan er usage ii	Feb n litres per	Mar day for ea	Apr ach month	May Vd,m = fa	Jun ctor from T	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	97.19	93.66	90.13	86.59	83.06	79.52	79.52	83.06	86.59	90.13	93.66	97.19		
										I Total = Su	I m(44) _{1 12} =	-	1060.3	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	0Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	144.14	126.06	130.08	113.41	108.82	93.9	87.02	99.85	101.04	117.76	128.54	139.59		
										Total = Su	m(45) _{1 12} =		1390.21	(45)
lf instan	taneous w	ater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)			-		
(46)m=	21.62	18.91	19.51	17.01	16.32	14.09	13.05	14.98	15.16	17.66	19.28	20.94		(46)
	storage						-		•					
-		. ,					-	within sa	ame ves	sel		0		(47)
Otherv	vise if no	stored			velling, e ncludes i			(47) ombi boil	ers) ente	er '0' in ((47)			
	storage		oclared I	nss fact	or is kno	wn (k\//	n/dav).]		(48)
	anulau					**** (12.841	"uuy).					0		(48)
Tomor	erature fa	actor tra												

			storage	•				(48) x (49)) =			0		(50)
,			eclared of factor fr	•									I	(54)
		•	ee secti			n/iitie/ua	iy)					0		(51)
	•	from Ta		011 4.0								0	l	(52)
			m Table	2b								0		(53)
Enera	v lost fro	m water	· storage	. kWh/ve	ear			(47) x (51)) x (52) x (53) =		0		(54)
•••		(54) in (5	-	, .,								0		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m			I	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	l	(56)
	-	•	d solar sto	-	-	-	-	-	-	-	-	-	l lix H	()
-	0	0	0	0	0	0	0	0	0	0	0	0		(57)
(57)m=	0	0	0	0	0	0	0	0	0	0		0		
	•		nnual) fro									0		(58)
	•		culated f				. ,	. ,		* *!= ~ **** ~	atat)			
		r	rom Tab	1	r		r	r –	r -	r	, 	0	l	(59)
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 3	65 × (41)m		i				
(61)m=	49.53	43.11	45.93	42.7	42.32	39.22	40.52	42.32	42.7	45.93	46.19	49.53		(61)
Total h	neat req	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	193.66	169.17	176.01	156.11	151.15	133.12	127.54	142.18	143.75	163.68	174.73	189.12		(62)
Solar DH	-IW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter							-				
(64)m=	193.66	169.17	176.01	156.11	151.15	133.12	127.54	142.18	143.75	163.68	174.73	189.12		
								Outp	out from w	ater heate	r (annual)₁	12	1920.22	(64)
Heat a	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	1	_
-			54.73			-			-			58.8	-	(65)
			ulation of										eating	
	. ,		e Table 5	. ,	-	ymraer i		attening	or not n		on con	in any i	louing	
)•									
Metab	Jan	Feb	e 5), Wat Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02		(66)
			ted in Ap								111.02	111.02		()
(67)m=	22.57	20.04	16.3	12.34	9.22	7.79	8.41	10.94	14.68	18.64	21.76	23.19		(67)
											21.70	23.19		(07)
	<u> </u>	· · · · · · · · · · · · · · · · · · ·	ulated in	· · ·	· · · ·		i	,	i		470.54	404 70	I	(69)
(68)m=	200.61	202.69	197.45	186.28	172.18	158.93	150.08	148	153.25	164.41	178.51	191.76		(68)
	<u> </u>	· · · · · · · · · · · · · · · · · · ·	ated in A	· ·	L, equat		· · · · · ·		1	r			l .	
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4		(69)
Pumps	and fa	ns gains	(Table 5	ōa)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	aporatic	on (negat	tive valu	es) (Tab	le 5)								
(71)m=	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21		(71)

Water heating	gains (Ta	able 5)														
(72)m= 81.06	78.41	73.57	67.2	62.85	5	6.98	52.5	58.	85	61.49	68.06	75.4	79.03	3		(72)
Total interna	l gains =				•	(66)	m + (67)m	n + (68	3)m +	(69)m + (7	70)m +	(71)m + (72))m			
(73)m= 364.44	361.35	347.52	326.02	304.47	2	83.91	271.21	277	.99	289.62	311.3	2 335.87	354.1	8		(73)
6. Solar gain	IS:															
Solar gains are	calculated u	sing solar	flux from	Table 6a	a and	associ	ated equa	tions	to con	vert to the	e applic	able orientat	ion.			
Orientation:		actor	Area			Flu				g_		FF			Gains	
	Table 6d		m²			Tat	ole 6a	_	18	ble 6b	_	Table 6c		_	(W)	
Northeast 0.9x	0.77	x	3.9	6	x	1	1.28	x		0.57	×	0.7		=	12.35	(75)
Northeast 0.9x	0.77	x	1.4	4	x	1	1.28	x		0.57	×	0.7		=	8.74	(75)
Northeast 0.9x	0.77	x	1.4	4	x	1	1.28	x		0.57	×	0.7		= [4.37	(75)
Northeast 0.9x	0.77	x	3.9	6	x	2	2.97	x		0.57	×	0.7		= [25.15	(75)
Northeast 0.9x	0.77	x	1.4	4	x	2	2.97	x		0.57	×	0.7		= [17.78	(75)
Northeast 0.9x	0.77	x	1.4	4	x	2	2.97	x		0.57	x	0.7		= [8.89	(75)
Northeast 0.9x	0.77	x	3.9	6	x	4	1.38	x		0.57	x	0.7		= [45.31	(75)
Northeast 0.9x	0.77	x	1.4	4	x	4	1.38	x		0.57	×	0.7		= [32.04	(75)
Northeast 0.9x	0.77	x	1.4	4	x	4	1.38	x		0.57	x	0.7		= [16.02	(75)
Northeast 0.9x	0.77	x	3.9	6	x	6	7.96	x		0.57	x	0.7		= [74.41	(75)
Northeast 0.9x	0.77	x	1.4	4	x	6	7.96	x		0.57	x	0.7		= [52.61	(75)
Northeast 0.9x	0.77	x	1.4	4	x	6	7.96	x		0.57	x	0.7		= [26.31	(75)
Northeast 0.9x	0.77	x	3.9	6	x	9	1.35	x		0.57	x	0.7		= [100.02	(75)
Northeast 0.9x	0.77	x	1.4	4	x	9	1.35	x		0.57	x	0.7		= [70.72	(75)
Northeast 0.9x	0.77	x	1.4	4	x	9	1.35	x		0.57	×	0.7		= [35.36	(75)
Northeast 0.9x	0.77	x	3.9	6	x	9	7.38	x		0.57	x	0.7		= [106.63	(75)
Northeast 0.9x	0.77	x	1.4	4	x	9	7.38	x		0.57	x	0.7		= [75.4	(75)
Northeast 0.9x	0.77	x	1.4	4	x	9	7.38	x		0.57	×	0.7		= [37.7	(75)
Northeast 0.9x	0.77	x	3.9	6	x	Į į	91.1	x		0.57	×	0.7		= [99.75	(75)
Northeast 0.9x	0.77	x	1.4	4	x	ę	91.1	x		0.57	×	0.7		= [70.53	(75)
Northeast 0.9x	0.77	x	1.4	4	x		91.1	x		0.57	×	0.7		= [35.27	(75)
Northeast 0.9x	0.77	x	3.9	6	x	7	2.63	x		0.57	×	0.7		= [79.52	(75)
Northeast 0.9x	0.77	x	1.4	4	x	7	2.63	x		0.57	×	0.7		= [56.23	(75)
Northeast 0.9x	0.77	x	1.4	4	x	7	2.63	x		0.57	x	0.7		= [28.11	(75)
Northeast 0.9x	0.77	x	3.9	6	x	5	0.42	x		0.57	x	0.7		= [55.21	(75)
Northeast 0.9x	0.77	x	1.4	4	x	5	0.42	x		0.57	×	0.7		= [39.04	(75)
Northeast 0.9x	0.77	x	1.4	4	x	5	0.42	x		0.57	×	0.7		= [19.52	(75)
Northeast 0.9x	0.77	x	3.9	6	x	2	8.07	x		0.57	×	0.7		= [30.73	(75)
Northeast 0.9x	0.77	×	1.4	4	x	2	8.07	x		0.57	x	0.7		= [21.73	(75)
Northeast 0.9x	0.77	x	1.4		x	2	8.07	x		0.57	×	0.7		= [10.87	(75)
Northeast 0.9x		×	3.9		x		14.2	x		0.57	×	0.7		= [15.55	(75)
Northeast 0.9x	0.77	×	1.4	4	x		14.2	×		0.57	×	0.7		= [10.99	(75)
						B		•	-					-		

Northeast 0.9x	0.77) ×	1.4	×	14.2	×	0.57	x	0.7	=	5.5	(75)
Northeast 0.9x	0.77	l x	3.96	x x	9.21	x x	0.57	x	0.7	- =	10.09	(75)
Northeast 0.9x	0.77	l ^ l x	1.4	x	9.21	x	0.57	x	0.7	-	7.13	(75)
Northeast 0.9x	0.77) ^ x	1.4	x	9.21	x x	0.57	x	0.7	=	3.57	(75)
Southeast 0.9x	0.77) ^ x	0.98	x x	36.79	x x	0.57	x	0.7	=	29.91	(77)
Southeast 0.9x	0.77	^ x	2.17	x	36.79	x x	0.57	x	0.7	=	23.91	(<i>11)</i> (77)
Southeast 0.9x	0.77) ^ x	0.98	x	62.67	x x	0.57	x	0.7	=	50.95	(<i>)</i> (77)
Southeast 0.9x	0.77	^ x	2.17	x	62.67	x	0.57	x	0.7	 =	37.61	(77)
Southeast 0.9x	0.77) ^ x	0.98	x	85.75	x x	0.57	x	0.7	=	69.71	(77)
Southeast 0.9x	0.77] x	2.17	l x	85.75	 x	0.57	x	0.7	 =	51.45	(77)
L Southeast 0.9x	0.77) x	0.98	l x	106.25	x	0.57	x	0.7	=	86.38	
Southeast 0.9x	0.77	」 】	2.17	x	106.25	x	0.57	x	0.7	=	63.75	
Southeast 0.9x	0.77	x	0.98	x	119.01	x	0.57	x	0.7	=	96.75	
Southeast 0.9x	0.77	」 x	2.17	x	119.01	x	0.57	x	0.7	=	71.41	(77)
Southeast 0.9x	0.77	x	0.98	x	118.15	x	0.57	x	0.7	=	96.05	(77)
Southeast 0.9x	0.77	x	2.17	x	118.15	×	0.57	x	0.7	=	70.89	(77)
Southeast 0.9x	0.77	x	0.98	x	113.91	x	0.57	x	0.7	=	92.6	(77)
Southeast 0.9x	0.77	x	2.17	x	113.91	×	0.57	x	0.7	=	68.35	(77)
Southeast 0.9x	0.77	x	0.98	x	104.39	x	0.57	x	0.7	=	84.86	(77)
Southeast 0.9x	0.77	x	2.17	x	104.39	×	0.57	x	0.7	=	62.64	(77)
Southeast 0.9x	0.77	x	0.98	x	92.85	x	0.57	x	0.7	=	75.48	(77)
Southeast 0.9x	0.77	x	2.17	x	92.85	x	0.57	x	0.7	=	55.71	(77)
Southeast 0.9x	0.77	x	0.98	x	69.27	x	0.57	x	0.7	=	56.31	(77)
Southeast 0.9x	0.77	x	2.17	x	69.27	×	0.57	x	0.7	=	41.56	(77)
Southeast 0.9x	0.77	x	0.98	x	44.07	×	0.57	x	0.7	=	35.83	(77)
Southeast 0.9x	0.77	x	2.17	x	44.07	×	0.57	x	0.7	=	26.44	(77)
Southeast 0.9x	0.77	x	0.98	x	31.49	x	0.57	x	0.7	=	25.6	(77)
Southeast 0.9x	0.77	x	2.17	x	31.49	x	0.57	x	0.7	=	18.89	(77)
Rooflights 0.9x	1	x	0.3	x	26	×	0.63	x	0.7	=	6.19	(82)
Rooflights 0.9x	1	x	0.3	x	54	×	0.63	x	0.7	=	12.86	(82)
Rooflights 0.9x	1	x	0.3	x	96	x	0.63	x	0.7	=	22.86	(82)
Rooflights 0.9x	1	×	0.3	x	150	x	0.63	x	0.7	=	35.72	(82)
Rooflights 0.9x	1	×	0.3	x	192	x	0.63	x	0.7	=	45.72	(82)
Rooflights 0.9x	1	×	0.3	x	200	×	0.63	x	0.7	=	47.63	(82)
Rooflights 0.9x	1	×	0.3	x	189	x	0.63	x	0.7	=	45.01	(82)
Rooflights 0.9x	1	x	0.3	×	157	×	0.63	x	0.7	=	37.39	(82)
Rooflights 0.9x	1	×	0.3	x	115	×	0.63	x	0.7	=	27.39	(82)
Rooflights 0.9x	1	×	0.3	×	66	×	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	×	0.3	×	33	×	0.63	x	0.7	=	7.86	(82)
Rooflights 0.9x	1	×	0.3	×	21	×	0.63	x	0.7	=	5	(82)

Solar g	ains in	watts, ca	alculated	for eacl	n month			(83)m = S	um(74)m	(82)m			
(83)m=	83.64	153.23	237.39	339.18	419.98	434.3	411.51	348.75	272.35	176.92	102.16	70.28	(83)

(84)m=	448.08	514.59	584.91	665.2	724.45	718.2	682.71	626.74	561.97	488.23	438.03	424.46		(84)
7. Me	an inter	nal temp	erature	(heating	season)								
Temp	erature	during h	eating p	eriods ir	n the livii	ng area t	from Tab	ole 9, Th	1 (°C)				21	(85)
		-	• •		ea, h1,m	-			、 ,					
-	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.99	0.96	0.89	0.74	0.58	0.65	0.88	0.98	1	1		(86)
									. 0)					
	19.47	19.63	19.92	20.33	20.68	20.91	20.98	7 in Table 20.96	e 9C) 20.79	20.33	19.84	19.46		(87)
(87)m=	19.47	19.05	19.92	20.33	20.00	20.91	20.96	20.90	20.79	20.33	19.04	19.40		(07)
				i	i		r	able 9, Tl	h2 (°C)					
(88)m=	19.77	19.77	19.78	19.8	19.8	19.82	19.82	19.83	19.81	19.8	19.79	19.79		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.95	0.85	0.64	0.44	0.5	0.8	0.97	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	17.75	18	18.42	19.01	19.49	19.76	19.81	19.81	19.64	, 19.03	18.31	17.74		(90)
I									f	LA = Livin	g area ÷ (4	4) =	0.51	(91)
Maan	intorna	Itompor	oturo (fo	r tho wh	olo dwo	lling) – fl	I A V T1	. (1 fl	$\Lambda \to T_2$			l		
(92)m=	18.64	18.84	19.19	19.69	20.1	20.35	20.41	+ (1 – fL 20.4	20.23	19.7	19.1	18.62		(92)
								4e, whe			13.1	10.02		(02)
(93)m=	18.49	18.69	19.04	19.54	19.95	20.2	20.26	20.25	20.08	19.55	18.95	18.47		(93)
. ,		ting requ			10100		20.20	20.20	20100	10100	10100	10111		()
		· ·			re obtair	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti.m=(76)m an	d re-calc	ulate	
		factor fo					op 11 01		o, oo ma	.	r c)m an		alato	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	1	0.99	0.98	0.94	0.85	0.68	0.5	0.56	0.82	0.96	0.99	1		(94)
Usefu	ıl gains,	hmGm ,	W = (94	4)m x (8	4)m									
(95)m=	445.93	509.92	572.87	627.49	617.25	486.31	338.15	349.45	462.57	470.43	434.16	422.86		(95)
1	nly avera	age exte	rnal tem	perature	e from Ta	able 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)
				· · ·	1	1		x [(93)m·		-				()
(97)m=	1411.1		1238.13		796.14	529.97	346.45	363.19	570.43	863.56	1152.02	1398.44		(97)
-			1	i i i i i i i i i i i i i i i i i i i	i i i i i i i i i i i i i i i i i i i	i i i i i i i i i i i i i i i i i i i	1	24 x [(97)						
(98)m=	718.09	575.49	494.96	289.98	133.09	0	0	0	0	292.49	516.86	725.83		٦
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	3746.79	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								52.45	(99)
_														
9a. En	ergy rec	luiremer	nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
	ergy rec e heatir		nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space	e heatir	ng:			eating sy y/supple		Ĭ		CHP)				0	(201)
Spac Fracti	e heatin on of sp	ng:	it from s	econdar	y/supple		system						0	(201) (202)
Spac Fracti Fracti	e heatin on of sp on of sp	ng: bace hea	it from so It from m	econdar nain syst	y/supple em(s)		system		- (201) =	(203)] =				

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

Efficie	ency of	main spa	ace heat	ting syste	em 1								90.9	(206)
	•	•		ementar		a systen	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	1
Space			1	calculate			••••	1 1009	000	•••]	
-	718.09	575.49	494.96	289.98	133.09	0	0	0	0	292.49	516.86	725.83		
(211)m	ı = {[(98	s)m x (20)4)] } x ′	100 ÷ (20	06)	-	-	-	-	-	-			(211)
	789.97	633.11	544.51	319.01	146.41	0	0	0	0	321.77	568.6	798.5		_
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 1}	2	4121.88	(211)
•		•		′y), kWh/	month									
= {[(98] (215)m=)m x (20 0	01)] } x 1	00 ÷ (20	08) 0	0	0	0	0	0	0	0	0	1	
(213)11=	0	0	0	0	0	0	0	-	l (kWh/yea	-	-	-	0	(215)
Water	heating	r									- / 15,10. 1.	2	0	
	•	-	ter (calc	ulated a	bove)			-		-		-		
-	193.66	169.17	176.01	156.11	151.15	133.12	127.54	142.18	143.75	163.68	174.73	189.12		_
Efficier	ncy of w	ater hea	ater										80.8	(216)
(217)m=	88.55	88.39	88.01	87.09	85.23	80.8	80.8	80.8	80.8	87	88.12	88.61		(217)
		heating, m x 100												
(219)m=		191.39	199.98	179.25	177.33	164.75	157.85	175.96	177.9	188.15	198.29	213.42		
								Tota	I = Sum(2	19a) ₁₁₂ =	1		2242.99	(219)
	l totals									k	Wh/yea	r	kWh/year	-
Space	heating	fuel use	ed, main	system	1								4121.88	
Water	heating	fuel use	ed										2242.99]
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
mech	anical v	entilatio	n - balar	nced, ext	ract or p	ositive i	nput fror	n outside	Э			257.95		(230a)
centra	al heatir	ng pump	:									30		(230c)
Total e	lectricit	y for the	above,	kWh/yea	ır			sum	of (230a)	(230g) =			287.95	(231)
Electric	city for I	ighting											398.51	(232)
12a. (CO2 em	nissions ·	– Individ	lual heat	ing syste	ems incl	uding mi	cro-CHF)					_
						Fn	ergy			Fmiss	ion fac	tor	Emissions	
							/h/year			kg CO			kg CO2/yea	ar
Space	heating	ı (main s	ystem 1)		(21	1) x			0.2	16	=	890.33	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(21	9) x			0.2	16	=	484.49	(264)
Space	and wa	ter heati	ng			(26	1) + (262)	+ (263) + (264) =				1374.81	(265)
Electric	city for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	149.45	(267)
Electric	city for I	ighting				(23	2) x			0.5	19	=	206.82	(268)
Total C	:O2, kg	/year							sum o	f (265) (2	271) =		1731.08	(272)
Dwelli	ng CO2	2 Emissi	on Rate	;					(272)	÷ (4) =			24.23	(273)

EI rating (section 14)

80 (274)

		U	Jser Details:						
Assessor Name: Software Name:	Oliver Morris Stroma FSAP 20 ²		Softw	a Num are Ver	sion:			025430 n: 1.0.3.4	
			perty Address	s: Unit 5 p	proposec				
Address :	, London, NW6 1NF	२							
1. Overall dwelling dime	nsions:		A and a (and 2)		A 11) (- 1	
Ground floor			Area(m²) 73.1	(1a) x	Av. Hei	gnt(m) 91	(2a) =	212.79	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e	e)+(1n)	73.1	(4)					
Dwelling volume				(3a)+(3b)	+(3c)+(3d))+(3e)+	.(3n) =	212.79	(5)
2. Ventilation rate:		_							
		econdary heating	other		total			m ³ per hou	r
Number of chimneys	0 +	0	+ 0] = [0	x 4	40 =	0	(6a)
Number of open flues	0 +	0	+ 0	 =	0	x 2	20 =	0	(6b)
Number of intermittent far	ns				0	x 1	10 =	0	(7a)
Number of passive vents				Γ	0	x 1	10 =	0	(7b)
Number of flueless gas fin	res			Ē	0	x 4	40 =	0	(7c)
							Air ch	anges per ho	ur
Infiltration due to chimney	/s. flues and fans = (6)	6b)+(7a)+	+(7b)+(7c) =	Г	0	<u> </u>	÷ (5) =	0	(8)
If a pressurisation test has b				continue fre	-			0	
Number of storeys in th	ne dwelling (ns)						[0	(9)
Additional infiltration						[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0. if both types of wall are pr	25 for steel or timber resent, use the value correst			•	uction		[0	(11)
deducting areas of openin	• • •	lad) ar 0.1 (ontor O			г		
If suspended wooden f If no draught lobby, ent			(sealed), else	enter 0				0	(12)
Percentage of windows		tripped					l	0	(13) (14)
Window infiltration	s and doors draught s	inpped	0.25 - [0.	2 x (14) ÷ 1	00] =		l	0	(14)
Infiltration rate				+ (11) + (1	-	- (15) =	l	0	(16)
Air permeability value,	a50, expressed in cul	oic metres r	per hour per s	square m	etre of e	nvelope	area	5	(17)
If based on air permeabili		•	· ·	•				0.25	(18)
Air permeability value applie	s if a pressurisation test ha	s been done c	or a degree air p	ermeability	is being us	sed	L		
Number of sides sheltere	d			_				2	(19)
Shelter factor				[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporat	-		(21) = (1	3) x (20) =			l	0.21	(21)
Infiltration rate modified for					-				
Jan Feb	Mar Apr May	Jun	Jul Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		,		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		
Wind Factor (22a)m = (22	2)m ÷ 4								
	1.23 1.1 1.08	0.95	0.95 0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltr	ation rat	e (allowi	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m					
_ [0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se						0.5	(23a)
				endix N, (2	(23a) = (23a	a) × Fmv (e	equation (I	N5)), othe	rwise (23ł	(23a) = (23a)			0.5	(23a)
				iency in %						()			0.5 76.5	(23c)
			-	-	-					2h)m + (23b) x [1 – (23c)		(200)
(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	. 100]	(24a)
Ľ	balance	d mech	ı anical ve	ntilation	u without	heat rec	coverv (N	1 MV) (24t	m = (2)	1 2b)m + ()	1 23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,				ntilation of then (24)	•					.5 × (23t))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,				iole hous im = (221		•				0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	tive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in bo	x (25)	-	-			
(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37		(25)
3 Hea	at losse	s and he	eat loss i	paramet	er.									
ELEM		Gros	SS	Openin rr	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²∙ł		A X k kJ/K
Doors						1.79	x	1.5	=	2.685				(26)
Windov	vs Type	e 1				1.17	x1	/[1/(1.4)+	0.04] =	1.55				(27)
Windov	vs Type	92				1.17		/[1/(1.4)+	0.04] =	1.55				(27)
Rooflig	hts					0.26		/[1/(1.6) +	0.04] =	0.416				(27b)
Walls T	ype1	34.3	33	0		34.33	3 X	0.25	=	8.58				(29)
Walls T	ype2	12.2	29	5.85	;	6.44	x	0.28	=	1.8	T I		$\overline{}$	(29)
Walls T	уре3	19.6	62	1.79	,	17.83	3 X	0.25	=	4.46	i F		$\exists \square$	(29)
Roof T	ype1	39.9	93	0.26	;	39.67	′ ×	0.18	=	7.14	i F		$\exists \square$	(30)
Roof T	ype2	26.9)7	0		26.97	′ ×	0.18	=	4.85	i F		$\exists \square$	(30)
Roof T	уре3	10.6	62	0	=	10.62	<u>x</u>	0.16	=	1.7	i F		\exists	(30)
Total a	rea of e	lements	, m²			143.7	6							(31)
Party w	vall					34.37	, X	0	=	0				(32)
Party w	vall					14.13	3 X	0	=	0	i F		$\exists \square$	(32)
Party fl	oor					63.63	3				i		-	(32a)
Party fl	oor					9.47					[$\exists \square$	(32a)
				effective wi nternal wal			ated using	g formula 1	1/[(1/U-vali	ue)+0.04] a	as given in	n paragraph	3.2	
Fabric I	heat los	s, W/K	= S (A x	U)				(26) (30) + (32) =				39.37	(33)
											2) + (32a)			

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

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

Indicative Value: Medium

250

(35)

can be i	used inste	ad of a de	tailed calcu	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	<						21.56	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			60.93	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	27.28	26.9	26.53	24.67	24.29	22.43	22.43	22.05	23.17	24.29	25.04	25.78		(38)
Heat t	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	88.21	87.84	87.46	85.6	85.22	83.36	83.36	82.99	84.1	85.22	85.97	86.72		
										-	Sum(39)1	₁₂ /12=	85.5	(39)
	· · ·	ameter (H	HLP), W/						(40)m	= (39)m ÷	· (4)		1	
(40)m=	1.21	1.2	1.2	1.17	1.17	1.14	1.14	1.14	1.15	1.17	1.18	1.19		_
Numb	er of day	/s in moi	nth (Tab	le 1a)					,	Average =	Sum(40)₁	₁₂ /12=	1.17	(40)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	1	(41)
		•												
4. Wa	ater hea	ting enei	rav reaui	rement:								kWh/ye	ear:	
		upancy, l о м – 1		[1 - eyn	(-0 0003	849 v (TF	-130)2)] + 0.0)013 v (⁻	TFA -13		32		(42)
	A £ 13.		1.70 X		(0.0000	H0 X (11	10.0	/2/] + 0.0		1177 10.	.0)			
								(25 x N)				.28]	(43)
		al average i litres per j				-	-	to achieve	a water us	se target o	f			
notmor		r				1	·		-			i _	1	
Hot wat	Jan	Feb in litres per	Mar day for or	Apr Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
								 					1	
(44)m=	98.2	94.63	91.06	87.49	83.92	80.35	80.35	83.92	87.49	91.06	94.63	98.2		_
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D	0Tm / 3600			m(44) _{1 12} = ables 1b, 1		1071.31	(44)
(45)m=	145.63	127.37	131.44	114.59	109.95	94.88	87.92	100.89	102.09	118.98	129.88	141.04		
										Total = Su	m(45) _{1 12} =		1404.65	(45)
lf instan	taneous v	vater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46) to (61)				1	
(46)m=	21.84	19.11	19.72	17.19	16.49	14.23	13.19	15.13	15.31	17.85	19.48	21.16		(46)
	storage		includin	na anv su	olar or M	///HRS	storane	within sa	me ves	ما		0	1	(47)
-		neating a					-			001		0	J	(47)
		-			-			ombi boil	ers) ente	er '0' in (47)			
	storage			(,			
a) If n	nanufact	turer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0]	(48)
Tempe	erature f	actor fro	m Table	2b								0	j	(49)
Energ	y lost fro	om water	storage	, kWh/ye	ear			(48) x (49)	=			0	j	(50)
,		turer's de		•									1	
		age loss			e 2 (kW	h/litre/da	iy)					0	J	(51)
		neating s from Ta		JII 4.3								0	1	(52)
		actor fro		2b								0 0		(52)
-														

0.	•		•	e, kWh/y	ear			(47) x (51)) x (52) x (53) =		0		(54)
	. ,	(54) in (8										0		(55)
Water	storage	loss cal	culated	for each	month	_	_	((56)m = (55) × (41)	m	-	_		
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	om Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	ry circuit	loss (ar	nual) fro	om Table	∋ 3							0		(58)
Primar	ry circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	i loss ca	lculated	for each	month	(61)m =	(60) ÷ 3	65 × (41))m						
(61)m=	50.04	43.56	46.4	43.15	42.76	39.62	40.94	42.76	43.15	46.4	46.67	50.04		(61)
Total h	neat req	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	195.68	170.93	177.84	157.73	152.71	134.5	128.86	143.65	145.24	165.38	176.54	191.08		(62)
Solar Dł	HW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter											
(64)m=	195.68	170.93	177.84	157.73	152.71	134.5	128.86	143.65	145.24	165.38	176.54	191.08		
								Outp	out from wa	ater heate	r (annual)₁	12	1940.16	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	60.93	53.24	55.3	48.89	47.25	41.45	39.47	44.24	44.73	51.16	54.85	59.41		(65)
inclu	ude (57)	m in calo	ulation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	leating	
5. In	ternal ga	ains (see	e Table (5 and 5a):									
Metab	olic gair	is (Table	e 5). Wat	tts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	115.95	115.95	115.95	115.95	115.95	115.95	115.95	115.95	115.95	115.95	115.95	115.95		(66)
Lightin	ig gains	(calcula	ted in A	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	27.23	24.18	19.67	14.89	11.13	9.4	10.15	13.2	17.71	22.49	26.25	27.98		(67)
Applia	nces ga	ins (calc	ulated ir	n Appeno	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	204.42	206.54	201.2	189.82	175.45	161.95	152.93	150.81	156.16	167.54	181.9	195.4		(68)
	L na dains	(calcula	L Ited in A	ı ppendix	L equat	ion I 15	or I 15a') also se	i ee Table	5				
(69)m=	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59		(69)
	s and fai	ns gains	(Table :	1										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	se.a. ev	i vaporatio	n (nega	ı tive valu	ı es) (Tab	le 5)	I		I			I		
(71)m=	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76		(71)
Water	heating	ı gains (1	able 5)	I	I	I	I	ļ	I	<u>I</u>	<u>I</u>	I	I	
(72)m=	81.9	79.23	74.33	67.9	63.51	57.57	53.05	59.46	62.13	68.77	76.18	79.85		(72)
	internal	gains =				(66)	l m + (67)m	י 1 + (68)m -	ı + (69)m + (ı (70)m + (7	1)m + (72)	m	I	
(73)m=	374.33	370.74	355.98	333.39	310.87	289.71	276.92	284.25	296.78	319.58	345.12	364.02		(73)
	lar gains			1	1	1	1	1	1	1	1	1		

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

Orientation:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	1.17	x	11.28	x	0.57	x	0.7	=	3.65	(75)
Northeast 0.9x	0.77	x	1.17	x	22.97	×	0.57	x	0.7	=	7.43	(75)
Northeast 0.9x	0.77	x	1.17	x	41.38	x	0.57	x	0.7	=	13.39	(75)
Northeast 0.9x	0.77	x	1.17	x	67.96	×	0.57	x	0.7	=	21.98	(75)
Northeast 0.9x	0.77	x	1.17	x	91.35	x	0.57	x	0.7	=	29.55	(75)
Northeast 0.9x	0.77	x	1.17	x	97.38	x	0.57	x	0.7	=	31.51	(75)
Northeast 0.9x	0.77	x	1.17	x	91.1	x	0.57	x	0.7	=	29.47	(75)
Northeast 0.9x	0.77	x	1.17	x	72.63	x	0.57	x	0.7	=	23.5	(75)
Northeast 0.9x	0.77	x	1.17	x	50.42	x	0.57	x	0.7	=	16.31	(75)
Northeast 0.9x	0.77	x	1.17	x	28.07	x	0.57	x	0.7	=	9.08	(75)
Northeast 0.9x	0.77	x	1.17	x	14.2	x	0.57	x	0.7	=	4.59	(75)
Northeast 0.9x	0.77	x	1.17	x	9.21	x	0.57	x	0.7	=	2.98	(75)
Northwest 0.9x	0.77	x	1.17	x	11.28	x	0.57	x	0.7	=	14.6	(81)
Northwest 0.9x	0.77	x	1.17	x	22.97	x	0.57	x	0.7	=	29.72	(81)
Northwest 0.9x	0.77	x	1.17	x	41.38	x	0.57	x	0.7	=	53.55	(81)
Northwest 0.9x	0.77	x	1.17	x	67.96	x	0.57	x	0.7	=	87.94	(81)
Northwest 0.9x	0.77	x	1.17	x	91.35	x	0.57	x	0.7	=	118.21	(81)
Northwest 0.9x	0.77	x	1.17	x	97.38	x	0.57	x	0.7	=	126.02	(81)
Northwest 0.9x	0.77	x	1.17	x	91.1	x	0.57	x	0.7	=	117.89	(81)
Northwest 0.9x	0.77	x	1.17	x	72.63	x	0.57	x	0.7	=	93.98	(81)
Northwest 0.9x	0.77	x	1.17	x	50.42	x	0.57	x	0.7	=	65.25	(81)
Northwest 0.9x	0.77	x	1.17	x	28.07	x	0.57	x	0.7	=	36.32	(81)
Northwest 0.9x	0.77	x	1.17	x	14.2	x	0.57	x	0.7	=	18.37	(81)
Northwest 0.9x	0.77	x	1.17	x	9.21	x	0.57	x	0.7	=	11.92	(81)
Rooflights 0.9x	1	x	0.26	x	26	x	0.63	x	0.7	=	2.68	(82)
Rooflights 0.9x	1	x	0.26	x	54	x	0.63	x	0.7	=	5.57	(82)
Rooflights 0.9x	(1	x	0.26	x	96	x	0.63	x	0.7	=	9.91	(82)
Rooflights 0.9x	(1	x	0.26	x	150	x	0.63	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	0.26	x	192	x	0.63	x	0.7	=	19.81	(82)
Rooflights 0.9x	(1	x	0.26	x	200	x	0.63	x	0.7	=	20.64	(82)
Rooflights 0.9x	1	x	0.26	x	189	x	0.63	x	0.7	=	19.5	(82)
Rooflights 0.9x	1	x	0.26	x	157	x	0.63	x	0.7	=	16.2	(82)
Rooflights 0.9x	1	x	0.26	x	115	x	0.63	x	0.7	=	11.87	(82)
Rooflights 0.9x	(1	x	0.26	x	66	x	0.63	x	0.7	=	6.81	(82)
Rooflights 0.9x	(1	x	0.26	×	33	×	0.63	x	0.7	=	3.41	(82)
Rooflights 0.9x	1	x	0.26	x	21	x	0.63	x	0.7	=	2.17	(82)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m	(82)m			
(83)m=	20.93	42.72	76.84	125.4	167.57	178.16	166.87	133.68	93.43	52.21	26.37	17.07	(83)
Total g	ains – ii	nternal a	ind solar	(84)m =	= (73)m -	+ (83)m	, watts						
(84)m=	395.27	413.46	432.82	458.79	478.45	467.87	443.78	417.93	390.21	371.79	371.49	381.09	(84)

7. Me	an inter	nal tem	berature	(heating	season)								
				` U		, 	from Tal	ole 9, Th	1 (°C)				21	(85)
-		•	• •	living are		•		,	()					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	1	0.99	0.97	0.88	0.75	0.8	0.95	0.99	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	bllow ste	ps 3 to 7	7 in Tabl	e 9c)					
(87)m=	19.63	19.73	19.93	20.26	20.58	20.85	20.95	20.94	20.73	20.34	19.95	19.63		(87)
Temp	erature	durina h	neating r	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)				I	
(88)m=	19.91	19.92	19.92	19.94	19.95	19.97	19.97	19.97	19.96	19.95	19.94	19.93		(88)
l Itilis:	tion fac	tor for a	ains for	rest of d	wellina	h2 m (se	e Table	9a)						
(89)m=	1	1	1	0.99	0.95	0.82	0.61	0.67	0.91	0.99	1	1		(89)
		l I tompor	I ature in	the rest	of dwalli	ing T2 (f	I ollow ste	eps 3 to ⁻	I 7 in Tabl					
(90)m=	18.08	18.23	18.54	19.02	19.48	19.84	19.95	19.94	19.7	19.14	18.57	18.09		(90)
()											g area ÷ (4		0.5	(91)
Moon	intorno	Itompor	oturo (fo	r tho wh	olo dwo	lling) – f	ι Λ ν Τ1	+ (1 – fL	۸) v To					
(92)m=	18.86	18.98	19.24	19.64	20.03	20.35	20.45	+ (1 – 1L 20.44	A) × 12	19.74	19.26	18.86		(92)
								4e, whe			10.20	10.00		
(93)m=	18.71	18.83	19.09	19.49	19.88	20.2	20.3	20.29	20.07	19.59	19.11	18.71		(93)
8. Sp	ace hea	ting requ	uirement											
						ned at st	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut		1	or gains	using Ta	able 9a	i				i			I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
		tor for g	1	0.98	0.95	0.83	0.66	0.74	0.92	0.99			l	(94)
(94)m=			0.99			0.83	0.00	0.71	0.92	0.99	1	1		(34)
(95)m=	394.31	412.04	, VV = (94 430.02	4)m x (8 450.89	452.62	390.12	291.85	297.82	358.83	366.46	369.95	380.33		(95)
				perature			201100							()
(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	e for mea	an interr	al tempe	erature,	Lm , W =	-[(39)m	r [(93)m	– (96)m]	1			
(97)m=	1271.06	1223.54	1100.95	906.46	697.15	466.57	308.68	322.83	502.08	766.33	1032.38	1258.48		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	652.3	545.33	499.17	328.01	181.94	0	0	0	0	297.5	476.95	653.34		
								Tota	l per year	(kWh/yea	⁻) = Sum(9	8)15,912 =	3634.55	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								49.72	(99)
9a. En	ergy rec	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heatir	-												
				econdar		mentary	y system						0	(201)
Fracti	ion of sp	bace hea	at from m	nain syst	em(s)			(202) = 1	– (201) =				1	(202)
Fracti	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of I	main spa	ace heat	ing syste	em 1								90.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g systen	า, %						0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space		· ·	r İ	calculate	r í			1	1				I	
	652.3	545.33	499.17	328.01	181.94	0	0	0	0	297.5	476.95	653.34		
(211)m			<u> </u>	$100 \div (20)$	· ·					007.00	504.7	740 75		(211)
	717.61	599.92	549.14	360.85	200.15	0	0	0 Tota	0 l (kWh/ve	327.28	524.7 211) _{15.10, 12}	718.75	2008.4	(211)
Snace	a hoatin	a fual (s	econdar	·y), kWh/	month			1010		ui) – Cu ii(1	- · · / 15,10. 12	2	3998.4	
•)1)]}x1		• /	monui									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
				-				Tota	ll (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	1 2	0	(215)
	heating	•												
Output	from w	ater hea 170.93	ter (calc 177.84	ulated a	bove) 152.71	134.5	128.86	143.65	145.24	165.38	176.54	191.08		
Efficier		ater hea		107.70	102.71	104.0	120.00	140.00	140.24	100.00	170.04	101.00	80.8	(216)
(217)m=		88.27	88.01	87.35	85.99	80.8	80.8	80.8	80.8	87.01	87.93	88.4		」、 (217)
Fuel fo	r water	heating,	kWh/m	onth	1	I		1	1					
· /		m x 100) ÷ (217		177.59	400.40	450.40	477 70	470 75	400.07	000 70	040.40		
(219)m=	221.47	193.65	202.07	180.57	177.59	166.46	159.48	177.79 Tota	179.75	190.07	200.78	216.16	2265.83	(219)
Total = Sum(219a) ₁₁₂ = Annual totals kWh/year												r	kWh/year	
Space heating fuel used, main system 1													3998.4	1
Water heating fuel used													2265.83	ī
Electricity for pumps, fans and electric keep-hot														J
mechanical ventilation - balanced, extract or positive input from outside 259.61														(230a)
												30		(230c)
Total electricity for the above, kWh/year								sum	of (230a)	(230g) =	:		289.61	(231)
Electricity for lighting													480.82	(232)
12a. (CO2 em	issions ·	– Individ	lual heat	ing syste	ems inclu	uding mi	cro-CHF	þ					-1
						C m	0101/			Emico	ion fac	101	Emissions	
						lergy /h/year			kg CO			kg CO2/yea	ır	
Space	heating	(main s	ystem 1)			1) x			0.2		=	863.65	(261)
Space heating (secondary)						(21	5) x			0.5	19	=	0	(263)
Water heating						(21	9) x			0.2	16	=	489.42	(264)
Space and water heating							1) + (262)	+ (263) + ((264) =				1353.07	(265)
Electricity for pumps, fans and electric keep-hot						t (23	1) x			0.5	19	=	150.31	(267)
Electricity for lighting						(23	2) x			0.5	19	=	249.55	(268)
Total C	:02, kg/	year							sum o	of (265) (2	271) =		1752.93	(272)
Dwelli	ng CO2	Emissi	on Rate	;					(272)	÷ (4) =			23.98	(273)
EI ratin	ig (secti	on 14)											80	(274)

Appendix Energy Assessment 123 High Street

GREEN Scenario

			User D	etails:						
Assessor Name: Software Name:	Oliver Morri Stroma FSA	-		Strom Softwa					025430 n: 1.0.3.12	
	etroinia r e,		Property				GREE			
Address :	, London, NV	V6 1NR								
1. Overall dwelling dime										
Ground floor				a(m²) 55.86	(1a) x	Av. He	ight(m) 2.8	(2a) =	Volume(m ³) 156.41	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1	1d)+(1e)+((1n) 🗾 🗄	5.86	(4)			-		
Dwelling volume					(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	156.41	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	main heating 0	second heating + 0 + 0		0 0] = [] = [total 0 0		40 = 20 =	m ³ per hour	(6a) (6b)
Number of intermittent fa	ns					0	x ′	10 =	0	 (7a)
Number of passive vents						0	x /	10 =	0](7b)
						-		40 =	-	
Number of flueless gas fi	162					0	^		0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimne If a pressurisation test has b Number of storeys in tl	een carried out or	is intended, proc			continue fre	0 om (9) to (÷ (5) =	0	(8)
Additional infiltration)					[(9)	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0	.25 for steel or	timber frame	or 0.35 fo	r masonr	v constr	uction	[(0)	11000 -	0	(10) (11)
if both types of wall are p deducting areas of openii	resent, use the valu	ue corresponding 0.35	g to the great	er wall are	a (after					
If suspended wooden f			0.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	-								0	(13)
Percentage of windows	s and doors dra	aught stripped	1	0.25 [0.2	$\mathbf{v}(1\mathbf{A}) \cdot 1$	001 -			0	(14)
Window infiltration				0.25 - [0.2 (8) + (10)			⊾ (15) –		0	(15)
Infiltration rate Air permeability value,	a50 expressed	d in cubic me	tres per br					area	0	(16)
If based on air permeabil			•	•	•		invelope	aica	5 0.25	(17) (18)
Air permeability value applie						is being us	sed		0.25	
Number of sides sheltere	ed				-	-			1	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	9)] =			0.92	(20)
Infiltration rate incorporat	ting shelter fact	or		(21) = (18)) x (20) =				0.23	(21)
Infiltration rate modified f	or monthly wind	d speed								
Jan Feb	Mar Apr	May Jur	n Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table	97								
(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 $(22a)m = (2a)m =$	2)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		

Adjust	ed infiltr	ation rat	e (allow	ing for sł	nelter an	nd wind s	peed)	= (21a) :	k (22a)ı	n			_		
0.1.1	0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27]		
		al ventila	•	rate for t	ne appli	cable ca	se						0.5	((23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation	(N5)) , oth	erwise (2	23b) = (23a)			0.		(23b)
lf bala	anced with	n heat reco	overy: effic	ciency in %	allowing	for in-use fa	actor (fro	om Table 4	h) =	, , ,			76.		(23c)
a) If	balance	ed mecha	anical ve	entilation	with he	at recove	erv (M\	/HR) (24	la)m =	(22b)m +	(23b) × [1 – (23c)		<u> </u>	,)
, (24a)m=	r	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	<u> </u>	0.38	0.39		((24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	covery	(MV) (24	b)m =	(22b)m +	(23b)		1		
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	((24b)
c) If	whole h	ouse ex	tract ver	ntilation of	or positiv	/e input v	ventilat	ion from	outside	9	-	-	-		
i	if (22b)n	n < 0.5 ×	(23b), t	then (240	c) = (23k	o); otherv	wise (2	4c) = (22	2b) m +	0.5 × (23	lb)		-		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(:	(24c)
,				nole hous)m = (221						x 0.5]	_		_		
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		()	(24d)
Effe	ctive air	change	rate - ei	nter (24a) or (24	o) or (24	c) or (2	4d) in bo	ox (25)		- i		-		
(25)m=	0.41	0.41	0.4	0.37	0.37	0.34	0.34	0.33	0.35	0.37	0.38	0.39		((25)
3. He	at losse	s and he	eat loss	paramete	er:										
ELEN	IENT	Gros area		Openin m		Net Ar A ,r		U-va W/m		A X U (W	J //K)	k-valu kJ/m²⊷		A X k kJ/K	
Doors						1.79	×	1.5		= 2.68	5			((26)
Windo	ws Type	e 1				2.48	×	1/[1/(1.4)	+ 0.04]	= 3.29				((27)
Windo	ws Type	2				3.63	×	1/[1/(1.4)	+ 0.04]	= 4.81				((27)
Windo	ws Type	e 3				2.9	×	1/[1/(1.4)	+ 0.04]	= 3.84				((27)
Windo	ws Type	e 4				2.94	×	1/[1/(1.4)	+ 0.04]	= 3.9				((27)
Floor						55.56	3 ×	0.2	5	= 13.8	Э			((28)
Walls ⁻	Type1	47.5	59	18.0	6	29.53	3 X	0.2	5	= 7.38				((29)
Walls ⁻	Type2	11.5	56	0		11.56	3 ×	0.2	5	= 2.89				((29)
Walls ⁻	ТуреЗ	4.79	9	1.79)	3	×	0.2	5	= 0.76				((29)
Total a	area of e	elements	, m²			119.5	5							((31)
Party v	wall					30.81	×	0		= 0				((32)
Party o	ceiling					55.88	3							((32b)
				effective wi nternal wal			ated usir	ng formula	1/[(1/U-v	alue)+0.04]	as given ir	n paragrapl	h 3.2		
Fabric	heat los	ss, W/K :	= S (A x	U)				(26) (3	0) + (32)	=			51.	55 ((33)
Heat c	apacity	Cm = S((Axk)						((2	8) (30) + (32) + (32a)	(32e) =	13028	3.67 ((34)
Therm	al mass	parame	ter (TM	P = Cm ÷	- TFA) iı	n kJ/m²K			Ind	icative Valu	e: Medium		25	0 ((35)
	-	sments wh ad of a de			construct	tion are not	t known j	precisely ti	he indica	tive values o	of TMP in T	able 1f			
Therm	al bridg	es : S (L	x Y) cal	lculated (using Ap	opendix ł	<						17.9) 3 ((36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	31)									

Total f	abric he	at loss							(33) +	(36) =			69.47	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y	-	-		(38)m	= 0.33 × (25)m x (5)	-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	21.28	20.98	20.69	19.19	18.9	17.4	17.4	17.11	18	18.9	19.49	20.09		(38)
Heat t	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	90.75	90.46	90.16	88.67	88.37	86.87	86.87	86.58	87.47	88.37	88.96	89.56		
Heat lo	oss nara	meter (H	HP) W	/m²K						Average = = (39)m ÷		₁₂ /12=	88.59	(39)
(40)m=	1.62	1.62	1.61	1.59	1.58	1.56	1.56	1.55	1.57	1.58	1.59	1.6	1	
									,	Average =	Sum(40)₁	₁₂ /12=	1.59	(40)
Numb		/s in moi	r Ì	,					0		NL	Dat	1	
(11)m-	Jan	Feb	Mar 21	Apr 20	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	(41)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31]	(41)
4 101														
4. 778	ater heat	ling enei	rgy requ	irement:								kWh/y	ear:	
		ipancy, l		F.4	(86]	(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	349 X (11	-A -13.9)2)] + 0.0	0013 x (IFA -13.	9)			
			ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		78	.43	1	(43)
		-		• •		lwelling is hot and co	-	to achieve	a water us	se target o	f		_	
notmor									0		NL	Du	1	
Hot wat	Jan er usage i	Feb	Mar dav for ea	Apr ach month	May Vd.m = fa	Jun ctor from 7	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	86.28	83.14	80	76.87	73.73	70.59	70.59	73.73	76.87	80	83.14	86.28	1	
(++)///-	00.20	00.14	00	10.01	10.10	10.00	10.00	10.10		Total = Su			941.22	(44)
Energy	content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	m x nm x D	OTm / 3600						
(45)m=	127.95	111.9	115.47	100.67	96.6	83.36	77.24	88.64	89.7	104.53	114.11	123.91		
lf instan	taneous w	vater heatii	ng at point	of use (no	o hot wate	r storage),	enter 0 in	boxes (46)		Total = Su	m(45) _{1 12} =	=	1234.08	(45)
(46)m=	19.19	16.79	17.32	15.1	14.49	12.5	11.59	13.3	13.45	15.68	17.12	18.59	1	(46)
1 C C	storage										=]	
Storag	e volum	e (litres)	includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		250]	(47)
	•	-			-	nter 110		. ,						
			hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boile	ers) ente	er '0' in (47)			
	storage nanufact		eclared I	oss facto	or is kno	wn (kWł	n/dav):				1	89	1	(48)
,		actor fro					, ,) / .					54	1	(49)
				, kWh/ye	ear			(48) x (49)	-			02	1	(50)
			-	•		or is not		. , . ,			····	02	_	()
		-			le 2 (kW	h/litre/da	ay)					0		(51)
	•	eating s from Ta		on 4.3								0	1	(52)
		actor fro		2b								0	4	(52) (53)
				, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0]	(54)
		(54) in (5	-									02	1	(55)
													-	

Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64		(57)
Primar	rv circuit	loss (ar	Inual) fro	om Table	9 3					•		0		(58)
	•	•		for each		59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi	i loss ca	lculated	for each	n month ((61)m =	(60) ÷ 30	65 × (41))m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	neat requ	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	182.85	161.49	170.38	153.8	151.5	136.49	132.14	143.54	142.83	159.43	167.24	178.81		(62)
Solar DI	HW input o	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contribut	ion to wate	er heating)	-	
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix C	<u>S)</u>					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter				-							
(64)m=	182.85	161.49	170.38	153.8	151.5	136.49	132.14	143.54	142.83	159.43	167.24	178.81		
								Outp	out from w	ater heate	r (annual)₁	12	1880.5	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	
(65)m=	86.46	76.88	82.32	75.98	76.04	70.22	69.6	73.39	72.33	78.68	80.44	85.12		(65)
inclu	ude (57)ı	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gain	s (Table												
	Jan		<u>5), vvai</u>	tts										
(66)m=	Jan	Feb	5), vvat Mar	tts Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	93.13				May 93.13	Jun 93.13	Jul 93.13	Aug 93.13	Sep 93.13	Oct 93.13	Nov 93.13	Dec 93.13		(66)
Lightin	93.13 Ig gains	Feb 93.13 (calcula	Mar ^{93.13} ted in Aj	Apr	93.13	93.13	93.13	93.13	93.13					(66)
Lightin	93.13 Ig gains	Feb 93.13	Mar ^{93.13} ted in Aj	Apr 93.13	93.13	93.13	93.13	93.13	93.13]	(66) (67)
Lightin (67)m=	93.13 ng gains 18.1	Feb 93.13 (calcula 16.07	Mar 93.13 ted in Aj 13.07	Apr 93.13 ppendix	93.13 L, equat 7.4	93.13 ion L9 o 6.25	93.13 r L9a), a 6.75	93.13 Iso see 8.77	93.13 Fable 5 11.77	93.13 14.95	93.13	93.13		
Lightin (67)m=	93.13 ng gains 18.1	Feb 93.13 (calcula 16.07	Mar 93.13 ted in Aj 13.07	Apr 93.13 ppendix 9.9	93.13 L, equat 7.4	93.13 ion L9 o 6.25	93.13 r L9a), a 6.75	93.13 Iso see 8.77	93.13 Fable 5 11.77	93.13 14.95	93.13	93.13		
Lightin (67)m= Applia (68)m=	93.13 ng gains 18.1 nces gai 162.4	Feb 93.13 (calcula 16.07 ins (calc 164.08	Mar 93.13 ted in Ap 13.07 ulated ir 159.84	Apr 93.13 ppendix 9.9 Append	93.13 L, equat 7.4 dix L, eq 139.38	93.13 ion L9 of 6.25 uation L 128.66	93.13 r L9a), a 6.75 13 or L1 121.49	93.13 Iso see 8.77 3a), also 119.81	93.13 Table 5 11.77 see Ta 124.06	93.13 14.95 ble 5 133.1	93.13 17.45	93.13 18.6		(67)
Lightin (67)m= Applia (68)m=	93.13 ng gains 18.1 nces gai 162.4	Feb 93.13 (calcula 16.07 ins (calc 164.08	Mar 93.13 ted in Ap 13.07 ulated ir 159.84	Apr 93.13 ppendix 9.9 Append 150.8	93.13 L, equat 7.4 dix L, eq 139.38	93.13 ion L9 of 6.25 uation L 128.66	93.13 r L9a), a 6.75 13 or L1 121.49	93.13 Iso see 8.77 3a), also 119.81	93.13 Table 5 11.77 see Ta 124.06	93.13 14.95 ble 5 133.1	93.13 17.45	93.13 18.6		(67)
Lightin (67)m= Applia (68)m= Cookir (69)m=	93.13 ng gains 18.1 nces ga 162.4 ng gains 32.31	Feb 93.13 (calcula 16.07 ins (calc 164.08 (calcula	Mar 93.13 ted in Ay 13.07 ulated ir 159.84 ted in A 32.31	Apr 93.13 ppendix 9.9 Append 150.8 ppendix 32.31	93.13 L, equat 7.4 dix L, eq 139.38 L, equat	93.13 ion L9 o 6.25 uation L 128.66 tion L15	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a)	93.13 Iso see 8.77 3a), also 119.81), also se	93.13 Table 5 11.77 see Ta 124.06 ee Table	93.13 14.95 ble 5 133.1 5	93.13 17.45 144.51	93.13 18.6 155.23		(67)
Lightin (67)m= Applia (68)m= Cookir (69)m=	93.13 ng gains 18.1 nces ga 162.4 ng gains 32.31	Feb 93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31	Mar 93.13 ted in Ay 13.07 ulated ir 159.84 ted in A 32.31	Apr 93.13 ppendix 9.9 Append 150.8 ppendix 32.31	93.13 L, equat 7.4 dix L, eq 139.38 L, equat	93.13 ion L9 o 6.25 uation L 128.66 tion L15	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a)	93.13 Iso see 8.77 3a), also 119.81), also se	93.13 Table 5 11.77 see Ta 124.06 ee Table	93.13 14.95 ble 5 133.1 5	93.13 17.45 144.51	93.13 18.6 155.23		(67)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	93.13 ng gains 18.1 nces gai 162.4 ng gains 32.31 s and far 3	Feb 93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3	Mar 93.13 ted in Ap 13.07 ulated in 159.84 ted in A 32.31 (Table \$ 3	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a)	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31	93.13 Iso see 8.77 3a), also 119.81), also se 32.31	93.13 Table 5 11.77 9 see Ta 124.06 9 Table 32.31	93.13 14.95 ble 5 133.1 5 32.31	93.13 17.45 144.51 32.31	93.13 18.6 155.23 32.31		(67) (68) (69)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	93.13 ng gains 18.1 nces gai 162.4 ng gains 32.31 s and far 3	Feb 93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3	Mar 93.13 ted in Ap 13.07 ulated in 159.84 ted in A 32.31 (Table \$ 3	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31	93.13 Iso see 8.77 3a), also 119.81), also se 32.31	93.13 Table 5 11.77 9 see Ta 124.06 9 Table 32.31	93.13 14.95 ble 5 133.1 5 32.31	93.13 17.45 144.51 32.31	93.13 18.6 155.23 32.31		(67) (68) (69)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	93.13 ng gains 18.1 nces gai 162.4 ng gains 32.31 s and far 3 s e.g. ev -74.5	Feb 93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3 raporatio	Mar 93.13 ted in Ap 13.07 ulated in A 159.84 ted in A 32.31 (Table \$ 3 on (nega -74.5	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3 tive valu	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31 3 es) (Tab	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31 3 le 5)	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31 3	93.13 Iso see 8.77 3a), also 119.81), also se 32.31 3	93.13 Table 5 11.77 9 see Ta 124.06 9 Table 32.31 3	93.13 14.95 ble 5 133.1 5 32.31 3	93.13 17.45 144.51 32.31 3	93.13 18.6 155.23 32.31 3		(67) (68) (69) (70)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	93.13 ng gains 18.1 nces gai 162.4 ng gains 32.31 s and far 3 s e.g. ev -74.5	Feb 93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3 raporatio -74.5	Mar 93.13 ted in Ap 13.07 ulated in A 159.84 ted in A 32.31 (Table \$ 3 on (nega -74.5	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3 tive valu	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31 3 es) (Tab	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31 3 le 5)	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31 3	93.13 Iso see 8.77 3a), also 119.81), also se 32.31 3	93.13 Table 5 11.77 9 see Ta 124.06 9 Table 32.31 3	93.13 14.95 ble 5 133.1 5 32.31 3	93.13 17.45 144.51 32.31 3	93.13 18.6 155.23 32.31 3		(67) (68) (69) (70)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	93.13 93.13 ag gains 18.1 nces ga 162.4 ng gains 32.31 s and far 3 s e.g. ev -74.5 heating 116.21	Feb 93.13 (calcula 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3 raporatio -74.5 gains (T	Mar 93.13 ted in Ap 13.07 ulated in 159.84 ted in A 32.31 (Table 5 able 5) 110.64	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3 tive valu -74.5	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31 3 es) (Tab -74.5	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31 3 le 5) -74.5 97.53	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31 3 -74.5 93.55	93.13 Iso see 8.77 3a), also 119.81 0, also se 32.31 3 -74.5 98.65	93.13 Table 5 11.77 9 see Ta 124.06 9 Table 32.31 3 -74.5 100.46	93.13 14.95 ble 5 133.1 5 32.31 3 -74.5 105.75	93.13 17.45 144.51 32.31 3 -74.5	93.13 18.6 155.23 32.31 3 -74.5 114.41		(67)(68)(69)(70)(71)
Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	93.13 93.13 ag gains 18.1 nces ga 162.4 ng gains 32.31 s and far 3 s e.g. ev -74.5 heating 116.21	Feb 93.13 (calculat 16.07 ins (calc 164.08 (calcula 32.31 ns gains 3 raporatio -74.5 gains (T 114.4	Mar 93.13 ted in Ap 13.07 ulated in 159.84 ted in A 32.31 (Table 5 able 5) 110.64	Apr 93.13 ppendix 9.9 Appendix 150.8 ppendix 32.31 5a) 3 tive valu -74.5	93.13 L, equat 7.4 dix L, eq 139.38 L, equat 32.31 3 es) (Tab -74.5	93.13 ion L9 of 6.25 uation L 128.66 tion L15 32.31 3 le 5) -74.5 97.53	93.13 r L9a), a 6.75 13 or L1 121.49 or L15a) 32.31 3 -74.5 93.55	93.13 Iso see 8.77 3a), also 119.81 3, also se 32.31 3 -74.5 98.65	93.13 Table 5 11.77 9 see Ta 124.06 9 Table 32.31 3 -74.5 100.46	93.13 14.95 ble 5 133.1 5 32.31 3 -74.5 105.75	93.13 17.45 144.51 32.31 3 -74.5 111.73	93.13 18.6 155.23 32.31 3 -74.5 114.41		(67)(68)(69)(70)(71)

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	3.63	x	11.28	x	0.57	x	0.7	=	22.65	(75)
Northeast 0.9x	0.77	x	2.9	x	11.28	x	0.57	x	0.7	=	9.05	(75)
Northeast 0.9x	0.77	x	3.63	x	22.97	x	0.57	x	0.7	=	46.1	(75)
Northeast 0.9x	0.77	x	2.9	x	22.97	x	0.57	x	0.7	=	18.42	(75)
Northeast 0.9x	0.77	x	3.63	x	41.38	x	0.57	x	0.7	=	83.07	(75)
Northeast 0.9x	0.77	x	2.9	x	41.38	x	0.57	x	0.7	=	33.18	(75)
Northeast 0.9x	0.77	x	3.63	x	67.96	x	0.57	x	0.7	=	136.42	(75)
Northeast 0.9x	0.77	x	2.9	x	67.96	x	0.57	x	0.7	=	54.49	(75)
Northeast 0.9x	0.77	x	3.63	x	91.35	x	0.57	x	0.7	=	183.37	(75)
Northeast 0.9x	0.77	x	2.9	x	91.35	x	0.57	x	0.7	=	73.25	(75)
Northeast 0.9x	0.77	x	3.63	x	97.38	x	0.57	x	0.7	=	195.49	(75)
Northeast 0.9x	0.77	x	2.9	x	97.38	x	0.57	x	0.7	=	78.09	(75)
Northeast 0.9x	0.77	x	3.63	x	91.1	x	0.57	x	0.7	=	182.88	(75)
Northeast 0.9x	0.77	x	2.9	x	91.1	x	0.57	x	0.7	=	73.05	(75)
Northeast 0.9x	0.77	x	3.63	x	72.63	x	0.57	x	0.7	=	145.79	(75)
Northeast 0.9x	0.77	x	2.9	x	72.63	x	0.57	x	0.7	=	58.24	(75)
Northeast 0.9x	0.77	x	3.63	x	50.42	x	0.57	x	0.7	=	101.22	(75)
Northeast 0.9x	0.77	x	2.9	x	50.42	x	0.57	x	0.7	=	40.43	(75)
Northeast 0.9x	0.77	x	3.63	x	28.07	x	0.57	x	0.7	=	56.34	(75)
Northeast 0.9x	0.77	x	2.9	x	28.07	x	0.57	x	0.7	=	22.51	(75)
Northeast 0.9x	0.77	x	3.63	x	14.2	x	0.57	x	0.7	=	28.5	(75)
Northeast 0.9x	0.77	x	2.9	x	14.2	x	0.57	x	0.7	=	11.38	(75)
Northeast 0.9x	0.77	x	3.63	x	9.21	x	0.57	x	0.7	=	18.5	(75)
Northeast 0.9x	0.77	x	2.9	x	9.21	x	0.57	x	0.7	=	7.39	(75)
Southeast 0.9x	0.77	x	2.94	x	36.79	x	0.57	x	0.7	=	29.91	(77)
Southeast 0.9x	0.77	x	2.94	x	62.67	x	0.57	x	0.7	=	50.95	(77)
Southeast 0.9x	0.77	x	2.94	x	85.75	x	0.57	x	0.7	=	69.71	(77)
Southeast 0.9x	0.77	x	2.94	x	106.25	x	0.57	x	0.7	=	86.38	(77)
Southeast 0.9x	0.77	x	2.94	×	119.01	x	0.57	x	0.7	=	96.75	(77)
Southeast 0.9x	0.77	x	2.94	x	118.15	x	0.57	x	0.7	=	96.05	(77)
Southeast 0.9x	0.77	x	2.94	x	113.91	x	0.57	x	0.7	=	92.6	(77)
Southeast 0.9x		x	2.94	x	104.39	x	0.57	x	0.7	=	84.86	(77)
Southeast 0.9x		x	2.94	x	92.85	x	0.57	x	0.7	=	75.48	(77)
Southeast 0.9x	0.77	x	2.94	x	69.27	x	0.57	x	0.7	=	56.31	(77)
Southeast 0.9x	0.77	x	2.94	x	44.07	x	0.57	x	0.7	=	35.83	(77)
Southeast 0.9x	••••	x	2.94	×	31.49	x	0.57	x	0.7	=	25.6	(77)
Northwest 0.9x		x	2.48	×	11.28	x	0.57	x	0.7	=	15.47	(81)
Northwest 0.9x		x	2.48	×	22.97	x	0.57	x	0.7	=	31.5	(81)
Northwest 0.9x	0.77	x	2.48	x	41.38	x	0.57	x	0.7	=	56.75	(81)

					_		, r							_	
Northwest		x	2.4	8	×	67.96	X	0.57	,	_ × _	0.7	=	93.2	(81)	
Northwest	0.9x 0.77	x	2.4	8	x	91.35	×	0.57	,	x	0.7	=	125.28	(81)	
Northwest	0.9x 0.77	x	2.4	8	x	97.38	×	0.57	,	x	0.7	=	133.56	(81)	
Northwest	0.9x 0.77	x	2.4	8	x	91.1	x	0.57	,	x	0.7	=	124.94	(81)	
Northwest	0.9x 0.77	x	2.4	8	x	72.63	x	0.57	,	_ x [0.7	=	99.61	(81)	
Northwest	0.9x 0.77	x	2.4	8	x	50.42	x	0.57	,	x	0.7	=	69.15	(81)	
Northwest	0.9x 0.77	x	2.4	8	x	28.07	x	0.57	,	x	0.7	=	38.49	(81)	
Northwest	0.9x 0.77	×	2.4	8	x	14.2	x	0.57	,	_ x [0.7	=	19.47	(81)	
Northwest	0.9x 0.77	x	2.4	8	x	9.21	x	0.57	,	x	0.7	=	12.64	(81)	
Solar gair	ns in watts, c	alculated	for eac	h month			(83)m	= Sum(74	l)m	(82)m		-	_		
(83)m= 77	7.08 146.97	242.71	370.48	478.65	503.	19 473.47	388	3.5 286.	.28	173.65	95.18	64.12		(83)	
Total gain	ns – internal a	and solar	(84)m =	= (73)m ·	+ (83)	m, watts					-				
(84)m= 42	27.73 495.47	580.19	690.64	781.57	789.	56 749.21	669.	.66 576	5.5	481.38	422.8	406.3		(84)	
7. Mean	internal temp	perature	(heating	season)										
	ature during h		` o		/	ea from Tal	ole 9,	Th1 (°C	;)				21	(85)	
	-	• •			-			,	,						
	Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec														
(86)m= 0	0.99 0.99	0.98	0.93	0.82	0.6	4 0.49	0.5	6 0.8	2	0.96	0.99	1		(86)	
Mean int	ternal temper	ature in	living ar	ea T1 (fo	ollow	steps 3 to 7	- 7 in T	able 9c)	•				1		
	9.31 19.5	19.85	20.33	20.71	20.9		20.9	<u> </u>	-	20.29	19.73	19.29		(87)	
													l		
· · · · · ·	ature during h	19.6	19.62	19.63	19.6	<u> </u>	19.6	`	<u> </u>	19.63	19.62	19.61	1	(88)	
							I		-	15.05	10.02	10.01		(00)	
	n factor for g	i 1			· · · · · ·	<u>`</u>	<u> </u>				ı —		1		
(89)m= 0	0.99 0.99	0.97	0.9	0.75	0.5	3 0.35	0.4	1 0.7	2	0.94	0.99	0.99		(89)	
Mean int	ternal temper	ature in	the rest	of dwelli	ng T2	2 (follow ste	eps 3	to 7 in T	able	e 9c)					
(90)m= 17	7.41 17.69	18.19	18.87	19.37	19.	6 19.64	19.6	64 19.4	48	18.84	18.03	17.39		(90)	
									fL	_A = Livin	ig area ÷ (4	4) =	0.54	(91)	
Mean int	ternal temper	ature (fo	r the wh	ole dwe	lling)	= fLA × T1	+ (1 ·	– fLA) ×	T2						
	8.43 18.66	19.08	19.65	20.09	20.3	1	20.3	<u> </u>	- T	19.61	18.94	18.41		(92)	
Apply ad	ljustment to t	he mean	interna	temper	ature	from Table	4e, v	where a	ppro	priate	•		1		
(93)m= 18	8.28 18.51	18.93	19.5	19.94	20.1	6 20.21	20.	2 20.0	03	19.46	18.79	18.26		(93)	
8. Space	e heating req	uirement													
	the mean in				ied at	step 11 of	Tabl	e 9b, so	that	: Ti,m=(76)m an	d re-calo	culate		
	ation factor fo	<u> </u>			Γ.	<u> </u>	. .						1		
	Jan Feb	Mar	Apr	May	Ju	n Jul	Αι	ug Se	әр	Oct	Nov	Dec			
	n factor for g	ains, nm 0.96	0.9	0.77	0.5	7 0.41	0.4	8 0.7	5	0.94	0.98	0.99		(94)	
· · /	ains, hmGm				0.5	0.41	0.4	.0 0.7	5	0.94	0.90	0.55		(01)	
	23.39 486.53	, W – (3- 557.35	620.45	600.08	453.	83 307.57	318.	.76 434	.9	451.22	415.25	402.9		(95)	
	average exte						L		-		I		l	. /	
	4.3 4.9	6.5	8.9	11.7	14.0		16.	4 14.	1	10.6	7.1	4.2		(96)	
	s rate for me	an intern	al tempe	erature,	ـــــــــــــــــــــــــــــــــــــ	W =[(39)m	x [(93	3)m– (96)m]		ļ	I	I		
	68.67 1231.23	r 1	940.04	727.99	482.	<u> </u>	328.	<u> </u>	ŕ	783.37	1039.88	1259.02		(97)	
					•	•	•	Į			•				

•••••••		9.090		1	1				, (00) <u>]</u> / (.				
(98)m=	628.88	500.43	419.15	230.1	95.17	0	0	0	0	247.12	449.73	636.95		-
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	3207.54	(98)
Space	e heating	g require	ement in	kWh/m ²	²/year								57.42	(99)
9a. En	ergy req	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heatir	-	4 fee											
	-			econdar		mentary	-		(201)				0	(201)
	-			nain syst	. ,			(202) = 1 - (204) = (20)		(202)] _			1	(202)
			-	main sys				(204) = (20	02) ^ [1 -	(203)] =			1	(204)
		-		ing syste		~ ~ ~ ~	. 0/						91	(206)
EIIICIE				ementar								_	0	(208)
Snoo	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	r
Space	628.88	500.43	419.15	230.1	95.17) 0	0	0	0	247.12	449.73	636.95		
(011)~						0	0	0	0	247.12	440.70	000.00		(014)
(211)fr	$1 = \{[(98)]$)m x (20 549.93	4)] } X 1 460.61	00 ÷ (20 252.86	104.58	0	0	0	0	271.56	494.21	699.95		(211)
	001.00	010.00	100.01	202.00	101.00	Ů	•			ar) =Sum(2			3524.77	(211)
Space	e heatin	n fuel (s	econdar	y), kWh/	month						· 1]```
•)1)]}x1		• • •										
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
						-		Tota	l (kWh/yea	ar) =Sum(2	2 15) _{15,10. 12}	1	0	(215)
Water	heating	I												-
Output				ulated a		400.40	400.44	440.54	4.40,00	450.40	407.04	470.04	l	
Efficion	182.85	161.49 ater hea	170.38	153.8	151.5	136.49	132.14	143.54	142.83	159.43	167.24	178.81	00.0	(216)
(217)m=	· ·	88.13	87.63	86.39	84.12	80.3	80.3	80.3	80.3	86.48	87.83	88.42	80.3	(217)
		heating,			04.12	00.0	00.0	00.0	00.0	00.40	07.00	00.42	I	(2)
		<u>m x 100</u>								-				
(219)m=	206.96	183.23	194.44	178.04	180.11	169.97	164.56	178.75	177.87		190.41	202.24		_
								Tota	I = Sum(2	19a) ₁₁₂ =			2210.94	(219)
	I totals	fuelues	d main	avatam	4					k	Wh/year	•	kWh/year	1
•			·	system	I								3524.77]
Water	heating	fuel use	d										2210.94	J
Electri	city for p	oumps, fa	ans and	electric	keep-ho	t								
mech	anical v	entilatior	n - balar	nced, ext	ract or p	ositive ir	nput fron	n outside	Э			143.11		(230a)
centra	al heatin	g pump:										30		(230c)
Total e	electricity	for the	above, l	kWh/yea	ır			sum	of (230a)	(230g) =			173.11	(231)
Electri	city for li	ghting											319.61	(232)
Electri	city gene	erated by	y PVs										-564.81	(233)
				lual heat	in <u>g svste</u>	ems inclu	udin <u>a mi</u>	cro <u>-CHP</u>						1

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	761.35 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	477.56 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1238.91 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	89.85 (267)
Electricity for lighting	(232) x	0.519 =	165.88 (268)
Energy saving/generation technologies			
Item 1		0.519 =	-293.13 (269)
Total CO2, kg/year	sum	of (265) (271) =	1201.5 (272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =	21.51 (273)
El rating (section 14)			84 (274)

Assessor Name: Diver Morris Strom FSAP 2012 Strom Number: STRO025432 Software Version: Version: 1.0.3.12 Property Address: Unit 2 proposed GREEN Address :				User D	etails:										
Address : , London, NW6 1NR J. Overall dwelling dimensions: Area(m ³) Av. Height(m) Volume(m ³) Ground floor 50.77 (1a) x 2.8 (2a) = 142.16 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 50.77 (4) 0 (a)+(3b)+(3c)+(3d)+(3c)+(3b) = (142.16 (5c) Dwelling volume (a)+(3b)+(3c)+(3d)+(3b)+(3b) = (142.16 (5c) Ventilation rate: Secondary o (a)+(3b)+(3b)+(3b)+(3b) = (a) (a) Number of chinneys 0 + 0 = 0 x40 = 0 (6a) Number of passive vents 0 x10 = 0 (7b) (a)			-												
I. Overall dwelling dimensions: Area(m ²) Av. Height(m) Volume(m ²) Ground floor 50.77 (1a) × 2.8 (2a) = 142.16 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 50.77 (4) 142.16 (5) Dwelling volume $(a)+(3b)+(3c)+(3d)+(3e)+(3n) =$ 142.16 (5) 2. Ventilation rate: main heating secondary other total m^3 per hour Number of chinneys 0 + 0 + 0 $x40 =$ 0 (6a) Number of open flues 0 + 0 + 0 $x10 =$ 0 (7a) Number of passive vents 0 $x10 =$ 0 (7a) Number of flueless gas fires 0 $(7a)$ 0 $(1a) + (1a) + (1a) + (1b) + (1a) + $				Property .	Address:	Unit 2 p	oroposed	d GREEI	N						
Area(m ²)Av. Height(m)Volume(m ²)Ground floor50.77(1a)2.8(2a)142.16(3a)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)50.77(4)142.16(5)Dwelling volume(3a)+(3b)+(3c)+(3d)+(3a)+(3d)+(3a)+(3d)+(3a)+(3d)+(3d)+(3d)+(3d)+(3d)+(3d)+(3d)+(3d	Address :	, London, NV	V6 1NR												
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One of the second of the seco	Number of sides sheltere	ed								3	(19)				
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(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	Wind Factor $(22a)m = (2a)m = (2a)m = (2a)m$	2)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 i	infiltra	tion rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m						
-	0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23			
Calculate			-	rate for t	he appli	cable ca	se						0.5		(23a)
				endix N. (2	3b) = (23a	a) × Fmv (e	equation (N	N5)), othe	rwise (23b) = (23a)			0.5		(23b)
						or in-use fa) (200)			0.5		(23c)
					Ũ		,		, ,	2b)m + ('	23h) x [[,]	1 – (23c)	76.)	(230)
·	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35			(24a)
										2b)m + (2		0.00	I		(/
· · ·				0	0				0	0	0	0	1		(24b)
	-			-	_	ve input v		-	-	Ů		Ů	I		
,					•	•				5 × (23b))				
	0	0	0	0	0	0	0	0	0	0	0	0	1		(24c)
	tural v	entilatio	n or wh	ole hous	e positiv	/e input v	ı ventilatio	n from l	oft				I		
,					•	erwise (2				0.5]					
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24d)
Effective	e air c	change	rate - er	nter (24a) or (24b	o) or (240	c) or (24	d) in boy	x (25)						
(25)m= 0	.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35			(25)
3. Heat lo	00000	and he	at loss r	haramete	⊇r.								-		
ELEMEI		Gros		Openin		Net Ar	ea	U-valı	le	AXU		k-value	<u>,</u>	ΑX	k
		area		m		A ,n		W/m2		(W/I	<)	kJ/m²·l		kJ/K	
Doors						1.79	x	1.5	=	2.685					(26)
Windows						2.48	x1,	/[1/(1.4)+	0.04] =	3.29					(27)
Floor						50.77	, X	0.25] = [12.6925	5 [(28)
Walls Typ	e1	26.7	'5	9.92		16.83	3 X	0.25	; 	4.21	= i				(29)
Walls Typ	e2	20.0		1.79		18.26		0.25		4.6	= i		\dashv		(29)
Total area						97.57			L		L				(31)
Party wall			,			3.89	×	0	= [0					(32)
Party wall											╡╏		\dashv		-
						20.38		0	= [0			\dashv		(32)
Party ceili * for window	•	coof wind		footivowi	ndowlly	50.77		formula 1	/[/1/	$(a) \cdot 0.041 a$	L n civon in	narograph			(32b)
** include th							aleu using	normula i	/[(1/0-vaiu	le)+0.04j a	is given in	parayrapr	1 3.2		
Fabric hea	at loss	s, W/K =	= S (A x	U)				(26) (30)	+ (32) =				37.3	3	(33)
Heat capa	acity C	Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	13232	.56	(34)
Thermal n	nass į	parame	ter (TMF	• = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250)	(35)
For design a	assessr	nents wh	ere the de	tails of the	construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f			1
can be used															-
Thermal b	-		,		• •		<						14.6	4	(36)
if details of the Total fabri			are not kn	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			E1 0	7	(37)
Ventilation			alculated	l monthly	1					= 0.33 × (25)m x (5)		51.9	7](37)
	Jan	Feb	Mar	Apr	/ May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1		
	7.1	16.87	16.65	15.51	15.28	14.15	14.15	13.92	14.6	15.28	15.74	16.19			(38)
													1		
Heat trans		68.84	r	67 40	67.25	66 40	66 40	65.00		= (37) + (3		69.46	1		
(39)m= 69	9.07	00.04	68.62	67.48	07.25	66.12	66.12	65.89	66.57	67.25	67.71	68.16			1

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Average = Sum(39)_{1 12} /12= $67.4 \rho_{age 2} \phi^{(39)}$

Heat lo	oss para	ımeter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.36	1.36	1.35	1.33	1.32	1.3	1.3	1.3	1.31	1.32	1.33	1.34		
Numbe			L				!		,	Average =	Sum(40)₁	₁₂ /12=	1.33	(40)
	Jan	Feb	nth (Tab Mar	, <u> </u>	Mov	Jun	Jul	Δυσ	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	Apr 30	May 31	30	31	Aug 31	30	31	Nov 30	31		(41)
(+1)11-	51	20	51		51			51		51		01		()
4. Wa	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
if TF if TF	A > 13. A £ 13.	9, N = 1	+ 1.76 x			·		9)2)] + 0.0		TFA -13.		71		(42)
Reduce	the annua	al average	hot water	0	5% if the c	welling is	designed	(25 x N) to achieve		se target o		.88		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	82.37	79.37	76.38	73.38	70.39	67.39	67.39	70.39	73.38	76.38	79.37	82.37		_
Enorm	contant of	bot wator	used es	loulotod m	onthu - 1	100 v Vd		DTm / 2600			m(44) _{1 12} =	L	898.54	(44)
				·	-		. <u> </u>	DTm / 3600		-				
(45)m=	122.15	106.83	110.24	96.11	92.22	79.58	73.74	84.62	85.63	99.79	108.93	118.29	4470.40	(45)
lf instant	taneous w	vater heati	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46		i otal = Su	m(45) _{1 12} =		1178.13	(45)
(46)m=	18.32	16.02	16.54	14.42	13.83	11.94	11.06	12.69	12.84	14.97	16.34	17.74		(46)
Water	storage	loss:						1		ļ				
Storag	e volum	e (litres)	includir	ng any s	olar or V	WHRS	storage	within sa	ame ves	sel		0		(47)
	•	-		ank in dw	-						47)			
	ise it no storage		not wate	er (this ir	iciudes i	nstantar	neous co	ombi boil	ers) ente	er 'O' in (47)			
	•		eclared I	oss fact	or is kno	wn (kWł	n/day):)		(48)
Tempe	erature f	actor fro	m Table	2b)		(49)
Energy	/ lost fro	m watei	storage	e, kWh/y	ear			(48) x (49)) =)		(50)
,				cylinder										
		-	ee secti	rom Tab	le 2 (kW	h/litre/da	ay))		(51)
	•	from Ta		011 4.5)		(52)
			m Table	2b								о С		(53)
Energy	/ lost fro	m watei	storage	e, kWh/y	ear			(47) x (51)) x (52) x (53) =)		(54)
Enter	(50) or ((54) in (8	55)									0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Appendi	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nual) fro	om Table	e 3))		(58)
	•					59)m =	(58) ÷ 30	65 × (41)	m					
•	dified by	factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ing and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for eac	ch	month (61)m =	= (60	D) ÷ 30	65 × (41))m								
(61)m=	41.97	36.53	38.92	2	36.19	35.87	:	33.23	34.34	35.	87	36.19	38.92	39.14	41	1.97		(61)
Total h	eat req	uired for	water	he	ating ca	alculate	ed fo	or eac	h month	(62)	m =	0.85 × (45)m	+ (46)m	+ (57)m +	(59)m + (61)m	
(62)m=	164.12	143.36	149.1	6	132.3	128.09	1	12.81	108.08	120	.49	121.82	138.7	1 148.0	7 16	0.27		(62)
Solar DH	W input	calculated	using A	ppe	endix G or	Append	ix H	(negati	ve quantity	/) (ent	er '0	' if no solar	r contrib	ution to w	ater he	ating)		
(add a	dditiona	al lines if	FGHR	Sa	and/or V	VWHR	S a	pplies	, see Ap	penc	dix C	G)						
(63)m=	0	0	0		0	0		0	0	C)	0	0	0		0		(63)
Output	from w	ater hea	ter															
(64)m=	164.12	143.36	149.1	6	132.3	128.09	1	12.81	108.08	120	.49	121.82	138.7	1 148.0	7 16	0.27		
											Outp	out from wa	ater hea	ter (annua	II) 1 12		1627.28	(64)
Heat g	ains fro	m water	heatin	g,	kWh/mo	onth 0.2	25 ´	[0.85	× (45)m	+ (6	i1)m	n] + 0.8 x	: [(46)ı	n + (57)	m + (ť	59)m]	
(65)m=	51.11	44.65	46.38		41	39.63		34.77	33.1	37	.1	37.52	42.91	46.01	49	9.83		(65)
inclu	de (57)	m in calo	culation	n o	f (65)m	only if	cyli	nder i	s in the o	dwell	ing	or hot wa	ater is	from co	mmur	nity h	leating	
5. Int	ernal a	ains (see	e Table	e 5	and 5a):					-					•	-	
	Ŭ	ns (Table																
metab	Jan	Feb	Ma		Apr	May	,	Jun	Jul	A	ug	Sep	Oct	Nov	/ [Dec		
(66)m=	85.64	85.64	85.64	-	85.64	85.64	-	35.64	85.64	85.	<u> </u>	85.64	85.64	_		5.64		(66)
l iahtin	a gains	(calcula	ted in .	Ap	pendix	eaus	tion	190	rl9a)a	lso s	ee -	Left Table 5						
(67)m=	16.79	14.91	12.13	<u> </u>	9.18	6.86	-	5.79	6.26	8.1		10.92	13.87	16.19	17	7.26		(67)
		ins (calc		_	Annend	hiv I o		tion L	13 or I 1	(32)	also							
(68)m=	149.23	150.78	146.8	_	138.57	128.09	<u>.</u>	18.23	111.64	110		114	122.3	1 132.7	9 14	2.65	l	(68)
														102.1		2.00		()
(69)m=	31.56	(calcula 31.56	31.56	-i	31.56	2, equa	_	31.56	31.56	31.		31.56	31.56	31.56	21	1.56		(69)
						51.50	<u> </u>	51.50	51.50	51.	50	51.50	51.50	51.50	, 1 3	1.50		(00)
		ns gains	r`	3 5 T		10		10	10		0	10	10	10		10	I	(70)
(70)m=	10		10		10	10	<u> </u>	10	10	1	0	10	10	10		10		(70)
		/aporatio	<u> </u>			, ,	-	,									I	(74)
(71)m=	-68.51	-68.51	-68.5		-68.51	-68.51	-	68.51	-68.51	-68	.51	-68.51	-68.5	-68.5	1 -68	8.51		(71)
		gains (T	ī — —	<u>΄</u> τ			-					· · · · ·		-			1	()
(72)m=	68.69	66.45	62.35		56.95	53.27	4	48.29	44.5	49.		52.11	57.68			5.97		(72)
		gains =						()	. ,	<u>`</u>	<i>'</i>	+ (69)m + (,	· / ·				
(73)m=	293.41	290.84	280.0	5	263.4	246.91		231	221.09	226	6.8	235.72	252.5	4 271.5	7 28	5.57		(73)
	ar gain																	
•		calculated	•	olar			a and			tions	to co		e applic		tation.		0	
Orienta		Access F Table 6d			Area m²			Flu Tal	x ole 6a		т	g_ able 6b		FF Table 6	2		Gains (W)	
Northur	_									1			_			1		٦
Northwo	L	0.77		x	2.4	8	x	<u> </u>	1.28	X		0.57	_ ×	0.7] =	30.95	(81)
Northwo	Ļ	0.77		X	2.4		x	<u> </u>	2.97	×		0.57	×	0.7] =	63	(81)
Northwo	L	0.77		X	2.4	8	x	4	1.38	×		0.57	×	0.7] =	113.5	(81)
Northwo	L	0.77		x	2.4	8	x	6	57.96	×		0.57	×	0.7		=	186.4	(81)
Northw	est <mark>0.9x</mark>	0.77		x	2.4	8	x	g	1.35	x		0.57	x	0.7		=	250.56	(81)

								. –						
Northwest 0.9	0.11	x	2.4	18	x	9	7.38	x	0.57	×	0.7	=	267.12	(81)
Northwest 0.9	0.77	x	2.4	18	x	9	91.1	x	0.57	×	0.7	=	249.89	(81)
Northwest 0.9	0.77	x	2.4	18	x	7	2.63	x	0.57	x	0.7	=	199.21	(81)
Northwest 0.9	0.77	x	2.4	18	x	5	0.42	x	0.57	×	0.7	=	138.3	(81)
Northwest 0.9	0.77	x	2.4	18	x	2	8.07	x	0.57	×	0.7	=	76.99	(81)
Northwest 0.9	0.77	x	2.4	18	x	1	4.2	x	0.57	×	0.7	=	38.94	(81)
Northwest 0.9	0.77	x	2.4	18	x	9	9.21	x	0.57	x	0.7	=	25.27	(81)
Solar <u>g</u> ains i	n watts, ca	lculated	for eac	h month	-			(83)m =	= Sum(74)m	(82)m	-	-		
(83)m= 30.95	5 63	113.5	186.4	250.56	2	67.12	249.89	199.2	1 138.3	76.99	38.94	25.27		(83)
Total gains -	- internal a	nd solar	(84)m =	= (73)m	+ (8	83)m ,	, watts				_			
(84)m= 324.3	6 353.83	393.55	449.79	497.46	4	98.13	470.98	426.0	1 374.02	329.53	310.51	310.84		(84)
7. Mean int	ernal temp	erature ((heating	seasor)									
Temperatu	re during h	eating p	eriods ir	n the livi	ng	area f	rom Tab	ole 9, ⁻	Th1 (°C)				21	(85)
Utilisation f	actor for ga	ains for li	iving are	ea, h1,m	ı (s	ee Ta	ble 9a)							
Jar	Feb	Mar	Apr	May	Ĺ	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.97	0.9	(0.75	0.59	0.66	0.89	0.98	1	1		(86)
Mean interr	al tempera	ature in l	ivina ar		പ	w ster	ns 3 to 7	' in Ta	hle 9c)					
(87)m= 19.52		19.92	20.32	20.68	1	20.91	20.98	20.96		20.33	19.87	19.51		(87)
					I									
	<u> </u>	T		1	T					10.00	10.91	10.01	l	(88)
(88)m= 19.79	9 19.8	19.8	19.82	19.82		9.84	19.84	19.84	19.83	19.82	19.81	19.81		(00)
Utilisation f		ains for r	est of d	welling,	h2,	,m (se	e Table	9a)			-	1	I	
(89)m= 1	0.99	0.99	0.95	0.85	(0.65	0.45	0.52	0.83	0.97	0.99	1		(89)
Mean interr	nal tempera	ature in t	he rest	of dwell	ing	T2 (fo	ollow ste	eps 3 t	o 7 in Tabl	e 9c)	_	-		
(90)m= 17.84	18.04	18.43	19.01	19.5	1	9.78	19.83	19.83	3 19.64	19.03	18.37	17.83		(90)
									f	LA = Livi	ng area ÷ (4	4) =	0.47	(91)
Mean interr	nal tempera	ature (fo	r the wh	ole dwe	llin	g) = fL	_A × T1	+ (1 –	fLA) × T2					
(92)m= 18.64	i 18.8	19.13	19.63	20.06	2	20.31	20.37	20.36	6 20.18	19.64	19.08	18.63		(92)
Apply adjus	stment to th	ne mean	interna	l temper	atu	ire fro	m Table	4e, w	here appro	opriate	1			
(93)m= 18.49) 18.65	18.98	19.48	19.91	2	20.16	20.22	20.2	20.03	19.49	18.93	18.48		(93)
8. Space he	eating requ	irement												
Set Ti to the			•		ned	at ste	ep 11 of	Table	9b, so tha	t Ti,m=	(76)m an	d re-calo	ulate	
the utilisation	1 1	<u> </u>	<u> </u>	1	-	. 1						_		
Jar		Mar	Apr	May		Jun	Jul	Au	g Sep	Oct	Nov	Dec		
Utilisation f	<u> </u>	0.98	0.95	0.86		0.68	0.5	0.57	0.84	0.97	0.99	1		(94)
Useful gain						0.00	0.5	0.57	0.04	0.97	0.99			(04)
(95)m= 322.6	1 1	386.64	427	426.77	1 3	338.1	233.94	241.4	6 314.33	318.99	307.75	309.52		(95)
Monthly av							200.01		0 011.00	010.00	001.10	000.02		()
(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 ra											1	I	l	
(97)m= 979.9	1 1	856.62	713.84	552.08	-	67.76	239.47	251.2		598.2	800.74	973.03		(97)
Space heat	ing require	ment for	r each n	nonth, k	Wh	/mont	h = 0.02	24 x [(9	97)m – (95)m] x (4	11)m	1	I	
(98)m= 488.9	- <u>ř</u>	349.66	206.52	93.24	Γ	0	0	0	0	207.73	354.95	493.65		
					•				-		•	•		

								Tota	l per year	(kWh/yeai	r) = Sum(9	8)15,912 =	2595.06	(98)
Space	e heatin	g require	ement in	n kWh/m²	²/year								51.11	(99)
9a. En	ergy reo	quiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	HP)					
	e heati	-										I		
				econdar		mentary			(201)				0	(201)
				nain syst	. ,			(202) = 1 -		(000)]		·	1	(202)
			-	main sys				(204) = (20	J2) × [1 –	(203)] =			1	(204)
	-	-		ing syste			- <i>i</i>						90.9	(206)
Efficie	ency of		· · ·	ementar		g system				r	i		0	(208)
•	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin 488.98	g require 400.31	ement (0 349.66	206.52	d above) 93.24	0	0	0	0	207.73	354.95	493.65		
(044)						0	0	0	0	207.73	304.90	493.00		(214)
(211)m	$1 = \{[(98) \\ 537.94]$	5)m x (20 440.39	4)] } X 1 384.67	100 ÷ (20 227.2	102.57	0	0	0	0	228.53	390.49	543.07		(211)
	557.54	440.33	304.07	221.2	102.07	0	0	-	-		211) _{15,10. 12}		2854.85	(211)
Space	e heatin	a fuel (s	econdar	·y), kWh/	month					, ,	· 1		200 1100], ,
•		01)] } x 1		• /	monur									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
	heating	-												
Output	from w 164.12	I	ter (calc 149.16	ulated a	bove) 128.09	112.81	108.08	120.49	121.82	138.71	148.07	160.27		
Efficier		ater hea		102.0	120.00	112.01	100.00	120.40	121.02	100.71	140.07	100.27	80.8	(216)
(217)m=	-	88	87.62	86.67	84.77	80.8	80.8	80.8	80.8	86.57	87.67	88.2		(217)
Fuel fo	r water	heating,	kWh/m	onth										
(219)m	n = (64)	<u>m x 100</u>) ÷ (217)m										
(219)m=	186.22	162.91	170.23	152.65	151.1	139.62	133.77	149.12	150.76 I = Sum(2	160.24	168.89	181.71		
٨٥٩٠٠٩	l totals							TOta	i = Suiii(2		White		1907.22	(219)
			ed, main	system	1					ĸ	Wh/year		kWh/year 2854.85	1
•	-	fuel use											1907.22	1
	-			electric	kaan ha	+							1001.22	J
		•												(000.)
				nced, ext	ract or p	ositive ii	nput fron	n outside	9			130.07		(230a)
centra	al heatir	ng pump	:									120		(230c)
Total e	lectricit	y for the	above,	kWh/yea	r			sum	of (230a)	(230g) =			250.07	(231)
Electric	city for I	ighting											296.54	(232)
Electric	city gen	erated b	y PVs										-564.81	(233)
12a. (CO2 err	nissions -	– Individ	lual heati	ing sys <u>te</u>	ems inclu	uding mi	cro-CHP						-
						Em	oray			Emias	ion fac	tor	Emissions	
							ergy /h/year			kg CO			kg CO2/yea	ır

Space heating (main system 1)	(211) x	0.216	=	616.65	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	411.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1028.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	129.79	(267)
Electricity for lighting	(232) x	0.519	=	153.9	(268)
Energy saving/generation technologies					٦
Item 1		0.519	=	-293.13	(269)
Total CO2, kg/year	sur	m of (265) (271) =		1019.16	(272)
Dwelling CO2 Emission Rate	(27	(2) ÷ (4) =		20.07	(273)
El rating (section 14)				86	(274)

Assessor Name: Diver Morris Strom FSAP 2012 Strom Number: STRO025432 Software Version: Version: 1.0.3.12 Property Address: Unit 3 proposed GREEN Address : London, NW6 1NR Coverall dwelling dimensions: Ave. Height(m) Ground floor				User D	etails:						
Property Address: Unit's proposed GREENAddress: Junit's proposed GREENAddress: Junit's proposed GREENAddress: Junit's proposed GREENArea(m ²)Av. Height(m)Volume(m ²)Ground floorCallVolume(m ²)Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)ScondaryOthertotalVolume(m ²)OthertotalValue(d)+(3b)+(3c)+(3c)+(3c)+(3c)+(3c)+(3c)+(3c)+(3c			2012								
I. Overall dwelling dimensions: Area(m ²) Av. Height(m) Volume(m ²) Ground floor 52.11 $(16) \times 2.8$ $(2a) = $ 145.91 $(3a)$ Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 52.11 (4) $(a)+(3b)+(3c)+(3d)+(3e)+(3n) = $ 145.91 (5) Ventilation rate: main becondary other total m ³ per hour Number of chinneys $0 + 0 = 0$ $x 40 = 0$ $0 = 0$ $(6e)$ Number of open flues $0 + 0 = 0$ $x 10 = 0$ $0 = 7e$ Number of passive vents $0 = x 40 = 0$ $0 = 7e$ Number of flueless gas fires $0 = x 10 = 0$ $0 = 7e$ Number of storeys in the dwelling (ns) $Aditional infitation (19) - 10e 1 = 0 0 = 10e Additional infitation 0.25 \cdot 10.2 \times (14) + 100 0 = 10e 0 = 11e If no draught lobby, enter 0.05, else enter 0 0 = 11e 0 = 11e 0 = 11e Percentage of windows and doors draught stripped 0 = 11e 0 = 11e 0 = 11e Window infittration rate 0 = 25 \cdot 10.2 \times (14) + 100 = 11e 0 = 11e 0 = 11e $			Р	roperty /	Address:	Unit 3 p	proposed	d GREEI	N		
Area(m ²)Av. Height(m)Volume(m ²)Ground floor 52.11 $(1a) \times 2.8$ $(2a) = 145.91$ (145.91) Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 52.11 (d) $(a)+(2b)+(3c)+(3d)+(3e)+(3n) = (145.91)$ $(d) = 10.91$ Dwelling volume $(3a)+(2b)+(3c)+(3d)+(3e)+(3c)+(3d)+(3e)+(3n) = (145.91)$ $(d) = 10.91$ $(d) = 10.91$ Number of chimneys 0 $+$ 0 $=$ 0 $x40 = 0$ $(d) = 0$ Number of open flues 0 $+$ 0 $=$ 0 $x40 = 0$ $(d) = 0$ Number of passive vents 0 $x10 = 0$ $(d) = 0$ $(d) = 0$ $(d) = 0$ Number of flueless gas fires 0 $x40 = 0$ 0 $(d) = 0$ Number of the less gas fires 0 $x40 = 0$ 0 $(d) = 0$ Number of storeys in the dwelling (ns) 0 $x40 = 0$ 0 $(d) = 0$ Additional infitration $(B)+(10)+(10)+(10)+(10)+(10)+(10)+(10)+(10$	Address :	, London, NW6	1NR								
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Developing volume $(3a)+(3b)+(3c)+(3d)+(3d)+(3d)+(3d)+(3d)+(3d)+(3d)+(3d$	Ground floor				· ·	(1a) x			(2a) =	• •	-
2. Ventilation rate: main heating secondary heating other total m³ per hour Number of chimneys 0 + 0 = 0 x40 = 0 (6s) Number of open flues 0 + 0 = 0 x40 = 0 (6s) Number of open flues 0 + 0 = 0 x20 = 0 (6s) Number of intermittent fans 0 x10 = 0 (7a) 0 (7a) (7b) Number of passive vents 0 x40 = 0 (7c) (7c) 0 (7c) (7c) Number of storeys in the dwalling (ns) Additional infiltration (9) (10) 0 (10) (11) 0 (10) (11) 0 (12) 0 (11) 0 (11) 0 (12) 0 (11) 0 (12) 0 (12) 0 (12) 0 (12) 0 (13) 10 10 (11) 10 10 (11) 10 10 (11) 10 10 10	Total floor area TFA = (1	a)+(1b)+(1c)+(1d)	+(1e)+(1r	n) 5	2.11	(4)					_
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Number of intermittent fans 0 $x10 =$ 0 $(7a)$ Number of passive vents 0 $x10 =$ 0 $(7b)$ Number of flueless gas fires 0 $x40 =$ 0 $(7c)$ Air changes per hourInfiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 $+(6) =$ 0 (9)Additional infiltration(9)Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction(10)If suspended wooden floor, enter 0.2 (unsealed), of 0.35 for masonry construction(11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas or opening); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 O(12)If no draught lobby, enter 0.05 , else enter 0 OO(12)If no draught lobby, enter 0.05 , else enter 0 OO(12)If no draught lobby, enter 0.05 , else enter 0 OOOO(12)If parmeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 O <t< td=""><td></td><td>heating</td><td>+ 0</td><td>, </td><td>0</td><td>Į Ľ</td><td>0</td><td></td><td></td><td>0</td><td>(6a)</td></t<>		heating	+ 0	, 	0	Į Ľ	0			0	(6a)
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Number of flueless gas fires $ \begin{array}{c} 0 \\ \text{Number of flueless gas fires} \end{array} $ $ \begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\$	Number of intermittent fa	ns					0	х ′	10 =	0	(7a)
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Wind Factor (22a)m = (22)m ÷ 4	Monthly average wind sp	eed from Table 7									
	(22)m= 5.1 5	4.9 4.4 4	.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
(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	Wind Factor $(22a)m = (22a)m$	2)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		

Adjuste	ed infiltra	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23		
		c <i>tive air</i> al ventila	-	rate for t	he appli	cable ca	se					Г	0.5	(23a)
				endix N. (2	3b) = (23a	a) × Fmv (e	equation (N	√5)) , other	wise (23b) = (23a)		L	0.5	(23a)
								n Table 4h)		, (,		L	76.5	(23c)
					Ũ		,	,		2h)m + ('	23h) x [1	L 1 – (23c)		(200)
(24a)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35	. 100]	(24a)
b) If I	balance	d mech	ı anical ve	ntilation	without	heat rec	coverv (N	и ЛV) (24b)m = (22	1 2b)m + (2	 23b)	<u> </u>		
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,					•	•		on from c c) = (22b		.5 × (23b)	<u> </u>		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If i	natural	ventilatio	on or wh	ole hous	e positiv	/e input v	ventilatio	on from l	oft			II		
,					•	•		0.5 + [(2		0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	ctive air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)					
(25)m=	0.36	0.36	0.35	0.33	0.33	0.3	0.3	0.3	0.31	0.33	0.34	0.35		(25)
3. Hea	at losse	s and he	eat loss p	paramet	er:									
ELEM		Gros area	SS	Openin rr	gs	Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²⋅k		A X k kJ/K
Doors														
20010						1.79	×	1.5	=	2.685				(26)
	ws Type	e 1				1.79 1.44		1.5 /[1/(1.4)+		2.685 1.91				(26) (27)
Window	ws Type ws Type						x1,		0.04] =					
Windov Windov		2				1.44	x1,	/[1/(1.4)+	0.04] = 0.04] =	1.91				(27)
Windov Windov Windov	ws Type	e 2 e 3				1.44	x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] =	1.91 1.59				(27) (27)
Windov Windov Windov	ws Type ws Type	e 2 e 3				1.44 1.2 1.91	x1) x1) x1) x1) x1)	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] =	1.91 1.59 2.53			7	(27) (27) (27)
Windov Windov Windov Windov	ws Type ws Type ws Type	e 2 e 3	52	4.08		1.44 1.2 1.91 2.94	x1, x1, x1, x1, x1, x1, x1, x	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	0.04] = [0.04] = [0.04] = [0.04] = [1.91 1.59 2.53 3.9				(27) (27) (27) (27)
Window Window Window Window Floor	ws Type ws Type ws Type ſype1	2 2 3 2 4		4.08		1.44 1.2 1.91 2.94 52.11	x1, x1, x1, x1, x1, x1, x1, x	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25	0.04] = [0.04] = [0.04] = [0.04] = [= [1.91 1.59 2.53 3.9 13.0275				(27) (27) (27) (27) (27) (28)
Window Window Window Floor Walls T	ws Type ws Type ws Type fype1 fype2	2 2 3 4 42.6 6.5	5	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7	x1, x1) x1) x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25	0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [1.91 1.59 2.53 3.9 13.0275 9.63 0.43				(27) (27) (27) (27) (28) (28) (29) (29)
Window Window Window Floor Walls T Walls T	ws Type ws Type ws Type fype1 fype2	2 3 4 42.6 6.5 19.3	5	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53	x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25 0.25	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41				(27) (27) (27) (27) (28) (29) (29) (29)
Window Window Window Floor Walls T Walls T Walls T Roof	ws Type ws Type ws Type Type1 Type2 Type3	2 2 3 4 42.6 6.5	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7	x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \\ 0.04] = \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	1.91 1.59 2.53 3.9 13.0275 9.63 0.43				(27) (27) (27) (27) (28) (29) (29) (29) (29) (30)
Window Window Window Floor Walls T Walls T Walls T Roof Total a	ws Type ws Type ws Type Type1 Type2 Type3 rea of e	2 3 4 42.6 6.5 19.3 28.6	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.24	x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25 0.25 0.25 0.16	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \\ 0.04] = \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41 4.59				(27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (29) (30) (31)
Window Window Window Floor Walls T Walls T Walls T Roof Total a Party w	ws Type ws Type ws Type Type1 Type2 Type3 rea of e vall	2 3 4 42.6 6.5 19.3 28.6	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.24 10.5	x1/ x1/ x1/ x1/ x1/ x x x x x x x x x x	<pre>/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+</pre>	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41 4.59 0				(27) (27) (27) (27) (28) (29) (29) (29) (29) (30) (31) (32)
Window Window Window Floor Walls T Walls T Walls T Roof Total a Party w Party w	ws Type ws Type ws Type Type1 Type2 Type3 rea of e vall vall	2 3 4 42.6 6.5 19.3 28.6	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.24 10.5 8.02	x1, x1, x1, x1, x1, x1, x1, x1, x1, x2, x3, x3, x4, x4, x4, x4, x4, x4, x4, x4, x4, x4	<pre>/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25 0.25 0.25 0.25 0.16 0 0 0.2</pre>	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \\ 0.04] = \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41 4.59 0 1.6				(27) (27) (27) (27) (28) (29) (29) (29) (29) (30) (31) (32) (32)
Window Window Window Floor Walls T Walls T Walls T Roof Total a Party w Party w	ws Type ws Type ws Type Type1 Type2 Type3 rea of e vall vall	2 3 4 42.6 6.5 19.3 28.6	5 32 38	4.85		1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.24 10.5 8.02 13.41	x1, x1, x1, x1, x1, x1, x1, x1, x1, x1,	<pre>/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+</pre>	$\begin{array}{c} 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ 0.04] = \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41 4.59 0				(27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (32) (32) (32)
Window Window Window Floor Walls T Walls T Walls T Roof Total at Party w Party w Party c * for wind	ws Type ws Type ws Type rype1 rype2 rype3 rea of e vall vall vall vall ceiling dows and	2 3 4 42.6 19.3 28.6 Ilements	5 32 38 38 3, m ² ows, use e	4.85 1.79 0	ndow U-ve	1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.22 10.5 8.02 13.41 52.11	x1/ x1/ x1/ x1/ x1/ x x x x x x x x x x	<pre>/[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.16 0 0 0.2 0 0</pre>	$\begin{array}{c} 0.04] = \\ 0.04] = \\ \\ 0.04] = \\ \\ 0.04] = \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41 4.59 0 1.6 0		paragraph		(27) (27) (27) (27) (28) (29) (29) (29) (29) (30) (31) (31) (32) (32)
Window Window Window Floor Walls T Walls T Walls T Roof Total a Party w Party w Party w Party c * for window	ws Type ws Type ws Type Type1 Type2 Type3 rea of e vall vall vall eeiling dows and e the area	2 3 4 42.6 6.5 19.3 28.6 lements	5 32 38 38 3, m ² ows, use e	4.85 1.79 0	ndow U-ve	1.44 1.2 1.91 2.94 52.11 38.54 1.7 17.53 28.68 149.22 10.5 8.02 13.41 52.11	x1/ x1/ x1/ x1/ x1/ x x x x x x x x x x	(1/(1.4)+)/(1/(1/(1.4)+)/(1/(1/(1.4)+)/(1/(1/(1.4)+))/(1/(1/(1.4)+)/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1.4)+))/(1/(1/(1/(1.4)+))/(1/(1/(1/($\begin{array}{c} 0.04] = \\ 0.04] = \\ \\ 0.04] = \\ \\ 0.04] = \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	1.91 1.59 2.53 3.9 13.0275 9.63 0.43 4.41 4.59 0 1.6 0		paragraph		(27) (27) (27) (27) (28) (29) (29) (29) (29) (29) (30) (31) (32) (32) (32)

Thermal mass parameter (TMP = $Cm \div TFA$) in kJ/m²K

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

Indicative Value: Medium

250

(35)

can be i	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	<						22.39	(36)
if details	of therma	al bridging	are not kri	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			70.61	(37)
Ventila	ation hea	at loss ca	alculated	monthl	у				(38)m	= 0.33 × ((25)m x (5)		_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	17.55	17.32	17.09	15.92	15.69	14.52	14.52	14.29	14.99	15.69	16.15	16.62		(38)
Heat t	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	88.16	87.93	87.7	86.53	86.3	85.13	85.13	84.9	85.6	86.3	86.76	87.23		
										-	Sum(39)1	₁₂ /12=	86.47	(39)
	<u> </u>	imeter (H	HLP), W/	/m²K		·	i		(40)m	= (39)m ÷	- (4)		1	
(40)m=	1.69	1.69	1.68	1.66	1.66	1.63	1.63	1.63	1.64	1.66	1.66	1.67		
Numb	er of dav	/s in moi	nth (Tab	le 1a)						Average =	Sum(40)₁	₁₂ /12=	1.66	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
		Į	Į	ļ	Į	ļ	ļ	ļ		Į	ļ	I	1	
4. Wa	ater hea	ting enei	rav reau	irement:								kWh/ye	ear:	
													,	
		ıpancy, l o_N – 1		[1 <u>-</u> eyn		249 v (TF	-130)2)] + 0.()013 x (⁻	TFA -13		75		(42)
	A £ 13.		+ 1.70 ×	[i - evb	(-0.000	H3 X (11	A-10.9	/2/] + 0.0		11 A - 15	.3)			
								(25 x N)				.82		(43)
		al average litres per j				-	-	to achieve	a water us	se target o	of		•	
notmor		· · ·		· ·		i	·		-			_	1	
Hot wat	Jan	Feb n litres per	Mar day for or	Apr Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			-										1	
(44)m=	83.4	80.37	77.33	74.3	71.27	68.24	68.24	71.27	74.3	77.33	80.37	83.4		
Energy	content of	hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x D)))))))))))))))))))			m(44) _{1 12} = ables 1b, 1		909.81	(44)
(45)m=	123.68	108.17	111.62	97.31	93.38	80.58	74.67	85.68	86.7	101.04	110.3	119.78]	
										Total = Su	m(45)1 12 =	-	1192.9	(45)
lf instan	taneous v	/ater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46)) to (61)				_	
(46)m=	18.55	16.23	16.74	14.6	14.01	12.09	11.2	12.85	13.01	15.16	16.54	17.97		(46)
	storage		الم ماريما					within or		aal			1	
-		. ,					-	within sa	ime ves	sei		0		(47)
	•	neating a			-			(47) mbi boil	are) ont	ar 'O' in ((17)			
	storage		not wate	21 (1113 11		nstantai					, , , ,			
	-	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0]	(48)
		actor fro					• •					0		(49)
		m water			ear			(48) x (49)	=			0]	(50)
		urer's de	-			or is not	known:					-	1	,
		age loss			le 2 (kW	h/litre/da	ıy)					0]	(51)
		eating s		on 4.3									1	(==)
		from Ta actor fro		2h								0		(52) (53)
. cmpe				20								0		(55)

0.			•	e, kWh/y	ear			(47) x (51) x (52) x (53) =		0]	(54)
	. ,	(54) in (8										0		(55)
Water	storage	loss cal	culated	for each	month	_		((56)m =)	(55) × (41)	m	-	-	_	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ((H11)] ÷ (5	0), else (5	57)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0]	(58)
Primar	y circuit	loss cal	culated	for each	month (59)m = ((58) ÷ 36	65 × (41))m				-	
(mo	dified by	factor f	rom Tab	le H5 if t	there is s	solar wat	ter heati	ng and a	a cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 3	65 × (41)m						
(61)m=	42.5	36.99	39.41	36.64	36.32	33.65	34.77	36.32	36.64	39.41	39.63	42.5]	(61)
Total h	neat req	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	166.18	145.16	151.03	133.96	129.69	114.23	109.44	122	123.34	140.45	149.93	162.28		(62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	H (negati	• ve quantity	y) (enter 'C)' if no sola	r contribut	ion to wate	r heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter	-	-		-						-	
(64)m=	166.18	145.16	151.03	133.96	129.69	114.23	109.44	122	123.34	140.45	149.93	162.28		
			•		•		•	Out	put from w	ater heate	r (annual)	12	1647.68	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)n	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	51.75	45.21	46.97	41.52	40.13	35.2	33.52	37.57	37.99	43.45	46.58	50.45		(65)
inclu	ude (57)	m in cal	culation	• of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	heating	
5. Int	ternal da	ains (see	e Table 5	5 and 5a):	-		-				-	_	
		is (Table			,									
metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62	87.62		(66)
	la gains		ted in A	ppendix	L, equat	ion L9 o	r L9a), a	lso see					1	
(67)m=	17.53	15.57	12.66	9.58	7.16	6.05	6.54	8.5	11.4	14.48	16.9	18.01]	(67)
Applia	nces da	ins (calc	ulated ir	I Append	dix L. ea	uation L	13 or L1	i 3a), also	see Ta	ble 5	ļ	ļ	1	
(68)m=	152.71	154.3	150.3	141.8	131.07	120.98	114.25	112.66	116.65	125.16	135.89	145.97]	(68)
		l (calcula		I nnendix					ı ee Table				1	
(69)m=	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76	31.76		(69)
		ns gains											J	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	1	(70)
					l les) (Tab		_		_	_	_	_	1	
(71)m=	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	-70.09	1	(71)
		gains (1											1	
(72)m=	69.55	67.28	63.13	57.66	53.93	48.89	45.05	50.49	52.76	58.4	64.7	67.81]	(72)
		gains =					I		+ (69)m +]	. /
(73)m=	292.08	289.43	278.37	261.33	244.45	228.21	218.12	223.94	233.1	250.32	269.77	284.08	1	(73)
	lar gains		1 2/ 0.07	1 201.00			210.12	1		200.02				()

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

Orientation:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	2.94	x	11.28	x	0.57	x	0.7	=	9.17	(75)
Northeast 0.9x	0.77	x	2.94	x	22.97	x	0.57	x	0.7	=	18.67	(75)
Northeast 0.9x	0.77	x	2.94	x	41.38	x	0.57	x	0.7	=	33.64	(75)
Northeast 0.9x	0.77	x	2.94	x	67.96	x	0.57	x	0.7	=	55.24	(75)
Northeast 0.9x	0.77	x	2.94	x	91.35	x	0.57	x	0.7	=	74.26	(75)
Northeast 0.9x	0.77	x	2.94	x	97.38	x	0.57	x	0.7	=	79.17	(75)
Northeast 0.9x	0.77	x	2.94	x	91.1	x	0.57	x	0.7	=	74.06	(75)
Northeast 0.9x	0.77	x	2.94	x	72.63	x	0.57	x	0.7	=	59.04	(75)
Northeast 0.9x	0.77	x	2.94	x	50.42	x	0.57	x	0.7	=	40.99	(75)
Northeast 0.9x	0.77	x	2.94	x	28.07	x	0.57	x	0.7	=	22.82	(75)
Northeast 0.9x	0.77	x	2.94	x	14.2	x	0.57	x	0.7	=	11.54	(75)
Northeast 0.9x	0.77	x	2.94	x	9.21	x	0.57	x	0.7	=	7.49	(75)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.57	x	0.7	=	29.3	(77)
Southeast 0.9x	0.77	x	1.2	x	36.79	x	0.57	x	0.7	=	12.21	(77)
Southeast 0.9x	0.77	x	1.91	x	36.79	x	0.57	x	0.7	=	19.43	(77)
Southeast 0.9x	0.77	x	1.44	x	62.67	x	0.57	x	0.7	=	49.91	(77)
Southeast 0.9x	0.77	x	1.2	x	62.67	x	0.57	x	0.7	=	20.8	(77)
Southeast 0.9x	0.77	x	1.91	x	62.67	x	0.57	x	0.7	=	33.1	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.57	x	0.7	=	68.29	(77)
Southeast 0.9x	0.77	x	1.2	x	85.75	x	0.57	x	0.7	=	28.45	(77)
Southeast 0.9x	0.77	x	1.91	x	85.75	x	0.57	x	0.7	=	45.29	(77)
Southeast 0.9x	0.77	x	1.44	x	106.25	x	0.57	x	0.7	=	84.61	(77)
Southeast 0.9x	0.77	x	1.2	x	106.25	x	0.57	x	0.7	=	35.26	(77)
Southeast 0.9x	0.77	x	1.91	x	106.25	x	0.57	x	0.7	=	56.11	(77)
Southeast 0.9x	0.77	x	1.44	x	119.01	x	0.57	x	0.7	=	94.77	(77)
Southeast 0.9x	0.77	x	1.2	x	119.01	x	0.57	x	0.7	=	39.49	(77)
Southeast 0.9x	0.77	x	1.91	x	119.01	x	0.57	x	0.7	=	62.85	(77)
Southeast 0.9x	0.77	x	1.44	x	118.15	x	0.57	x	0.7	=	94.09	(77)
Southeast 0.9x	0.77	x	1.2	×	118.15	x	0.57	x	0.7	=	39.2	(77)
Southeast 0.9x	0.77	x	1.91	x	118.15	x	0.57	x	0.7	=	62.4	(77)
Southeast 0.9x		x	1.44	x	113.91	x	0.57	x	0.7	=	90.71	(77)
Southeast 0.9x	0.77	x	1.2	x	113.91	x	0.57	x	0.7	=	37.8	(77)
Southeast 0.9x		x	1.91	x	113.91	x	0.57	x	0.7	=	60.16	(77)
Southeast 0.9x	0.77	x	1.44	x	104.39	x	0.57	x	0.7	=	83.13	(77)
Southeast 0.9x		x	1.2	x	104.39	x	0.57	x	0.7	=	34.64	(77)
Southeast 0.9x		x	1.91	x	104.39	x	0.57	x	0.7	=	55.13	(77)
Southeast 0.9x		x	1.44	×	92.85	x	0.57	x	0.7	=	73.94	(77)
Southeast 0.9x	_	x	1.2	×	92.85	x	0.57	x	0.7	=	30.81	(77)
Southeast 0.9x	0.77	x	1.91	x	92.85	x	0.57	x	0.7	=	49.04	(77)

Southeast ().9x 0.77	×	1.4	14	x	6	9.27	x		0.57	×	0.7	=	55.16	(77)
Southeast ().9x 0.77	×	1.	2	x	6	9.27	x		0.57	x [0.7	=	22.98	(77)
Southeast ().9x 0.77	×	1.9	91	x	6	9.27	x		0.57	x	0.7	=	36.58	(77)
Southeast ().9x 0.77	×	1.4	14	x	4	4.07	x		0.57	_ x [0.7	=	35.1	(77)
Southeast ().9x 0.77	×	1.	2	x	4	4.07	x		0.57	_ × [0.7	=	14.62	(77)
Southeast ().9x 0.77	×	1.9	91	x	4	4.07	x		0.57	_ × [0.7	=	23.27	(77)
Southeast ().9x 0.77	×	1.4	14	x	3	31.49	x		0.57	_ × [0.7	=	25.08	(77)
Southeast ().9x 0.77	×	1.	2	x	3	31.49	x		0.57	_ x [0.7	=	10.45	(77)
Southeast ().9x 0.77	×	1.9	91	x	3	31.49	x		0.57	x	0.7	=	16.63	(77)
								-							
Solar gain	s in watts, c	alculated	for eac	h month				(83)m	า = Sเ	um(74)m	(82)m				
(83)m= 70	.11 122.48	175.67	231.23	271.37	2	74.86	262.72	231	.94	194.78	137.54	84.53	59.64		(83)
Total gain	s – internal a	and solar	(84)m =	= (73)m	+ (8	83)m	, watts		ı			•			
(84)m= 36	2.19 411.91	454.04	492.56	515.83	5	03.07	480.84	455	.88	427.88	387.86	354.3	343.72]	(84)
7. Mean	internal tem	perature	(heating	season)				-	-		•		-	
	ture during l		`		<i>.</i>	area f	from Tab	ole 9.	. Th	1 (°C)				21	(85)
	n factor for g	• •			-				,	. (•)					
	an Feb	Mar	Apr	May	È	Jun	Jul	A	ug	Sep	Oct	Nov	Dec]	
	1 0.99	0.99	0.97	0.92	-	0.82	0.68	0.7	<u> </u>	0.9	0.98	0.99	1		(86)
		1												1	
	ernal tempe	19.65	20.06	20.46	-	w ste 0.78	20.92	20.		20.66	20.14	19.59	19.15	1	(87)
	19.55	19.05	20.00	20.40	2	.0.78	20.92	20.	.9	20.00	20.14	19.59	19.15	J	(07)
	ture during l		eriods ir	n rest of	dw	elling	from Ta	able 9	9, Tł	n2 (°C)				1	
(88)m= 19	.55 19.55	19.55	19.57	19.57	1	9.59	19.59	19.	59	19.58	19.57	19.57	19.56		(88)
Utilisation	n factor for g	ains for r	est of d	welling,	h2,	m (se	e Table	9a)							
(89)m= 0.	99 0.99	0.98	0.95	0.88		0.72	0.51	0.5	56	0.83	0.96	0.99	1		(89)
Mean inte	ernal tempe	rature in t	the rest	of dwell	ina	T2 (f	ollow ste	ens 3	to 7	in Tabl	e 9c)			-	
	.18 17.43	17.87	18.48	19.03	-	9.44	19.56	19.	-	19.3	18.6	17.8	17.16]	(90)
					1					f	LA = Liv	ng area ÷ (4) =	0.54	(91)
			. (I I.					. /4							
	ernal tempe	1 1		r	1		r	r i	- 1		10.11	40.77	40.04	1	(92)
		18.83	19.33	19.81		20.17	20.3	20.		20.04	19.44	18.77	18.24	J	(92)
	ustment to 1	18.68	19.18	19.66	-	0.02	m Table 20.15	4e, 20.		re appro 19.89	19.29	18.62	18.09	1	(93)
	heating req	1 1	19.10	19.00		.0.02	20.15	20.	13	19.09	19.29	10.02	10.09		(55)
	the mean in		nnorotu	ro obtoir		ot ot	on 11 of	Tobl		o a tha	t Tim-	(76)m.on	d ro. ool	aulata	
	ation factor f		•		ieu	aisi	ep i i ui	Tabl	ie st), 50 illa	t 11,111=	(70)11 an	u ie-cai	Julate	
	an Feb	Mar	Apr	May	Γ	Jun	Jul	A	ug	Sep	Oct	Nov	Dec]	
	n factor for g	jains, hm						I						1	
(94)m= 0.	99 0.99	0.98	0.95	0.89	(0.76	0.58	0.6	63	0.85	0.96	0.99	0.99]	(94)
Useful ga	ains, hmGm	, W = (94	1)m x (8-	4)m										1	
(95)m= 35	9.44 406.66	443.32	467.69	457.77	3	80.96	281.02	288	.08	362.04	371.83	349.74	341.57		(95)
Monthly a	average exte	ernal tem	perature	e from T	abl	e 8			I						
	.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 me	an intern	al tempe	erature,	Lm	i , W =	=[(39)m :	x [(9:	3)m-	- (96)m]			-	
(97)m= 121	7.67 1179.95	1068.29	889.79	686.63	4	61.12	302.18	316	.95	495.32	749.65	999.61	1211.3		(97)
•					•							-		-	

		9.090							, (00) <u>]</u> / (.				
(98)m=	638.53	519.66	464.98	303.91	170.27	0	0	0	0	281.1	467.91	647.07		-
								Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	3493.43	(98)
Space	e heatin	g require	ement in	ı kWh/m²	²/year								67.04	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	HP)					
-	e heatir	-			, .									1/00/0
					y/supple	mentary			(004)				0	(201)
	•			nain syst	~ /			(202) = 1 -		(222)]			1	(202)
			-	main sys				(204) = (2	02) × [1 –	(203)] =			1	(204)
		-		ing syste									90.9	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	ו, % ו						0	(208)
•	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	r
Space		<u> </u>	ement (c 464.98	1	d above)	í	0	0	0	001.1	467.04	647.07	l	
()	638.53	519.66		303.91	170.27	0	0	0	0	281.1	467.91	647.07	I	
(211)m	$1 = \{[(98) \\ 702.45]$)m x (20 571.68	4)]	100 ÷ (20 334.34)6) 187.32	0	0	0	0	309.24	514.75	711.85	1	(211)
	702.45	571.00	511.55	334.34	107.32	0	0		l (kWh/yea				3843.15	(211)
Snac	a hoatin	a fuol (e	econdar	y), kWh/	month					,	- 715,10. 12	2	3043.13](=)
•)1)]}x1		• ·	monun									
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	-	0	(215)
Water	heating	I												-
Output				ulated a					100.01				I	
⊏ #iaia	166.18	145.16	151.03	133.96	129.69	114.23	109.44	122	123.34	140.45	149.93	162.28		
(217)m=		ater hea 88.48	88.2	87.55	86.24	80.8	80.8	80.8	80.8	87.27	88.22	88.68	80.8	(216) (217)
· · ·		heating,			00.24	00.0	00.0	00.0	00.0	07.27	00.22	00.00]	(217)
		<u>m x 100</u>				-	-			-		-		
(219)m=	187.53	164.05	171.24	153	150.39	141.37	135.44	150.99	152.65	160.95	169.94	183		-
								Tota	I = Sum(2 ⁻	19a) ₁₁₂ =			1920.56	(219)
	I totals	fuelues	d main	system	1					k	Wh/year	•	kWh/year	1
•			·	System	I								3843.15]
	•	fuel use											1920.56]
Electri	city for p	oumps, fa	ans and	electric	keep-ho	t								
mech	anical v	entilatior	n - balar	nced, ext	ract or p	ositive i	nput fron	n outside	9			133.51		(230a)
centra	al heatin	g pump:										30		(230c)
Total e	electricity	for the	above,	kWh/yea	ır			sum	of (230a)	(230g) =			163.51	(231)
Electri	city for li	ghting											309.52	(232)
	•	erated by	v PVs										-564.81	(233)
				ual boat	ing evet	me ineli	Idina mi],,
Tza. (SOZ em	13510115 -		uarneal	ing syste			cro-CHP						

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	830.12 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	414.84 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1244.96 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	84.86 (267)
Electricity for lighting	(232) x	0.519 =	160.64 (268)
Energy saving/generation technologies			
Item 1		0.519 =	-293.13 (269)
Total CO2, kg/year	sum	of (265) (271) =	1197.33 (272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =	22.98 (273)
El rating (section 14)			83 (274)

			User D	etails:						
Assessor Name: Software Name:	Oliver Morris Stroma FSAP 20	12		Stroma Softwa					025430 n: 1.0.3.12	
		Р		Address:			GREE			
Address :	, London, NW6 1N									
1. Overall dwelling dimer	nsions:									
Ground floor				a(m²) 1.43	(1a) x	Av. He	ght(m) .96	(2a) =	Volume(m³) 211.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1	e)+(1r	1) 7	1.43	(4)					
Dwelling volume			L		(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	211.43	(5)
2. Ventilation rate:									<u> </u>	
Number of chimneys Number of open flues	heating 0 + [secondar heating	y] + [_] + [_	other] = [total		40 = 20 =	m ³ per hour	(6a) (6b)
		0		0	」⁻└	0			0	
Number of intermittent fan	IS				L	0		10 =	0	(7a)
Number of passive vents						0	x ′	10 =	0	(7b)
Number of flueless gas fire	es					0	x 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney: If a pressurisation test has be					continue fro	0 om (9) to (÷ (5) =	0	(8)
Number of storeys in the Additional infiltration	e dwelling (ns)						[(9)-	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.2 if both types of wall are pre- deducting areas of opening	esent, use the value corre gs); if equal user 0.35	sponding to	the greate	er wall area	a (after	uction			0	(11)
If suspended wooden flo		aled) or 0.	.1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente		tula a a al							0	(13)
Percentage of windows Window infiltration	and doors draught s	stripped		0.25 - [0.2	x (14) ∸ 1	001 -			0	
Infiltration rate				(8) + (10)			+ (15) =		0	(15) (16)
Air permeability value, c	150. expressed in cu	bic metre						area	0	(17)
If based on air permeabilit	• • •		•	•	•				0.25	(18)
Air permeability value applies	if a pressurisation test ha	as been dor	ne or a deg	ree air pei	meability i	is being us	sed			
Number of sides sheltered	ł								2	(19)
Shelter factor				(20) = 1 - [9)] =			0.85	(20)
Infiltration rate incorporation	-	_		(21) = (18)	x (20) =				0.21	(21)
Infiltration rate modified fo		1					<u>.</u>			
	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	- i i							· - 1	I	
(22)m= 5.1 5 4	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4									
(22a)m= 1.27 1.25 1	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltra	tion rate	e (allowir	ng for sł	nelter an	d wind s	peed) =	= (21a) x	(22a)m	1				
	0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25		
	ate effect chanical		-	ate for t	he appli	cable ca	se	-	-		-	-		(00-)
	aust air hea			ndiv N (2	2h) - (22c	\rightarrow Emy (c		NE)) otho	nuico (22	(22a)			0.5	(23a)
	aust all fier									bb) = (23a)			0.5	(23b)
					U				,			4 (00)	76.5	(23c)
ŕ									ŕ	22b)m + (<u> </u>	<u> </u>	÷ 100]	(24a)
(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37		(24a)
ŕ					· · · · · · · · · · · · · · · · · · ·		, , ,	1	ŕ	22b)m + (<u>, </u>		I	(0.41.)
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,	whole ho				•	•					-)			
r		< 0.5 ×	(230), ti	0	z) = (23L)			C = (22)	$\frac{5}{10}$	$0.5 \times (231)$	0	0		(24c)
(24c)m=			-	-	-					0	0	0		(240)
,	natural v f (22b)m				•					x 0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	ctive air c	hange i	rate - en	ter (24a) or (24t	o) or (240	c) or (24	4d) in bo	x (25)			-		
(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37		(25)
3. Hea	at losses	and he	at loss p	aramet	ər:				-	-	-	-		
ELEN		Gros area	S	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²·ł		A X k kJ/K
Doors		area	(111.)		I	1.79	 x		=	,		K0/111-1	`	(26)
	ws Type	1						<u>1.5</u> /[1/(1.4)+						
	ws Type					0.98								(27)
	ws Type					2.17		/[1/(1.4)+						(27)
						3.96		/[1/(1.4)+						(27)
	ws Type -					1.4		I/[1/(1.4)+						(27)
	ws Type	5				1.4		/[1/(1.4)+						(27)
Rooflig						0.3	× ´	/[1/(1.6) +	0.04] =	0.48	<u> </u>			(27b)
Walls T	Type1	11.50	6	0		11.56	; x	0.25	=	2.89				(29)
Walls T	Гуре2	12.34	4	7.91		4.43	x	0.28	=	1.24				(29)
Walls T	Гуре3	34.4		3.96	;	30.44	×	0.25	=	7.61				(29)
Walls T	Гуре4	2.33	;	1.4		0.93	x	0.28	=	0.26				(29)
Walls T	Гуре5	5.22	2	1.79)	3.43	x	0.25	=	0.86				(29)
Roof T	ype1	34.6	5	0		34.65	; x	0.18	=	6.24				(30)
Roof T	ype2	19.14	4	0		19.14	×	0.18	=	3.45	i F		\exists	(30)
Roof T	уре3	1.59)	0		1.59	×	0.2		0.32	i F		\exists	(30)
Roof T	ype4	15.49		0.6		14.89) x				= i		\exists	(30)
Roof T		16.4		0		16.47			=		= 1		\dashv	(30)
		L		ــــ				L			L			
i otal a	rea of ele	ements.	m²			153.1	9							(31)
rotar a	rea of ele	ements,	m²			153.1	9							(31)

Party f	loor					73.1					Г		_	(32a)	
					indow U-va Is and part		ated using	formula 1,	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	3.2		
Fabric	heat los	s, W/K =	= S (A x	U)				(26) (30)	+ (32) =]	49.39	(33)	
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	9812.48	(34)	
Therm	al mass	parame	ter (TMF	- = Cm -	÷ TFA) ir	n kJ/m²K	,		Indica	tive Value	: Medium	[250	(35)	
	•				construct	ion are no	t known pr	ecisely the	indicative	e values of	TMP in Ta	able 1f			
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix I	<]	22.98	(36)	
if details	of therma	l bridging	are not kn	own (36) =	= 0.15 x (3	1)						L			
Total f	abric he	at loss							(33) +	(36) =			72.36	(37)	
Ventila	tion hea	t loss ca	alculated	I monthly	у				(38)m	= 0.33 × (25)m x (5)	_			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(38)m=	27.1	26.73	26.36	24.51	24.14	22.28	22.28	21.91	23.03	24.14	24.88	25.62		(38)	
Heat ti	ansfer c	oefficier	nt, W/K				•		(39)m	= (37) + (3	38)m				
(39)m=	99.47	99.1	98.72	96.87	96.5	94.65	94.65	94.28	95.39	96.5	97.24	97.98			
Heat lo	oss para	meter (H	L HLP), W/	/m²K		I	1			-		₁₂ /12=	96.78	(39)	
(40)m=	1.39	1.39	1.38	1.36	1.35	1.33	1.33	1.32	1.34	1.35	1.36	1.37			
										I Average =	Sum(40)₁	₁₂ /12=	1.35	(40)	
Numbe	er of day	rs in mor	nth (Tab	le 1a)			-								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)	
Assum if TF	ied occu A > 13.9	ipancy, I 9, N = 1	N		(-0.0003	349 x (TF	-A -13.9)2)] + 0.()013 x (⁻	TFA -13.			ar.	(42)	
Annua <i>Reduce</i>	l averag	e hot wa al average	hot water	usage by	5% if the a	welling is	designed			se target o		.36		(43)	
Hot wate	Jan er usage ii	Feb n litres per	Mar day for ea	Apr ach month	May Vd,m = fa	Jun ctor from T	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec			
(44)m=	97.19	93.66	90.13	86.59	83.06	79.52	79.52	83.06	86.59	90.13	93.66	97.19			
(,													1060.3	(44)	
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x D)))))))))))))))))))							
(45)m=	144.14	126.06	130.08	113.41	108.82	93.9	87.02	99.85	101.04	117.76	128.54	139.59			
							1			Total = Su	m(45)1 12 =	-	1390.21	(45)	
lf instan	taneous w	ater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46) to (61)						
(46)m=	21.62	18.91	19.51	17.01	16.32	14.09	13.05	14.98	15.16	17.66	19.28	20.94		(46)	
	-														
-		. ,					-		ame ves	sel		0		(47)	
		-			-			. ,	`	(61.)	4-7				
			not wate	er (this in	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)				
	-		eclared I	oss facto	or is kno	wn (kWł	n/dav).					0		(48)	
,		Image parameter (TMP = Cm + TFA) in kJ/m ² K Indicative Value: Medium In assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f ed instead of a detailed calculation. Ib ridges : S (L x Y) calculated using Appendix K if thermal bridging are not known (36) = 0.15 x (31) oric heat loss calculated monthly (33) + (36) = on heat loss calculated monthly (33) + (36) = (33) + (36) = on heat loss calculated monthly (39) m = 0.33 x (25) m x (5) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 27.1 26.73 26.36 24.51 24.14 22.28 22.28 21.91 23.03 24.14 24.88 25.62 nsfer coefficient, W/K (39) m = (37) + (38) m 99.47 99.1 98.72 96.5 94.65 94.28 95.39 96.5 97.24 97.98 Average = Sum(30), /12= of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb													
1 emna	araturo f	actor tro	11 1 2010											(49)	

			r storage	-				(48) x (49)) =			0		(50)
,			eclared of	•								_	l	(= 1)
		•	factor fr		ie z (kvv	n/litre/da	iy)					0		(51)
	•	from Ta		011 4.5								0	l	(52)
			m Table	2b								0		(53)
			r storage		ear			(47) x (51)) x (52) x (53) =		0		(54)
		(54) in (5	-	,, j				X Y X =	, (- , (,	<u> </u>	0		(55)
	. ,	. , .	culated f	or each	month			((56)m = (55) × (41)	m		-		
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	-	÷	d solar sto	-	-	-	-	-	-	-	-	-	l lix H	()
-		i		- · ·	0				· · ·	· · · · ·	I		l	(57)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		
	•	•	nnual) fro									0		(58)
	-		Iculated				. ,	. ,			-1-1)			
		r	rom Tab		r		r	r –	r -	r	, 		I	(50)
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)m						
(61)m=	49.53	43.11	45.93	42.7	42.32	39.22	40.52	42.32	42.7	45.93	46.19	49.53		(61)
Total h	eat req	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	193.66	169.17	176.01	156.11	151.15	133.12	127.54	142.18	143.75	163.68	174.73	189.12		(62)
Solar Di	-IW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter											
(64)m=	193.66	169.17	176.01	156.11	151.15	133.12	127.54	142.18	143.75	163.68	174.73	189.12		
								IOutp	out from w	ater heate	r (annual)₁	12	1920.22	(64)
Heat o	ains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0 85	x (45)m) + (61)m	1 + 0.8	c [(46)m	+ (57)m	+ (59)m	1	-
-			54.73			_			-			58.8		(65)
			culation (
	. ,				-	yinnuer is	5 11 110 0	awening	of not w			munity	leating	
			e Table 5):									
Metab			e 5), Wat		. Maria	line	1.1	A	0.00	Ort	Nau	Dee	l	
(00)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(66)
(66)m=	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02	114.02		(66)
-		<u>`</u>	ted in Ap	·	· · ·		· · ·	r		1			I	
(67)m=	22.57	20.04	16.3	12.34	9.22	7.79	8.41	10.94	14.68	18.64	21.76	23.19		(67)
Applia	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	200.61	202.69	197.45	186.28	172.18	158.93	150.08	148	153.25	164.41	178.51	191.76		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	e Table	5				
(69)m=	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4	34.4		(69)
Pumps	and fa	ns gains	(Table 5	āa)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	se.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)							I	
(71)m=	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21	-91.21		(71)
		I	1	l	I	1	1	I	1	I	1	1	l	

Water heating gains (Table 5)										
(72)m= 81.06 78.41 73.57	67.2 62.85	5 5	6.98 52.5	58.	85 61.49	68.06	75.4	79.03		(72)
Total internal gains =	•		(66)m + (67)m	1 + (68	3)m + (69)m + (1	70)m + ((71)m + (72)	m		
(73)m= 364.44 361.35 347.52	326.02 304.4	7 2	83.91 271.21	277	.99 289.62	311.32	335.87	354.18		(73)
6. Solar gains:										
Solar gains are calculated using sola	ar flux from Table 6	Sa and	associated equa	tions	to convert to the	e applica	able orientati	ion.		
Orientation: Access Factor	Area		Flux		g_		FF		Gains	
Table 6d	M ²	_	Table 6a		Table 6b		Table 6c		(W)	
Northeast 0.9x 0.77 x	3.96	x	11.28	x	0.57	×	0.7	=	12.35	(75)
Northeast 0.9x 0.77 x	1.4	x	11.28	x	0.57	×	0.7	=	8.74	(75)
Northeast 0.9x 0.77 x	1.4	x	11.28	x	0.57	×	0.7	=	4.37	(75)
Northeast 0.9x 0.77 x	3.96	x	22.97	x	0.57	×	0.7	=	25.15	(75)
Northeast 0.9x 0.77 x	1.4	x	22.97	x	0.57	×	0.7	=	17.78	(75)
Northeast 0.9x 0.77 x	1.4	x	22.97	x	0.57	x	0.7	=	8.89	(75)
Northeast 0.9x 0.77 x	3.96	x	41.38	x	0.57	x	0.7	=	45.31	(75)
Northeast 0.9x 0.77 x	1.4	x	41.38	x	0.57	x	0.7	=	32.04	(75)
Northeast 0.9x 0.77 x	1.4	x	41.38	x	0.57	×	0.7	=	16.02	(75)
Northeast 0.9x 0.77 x	3.96	x	67.96	x	0.57	×	0.7	=	74.41	(75)
Northeast 0.9x 0.77 x	1.4	x	67.96	x	0.57	×	0.7	=	52.61	(75)
Northeast 0.9x 0.77 x	1.4	x	67.96	x	0.57	×	0.7	=	26.31	(75)
Northeast 0.9x 0.77 x	3.96	x	91.35	x	0.57	x	0.7	=	100.02	(75)
Northeast 0.9x 0.77 x	1.4	x	91.35	x	0.57	×	0.7	=	70.72	(75)
Northeast 0.9x 0.77 x	1.4	x	91.35	x	0.57	×	0.7	=	35.36	(75)
Northeast 0.9x 0.77 x	3.96	x	97.38	x	0.57	x	0.7	=	106.63	(75)
Northeast 0.9x 0.77 x	1.4	x	97.38	x	0.57	×	0.7	=	75.4	(75)
Northeast 0.9x 0.77 x	1.4	x	97.38	x	0.57	×	0.7	=	37.7	(75)
Northeast 0.9x 0.77 x	3.96	x	91.1	x	0.57	×	0.7	=	99.75	(75)
Northeast 0.9x 0.77 x	1.4	x	91.1	x	0.57	×	0.7	=	70.53	(75)
Northeast 0.9x 0.77 x	1.4	x	91.1	x	0.57	×	0.7	=	35.27	(75)
Northeast 0.9x 0.77 x	3.96	x	72.63	x	0.57	x	0.7	=	79.52	(75)
Northeast 0.9x 0.77 x	1.4	x	72.63	x	0.57	×	0.7	=	56.23	(75)
Northeast 0.9x 0.77 x	1.4	x	72.63	x	0.57	×	0.7	=	28.11	(75)
Northeast 0.9x 0.77 x	3.96	x	50.42	x	0.57	×	0.7	=	55.21	(75)
Northeast 0.9x 0.77 x	1.4	x	50.42	x	0.57	×	0.7	=	39.04	(75)
Northeast 0.9x 0.77 x	1.4	x	50.42	x	0.57	x	0.7	=	19.52	(75)
Northeast 0.9x 0.77 x	3.96] x	28.07	x	0.57	×	0.7	=	30.73	(75)
Northeast 0.9x 0.77 x	1.4] ×	28.07	x	0.57	_ × [0.7	=	21.73	(75)
Northeast 0.9x 0.77 x	1.4] x	28.07	x	0.57	× [0.7	=	10.87	(75)
Northeast 0.9x 0.77 x	3.96] x	14.2	x	0.57	X	0.7	=	15.55	(75)
Northeast 0.9x 0.77 x	1.4] ×	14.2	x	0.57	_ × [0.7	=	10.99	(75)

Northeast 0.9x	0.77	×	1.4	×	14.2) ×	0.57	x	0.7	=	5.5	(75)
Northeast 0.9x	0.77	l x	3.96	x	9.21	x	0.57	x	0.7	 =	10.09	(75)
Northeast 0.9x	0.77	l x	1.4	x	9.21	 x	0.57	x	0.7	=	7.13	(75)
Northeast 0.9x	0.77	x	1.4	x	9.21	x	0.57	x	0.7	=	3.57	 (75)
Southeast 0.9x	0.77	x	0.98	x	36.79	x	0.57	x	0.7	=	29.91	
Southeast 0.9x	0.77	x	2.17	x	36.79	x	0.57	x	0.7	=	22.08	(77)
Southeast 0.9x	0.77	×	0.98	x	62.67	×	0.57	x	0.7	=	50.95	(77)
Southeast 0.9x	0.77	×	2.17	x	62.67	×	0.57	x	0.7	=	37.61	- (77)
Southeast 0.9x	0.77	×	0.98	x	85.75	×	0.57	x	0.7	i =	69.71	(77)
Southeast 0.9x	0.77	×	2.17	x	85.75	×	0.57	x	0.7	=	51.45	(77)
Southeast 0.9x	0.77	×	0.98	×	106.25	×	0.57	x	0.7	=	86.38	(77)
Southeast 0.9x	0.77	×	2.17	x	106.25	×	0.57	x	0.7	=	63.75	(77)
Southeast 0.9x	0.77	×	0.98	×	119.01	×	0.57	x	0.7	=	96.75	(77)
Southeast 0.9x	0.77	x	2.17	x	119.01	x	0.57	x	0.7	=	71.41	(77)
Southeast 0.9x	0.77	x	0.98	x	118.15	x	0.57	x	0.7	=	96.05	(77)
Southeast 0.9x	0.77	x	2.17	x	118.15	x	0.57	x	0.7	=	70.89	(77)
Southeast 0.9x	0.77	x	0.98	x	113.91	×	0.57	x	0.7	=	92.6	(77)
Southeast 0.9x	0.77	x	2.17	x	113.91	×	0.57	x	0.7	=	68.35	(77)
Southeast 0.9x	0.77	x	0.98	x	104.39	×	0.57	x	0.7	=	84.86	(77)
Southeast 0.9x	0.77	×	2.17	x	104.39	×	0.57	x	0.7	=	62.64	(77)
Southeast 0.9x	0.77	x	0.98	x	92.85	×	0.57	x	0.7	=	75.48	(77)
Southeast 0.9x	0.77	x	2.17	x	92.85	×	0.57	x	0.7	=	55.71	(77)
Southeast 0.9x	0.77	x	0.98	x	69.27	x	0.57	x	0.7	=	56.31	(77)
Southeast 0.9x	0.77	x	2.17	x	69.27	x	0.57	x	0.7	=	41.56	(77)
Southeast 0.9x	0.77	x	0.98	x	44.07	x	0.57	x	0.7	=	35.83	(77)
Southeast 0.9x	0.77	×	2.17	x	44.07	×	0.57	x	0.7	=	26.44	(77)
Southeast 0.9x	0.77	x	0.98	x	31.49	×	0.57	x	0.7	=	25.6	(77)
Southeast 0.9x	0.77	×	2.17	x	31.49	×	0.57	x	0.7	=	18.89	(77)
Rooflights 0.9x	1	x	0.3	x	26	×	0.63	x	0.7	=	6.19	(82)
Rooflights 0.9x	1	×	0.3	x	54	x	0.63	x	0.7	=	12.86	(82)
Rooflights 0.9x	1	x	0.3	x	96	x	0.63	x	0.7	=	22.86	(82)
Rooflights 0.9x	1	×	0.3	×	150	×	0.63	x	0.7	=	35.72	(82)
Rooflights 0.9x	1	×	0.3	×	192	×	0.63	x	0.7	=	45.72	(82)
Rooflights 0.9x	1	x	0.3	x	200	x	0.63	x	0.7	=	47.63	(82)
Rooflights 0.9x	1	×	0.3	×	189	×	0.63	x	0.7	=	45.01	(82)
Rooflights 0.9x	1	×	0.3	×	157	×	0.63	x	0.7	=	37.39	(82)
Rooflights 0.9x	1	×	0.3	x	115	×	0.63	x	0.7	=	27.39	(82)
Rooflights 0.9x	1	×	0.3	×	66	×	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	×	0.3	×	33	×	0.63	x	0.7	=	7.86	(82)
Rooflights 0.9x	1	x	0.3	x	21	x	0.63	x	0.7	=	5	(82)

Solar g	ains in	watts, ca	alculated	for eac	n month			(83)m = S	um(74)m	(82)m			
(83)m=	83.64	153.23	237.39	339.18	419.98	434.3	411.51	348.75	272.35	176.92	102.16	70.28	(83)

(84)m=	448.08	514.59	584.91	665.2	724.45	718.2	682.71	626.74	561.97	488.23	438.03	424.46		(84)
7. Me	an inter	nal temp	erature	(heating	season)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area l	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)					I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.99	0.96	0.89	0.74	0.58	0.65	0.88	0.98	1	1		(86)
Mean	interna	tempera	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	19.47	19.63	19.92	20.33	20.68	20.91	20.98	20.96	, 20.79	20.33	19.84	19.46		(87)
Temp	erature	durina h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9. Tl	h2 (°C)					
(88)m=	19.77	19.77	19.78	19.8	19.8	19.82	19.82	19.83	19.81	19.8	19.79	19.79		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina.	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.95	0.85	0.64	0.44	0.5	0.8	0.97	0.99	1		(89)
Mean	interna	temper	ature in	the rest	of dwelli	ng T2 (fe	nllow ste	ons 3 to 7	7 in Tahl	e 9c)				
(90)m=	17.75	18	18.42	19.01	19.49	19.76	19.81	19.81	19.64	19.03	18.31	17.74		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.51	(91)
Moon	intorna	tompor	oturo (fo	r tho wh	olo duvol	lling) – fl	Λ ~ Τ1	, (1 fl	۸) v To			l		
(92)m=	18.64	18.84	19.19	19.69	20.1	lling) = fl 20.35	20.41	+ (1 – 1L 20.4	20.23	19.7	19.1	18.62		(92)
· ·						ature fro								~ /
(93)m=	18.49	18.69	19.04	19.54	19.95	20.2	20.26	20.25	20.08	19.55	18.95	18.47		(93)
8. Spa	ace hea	ting requ	uirement											
						ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut				using Ta								_		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa (94)m=	ation fac	tor for ga 0.99	ains, nm 0.98	0.94	0.85	0.68	0.5	0.56	0.82	0.96	0.99	1		(94)
` ´				4)m x (84		0.00	0.5	0.50	0.02	0.90	0.33	I		(01)
(95)m=		509.92	572.87	627.49	617.25	486.31	338.15	349.45	462.57	470.43	434.16	422.86		(95)
				perature										
(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 I	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	⊾ x [(93)m	– (96)m]				
(97)m=	1411.1	1366.31	1238.13	1030.24	796.14	529.97	346.45	363.19	570.43	863.56	1152.02	1398.44		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	h = 0.02	24 x [(97))m – (95)m] x (4′	1)m			
(98)m=	718.09	575.49	494.96	289.98	133.09	0	0	0	0	292.49	516.86	725.83		
				-				Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	3746.79	(98)
Space	e heating	g require	ement in	kWh/m²	²/year								52.45	(99)
9a. En	ergy rec	luiremen	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)			•		_
Space	e heatir	ng:												_
Fracti	on of sp	ace hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	t from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heatir	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =		ĺ	1	(204)
												-		

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

ency of	main spa	ace heat	ting syste	em 1								90.9	(206)
ency of	seconda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
e heatin	g require	ement (c	calculate	d above))							-	
718.09	575.49	494.96	289.98	133.09	0	0	0	0	292.49	516.86	725.83		
) = {[(98)m x (20	4)] } x 1	100 ÷ (20)6)	-		-				-	•	(211)
789.97	633.11	544.51	319.01	146.41	0	0	0	0	321.77	568.6	798.5		_
							Tota	al (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	Ē	4121.88	(211)
	•		• ·	month									
· · ·	1	, i		0	0	0	0	0	0	0	0	1	
0		Ů	<u> </u>		Ů	Ů			-	-		0	(215)
heating	r								, , , ,	¥ 13,10. 12	•		
-	-	ter (calc	ulated a	bove)	-						-	_	
193.66	169.17	176.01	156.11	151.15	133.12	127.5	4 142.18	143.75	163.68	174.73	189.12		
ncy of w	ater hea	iter										80.8	(216)
88.55	88.39	88.01	87.09	85.23	80.8	80.8	80.8	80.8	87	88.12	88.61		(217)
	-												
218.71	191.39	199.98	179.25	177.33	164.75	157.8	5 175.96	177.9	188.15	198.29	213.42]	
							Tota	1 = Sum(2)	19a) ₁₁₂ =			2242.99	(219)
l totals									k	Wh/year		kWh/yea	r
heating	fuel use	ed, main	system	1								4121.88	
heating	fuel use	d										2242.99	
city for p	oumps, fa	ans and	electric	keep-ho	t								_
anical v	entilatio	n - balar	nced, ext	ract or p	ositive i	nput fr	om outside	е			257.95]	(230a)
al heatir	ng pump	:									30	j	(230c)
lectricit	y for the	above, l	kWh/yea	r			sum	of (230a)	(230g) =			287.95	(231)
city for l	ighting											398.51	(232)
city gen	erated b	y PVs										-564.81	(233)
CO2 em	issions -	– Individ	lual heati	ing syste	ems inclu	uding r	micro-CHF	þ					
						•••	ar				tor	Emissions	
heating	ı (main s	ystem 1)		(21	1) x			0.2	16	=	890.33	(261)
heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
heating					(21	9) x			0.2	16	=	484.49	(264)
and wa	ter heati	ng			(26	1) + (262	2) + (263) + ((264) =	<u>.</u>			1374.81	(265)
city for p	oumps, fa	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	149.45	(267)
city for l	ighting				(23)	2) x			0.5	19	=	206.82	(268)
saving	/generat	ion tech	nologies	i									_
	ency of s Jan a heatin 718.09 $a = \{[(98) 789.97 a heatin m x (20) 0 heating from w 193.66 ncy of w 88.55 r water a = (64)218.71I totalsheatingheatingheatingheatingcity for panical val heatingbeatingbeatingheatingheatingcity for panical val heatingheatingbeatingcity for pcity for pheating$	ency of seconda Jan Feb e heating require 718.09 575.49 $a = \{[(98)m \times (20)$ 789.97 633.11 $a = \{[(98)m \times (20)$ 789.97 633.11 $a = \{(201)] \} \times 1$ 0 0 heating fuel (s $m \times (201)] \} \times 1$ 0 0 heating fuel (s $m \times (201)] \} \times 1$ 0 0 heating fuel (s 88.55 88.39 r water heating, $a = (64)m \times 100$ 218.71 191.39 I totals heating fuel use heating f	ency of secondary/suppl Jan Feb Mar a heating requirement (o 718.09 575.49 494.96 a = {[(98)m x (204)] } x $^{-7}$ 789.97 633.11 544.51 a heating fuel (secondar m x (201)] } x 100 \div (20 0 0 0 heating from water heater (calc 193.66 169.17 176.01 ncy of water heater 88.55 88.39 88.01 r water heating, kWh/m a = (64)m x 100 \div (217 218.71 191.39 199.98 I totals heating fuel used, main heating fuel used city for pumps, fans and anical ventilation - balar al heating pump: lectricity for the above, city for lighting city generated by PVs CO2 emissions – Individ heating (secondary) heating and water heating city for pumps, fans and and water heating city for pumps, fans and and water heating city for pumps, fans and heating (secondary) heating city for pumps, fans and city for pumps, fans and city for pumps, fans and heating (secondary) heating city for pumps, fans and city for pumps	ency of secondary/supplementar Jan Feb Mar Apr a heating requirement (calculate 718.09 575.49 494.96 289.98 $a = \{[(98)m \times (204)] \} \times 100 \div (2078), 00 \pm (20$	JanFebMarAprMayJanFebMarAprMayheating requirement (calculated above)718.09575.49494.96289.98133.09 $2 = \{[(98)m \times (204)] \} \times 100 \div (206)$ 789.97633.11544.51319.01146.41a heating fuel (secondary), kWh/month146.41a heating fuel (secondary), kWh/month000m x (201)] $\} x 100 \div (208)$ 000000193.66169.17176.01156.11193.66169.17176.01156.11151.15ncy of water heater88.5388.3988.0187.0985.23r water heating, kWh/month=(64)m x 100 ÷ (217)m177.331 totalsheating fuel used, main system 1heating fuel used179.25177.33I totalsheating fuel usednaincal ventilation - balanced, extract or pal heating pump:lectricity for the above, kWh/yearnaincal ventilation - balanced, extract or pal heating pump:lectricity for the above, kWh/yearcity for lightingcity for lightingcity for lightingcity for pumps, fans and electric keep-hoanical ventilation - Individual heating systemheating (main system 1)heating (secondary)heating <tr< td=""><td>ancy of secondary/supplementary heating system Jan Feb Mar Apr May Jun a heating requirement (calculated above) 718.09 575.49 494.96 289.98 133.09 0 $= \{[(98)m \times (204)] \} \times 100 \div (206)$ 789.97 633.11 544.51 319.01 146.41 0 a heating fuel (secondary), kWh/month $m \times (201)] \} \times 100 \div (208)$ 0 0 0 0 0 0 0 heating from water heater (calculated above) 193.66 169.17 176.01 156.11 151.15 133.12 recy of water heater 88.55 88.39 88.01 87.09 85.23 80.8 r water heating, kWh/month $= (64)m \times 100 \div (217)m$ 218.71 191.39 199.98 179.25 177.33 164.75 I totals heating fuel used, main system 1 heating fuel used, main system 1 heating fuel used city for pumps, fans and electric keep-hot anical ventilation - balanced, extract or positive i al heating pump: lectricity for the above, kWh/year city for lighting city generated by PVs CO2 emissions – Individual heating systems incl Meating (main system 1) heating (secondary) (21 heating (main system 1)) heating (secondary) (21 heating (main system 1)) heating (secondary) (21 heating (main system 1)) (21 heating (main system 1)) (21 heating (secondary) (21 heating (21 and water heating (23 heating (23 heating (23 heating (23 heating (23 heating (23 heating (23 heating (24 heating (24 heating (25 heating (23 heating td><td>ency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul a heating requirement (calculated above) 718.09 575.49 494.96 289.98 133.09 0 0 $= \{[(98)m \times (204)] \} \times 100 \div (206)$ 789.97 633.11 544.51 319.01 146.41 0 0 $= \{(98)m \times (204)] \} \times 100 \div (208)$ 0 0 0 0 0 0 0 0 0 0 heating fuel (secondary), kWh/month m $\times (201)] \} \times 100 \div (208)$ 0 0 0 0 0 0 0 0 0 heating fuel (secondary), kWh/month m $\times (201)] \} \times 100 \div (208)$ 193.66 169.17 176.01 156.11 151.15 133.12 127.5 Troy of water heater 88.55 88.39 88.01 87.09 85.23 80.8 80.8 r water heating, kWh/month $= (64)m \times 100 \div (217)m$ 218.71 191.39 199.98 179.25 177.33 164.75 157.8 H totals heating fuel used, main system 1 heating fuel used city for pumps, fans and electric keep-hot anical ventilation - balanced, extract or positive input fr al heating pump: lectricity for the above, kWh/year city for lighting city generated by PVs CO2 emissions – Individual heating systems including r heating (secondary) (215) \times heating (secondary) (215) \times heating (219) \times and water heating (261) + (261) \times city for pumps, fans and electric keep-hot (231) \times city for pumps, fans and electric keep-hot (231) \times city for pumps, fans and electric keep-hot (231) \times heating (232) \times</td><td>ncy of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug a heating requirement (calculated above) 718.09 575.49 494.96 289.98 133.09 0 0 0 = ([(98)m x (204)] $\ x 100 \div (206)$ 789.97 633.11 544.51 319.01 146.41 0 0 0 = ([(98)m x (204)] $\ x 100 \div (208)$ 0 0 0 0 0 0 0 0 0 0 0 total beating fuel (secondary), kWh/month m x (201)] $\ x 100 \div (208)$ 0 0 0 0 0 0 0 0 0 0 Total heating fuel (secondary), kWh/month m x (201)] $\ x 100 \div (208)$ 133.66 169.17 176.01 156.11 151.15 133.12 127.54 142.18 tory of water heater 133.66 169.17 176.01 156.11 151.15 133.12 127.54 142.18 tory of water heater 133.66 169.17 176.01 156.11 151.15 133.12 127.54 142.18 tory of water heating, kWh/month = (64)m x 100 ÷ (217)m = (10)m x 100 ± (210)m = (10)m x 100 ± (210)m</td><td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td><td>Image of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct 18.00 575.40 494.96 289.98 133.09 0 0 0 0 222.49 18.01 575.40 494.96 289.98 133.09 0 0 0 0 222.49 19.01 575.40 494.96 289.98 133.09 0 0 0 0 222.49 19.01 146.41 0 0 0 0 321.77 Total (kWhyear) = Sum(2) 19.02 100 + (208) 0</td><td>Introver of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov 2 heating requirement (calculated above) 718.09 575.49 494.98 289.98 133.09 0 0 0 292.49 516.86 = {[(98)m x (204)] } x 100 ÷ (206) 789.97 633.11 544.51 319.01 146.41 0 0 0 321.77 568.6 e heating fuel (secondary), kWh/month mx (201)] } x 100 ÷ (208) 0<!--</td--><td>Interview nearing system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 2 heating requirement (calculated above) 778.0 575.49 484.66 288.98 133.09 0 0 0 0 292.49 516.86 725.83 1= {{(198)}m x (204)} x 100 + (206) 788.97 533.11 544.51 319.01 146.41 0 0 0 321.77 568.6 798.5 a heating fuel (secondary), kWh/month mx (201)} x 100 + (208) 0</td><td>nncy of secondary/supplementary heating system, % 0 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 1800 575.48 494.98 288.88 133.09 0 0 0 0 292.48 516.86 725.83 178.09 575.48 494.98 283.88 133.09 0 0 0 321.77 568.6 788.5 178.97 633.11 544.51 313.01 146.41 0 0 0 321.77 568.6 788.5 178.99 633.11 544.51 313.01 146.41 0</td></td></tr<>	ancy of secondary/supplementary heating system Jan Feb Mar Apr May Jun a heating requirement (calculated above) 718.09 575.49 494.96 289.98 133.09 0 $= \{[(98)m \times (204)] \} \times 100 \div (206)$ 789.97 633.11 544.51 319.01 146.41 0 a heating fuel (secondary), kWh/month $m \times (201)] \} \times 100 \div (208)$ 0 0 0 0 0 0 0 heating from water heater (calculated above) 193.66 169.17 176.01 156.11 151.15 133.12 recy of water heater 88.55 88.39 88.01 87.09 85.23 80.8 r water heating, kWh/month $= (64)m \times 100 \div (217)m$ 218.71 191.39 199.98 179.25 177.33 164.75 I totals heating fuel used, main system 1 heating fuel used, main system 1 heating fuel used city for pumps, fans and electric keep-hot anical ventilation - balanced, extract or positive i al heating pump: lectricity for the above, kWh/year city for lighting city generated by PVs CO2 emissions – Individual heating systems incl Meating (main system 1) heating (secondary) (21 heating (main system 1)) heating (secondary) (21 heating (main system 1)) heating (secondary) (21 heating (main system 1)) (21 heating (main system 1)) (21 heating (secondary) (21 heating (21 and water heating (23 heating (23 heating (23 heating (23 heating (23 heating (23 heating (23 heating (24 heating (24 heating (25 heating (23 heating ency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul a heating requirement (calculated above) 718.09 575.49 494.96 289.98 133.09 0 0 $= \{[(98)m \times (204)] \} \times 100 \div (206)$ 789.97 633.11 544.51 319.01 146.41 0 0 $= \{(98)m \times (204)] \} \times 100 \div (208)$ 0 0 0 0 0 0 0 0 0 0 heating fuel (secondary), kWh/month m $\times (201)] \} \times 100 \div (208)$ 0 0 0 0 0 0 0 0 0 heating fuel (secondary), kWh/month m $\times (201)] \} \times 100 \div (208)$ 193.66 169.17 176.01 156.11 151.15 133.12 127.5 Troy of water heater 88.55 88.39 88.01 87.09 85.23 80.8 80.8 r water heating, kWh/month $= (64)m \times 100 \div (217)m$ 218.71 191.39 199.98 179.25 177.33 164.75 157.8 H totals heating fuel used, main system 1 heating fuel used city for pumps, fans and electric keep-hot anical ventilation - balanced, extract or positive input fr al heating pump: lectricity for the above, kWh/year city for lighting city generated by PVs CO2 emissions – Individual heating systems including r heating (secondary) (215) \times heating (secondary) (215) \times heating (219) \times and water heating (261) + (261) \times city for pumps, fans and electric keep-hot (231) \times city for pumps, fans and electric keep-hot (231) \times city for pumps, fans and electric keep-hot (231) \times heating (232) \times	ncy of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug a heating requirement (calculated above) 718.09 575.49 494.96 289.98 133.09 0 0 0 = ([(98)m x (204)] $\ x 100 \div (206)$ 789.97 633.11 544.51 319.01 146.41 0 0 0 = ([(98)m x (204)] $\ x 100 \div (208)$ 0 0 0 0 0 0 0 0 0 0 0 total beating fuel (secondary), kWh/month m x (201)] $\ x 100 \div (208)$ 0 0 0 0 0 0 0 0 0 0 Total heating fuel (secondary), kWh/month m x (201)] $\ x 100 \div (208)$ 133.66 169.17 176.01 156.11 151.15 133.12 127.54 142.18 tory of water heater 133.66 169.17 176.01 156.11 151.15 133.12 127.54 142.18 tory of water heater 133.66 169.17 176.01 156.11 151.15 133.12 127.54 142.18 tory of water heating, kWh/month = (64)m x 100 ÷ (217)m = (10)m x 100 ± (210)m = (10)m x 100 ± (210)m	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Image of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct 18.00 575.40 494.96 289.98 133.09 0 0 0 0 222.49 18.01 575.40 494.96 289.98 133.09 0 0 0 0 222.49 19.01 575.40 494.96 289.98 133.09 0 0 0 0 222.49 19.01 146.41 0 0 0 0 321.77 Total (kWhyear) = Sum(2) 19.02 100 + (208) 0	Introver of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov 2 heating requirement (calculated above) 718.09 575.49 494.98 289.98 133.09 0 0 0 292.49 516.86 = {[(98)m x (204)] } x 100 ÷ (206) 789.97 633.11 544.51 319.01 146.41 0 0 0 321.77 568.6 e heating fuel (secondary), kWh/month mx (201)] } x 100 ÷ (208) 0 </td <td>Interview nearing system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 2 heating requirement (calculated above) 778.0 575.49 484.66 288.98 133.09 0 0 0 0 292.49 516.86 725.83 1= {{(198)}m x (204)} x 100 + (206) 788.97 533.11 544.51 319.01 146.41 0 0 0 321.77 568.6 798.5 a heating fuel (secondary), kWh/month mx (201)} x 100 + (208) 0</td> <td>nncy of secondary/supplementary heating system, % 0 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 1800 575.48 494.98 288.88 133.09 0 0 0 0 292.48 516.86 725.83 178.09 575.48 494.98 283.88 133.09 0 0 0 321.77 568.6 788.5 178.97 633.11 544.51 313.01 146.41 0 0 0 321.77 568.6 788.5 178.99 633.11 544.51 313.01 146.41 0</td>	Interview nearing system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 2 heating requirement (calculated above) 778.0 575.49 484.66 288.98 133.09 0 0 0 0 292.49 516.86 725.83 1= {{(198)}m x (204)} x 100 + (206) 788.97 533.11 544.51 319.01 146.41 0 0 0 321.77 568.6 798.5 a heating fuel (secondary), kWh/month mx (201)} x 100 + (208) 0	nncy of secondary/supplementary heating system, % 0 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 1800 575.48 494.98 288.88 133.09 0 0 0 0 292.48 516.86 725.83 178.09 575.48 494.98 283.88 133.09 0 0 0 321.77 568.6 788.5 178.97 633.11 544.51 313.01 146.41 0 0 0 321.77 568.6 788.5 178.99 633.11 544.51 313.01 146.41 0	

Item 1 = (269) 0.519 -293.13 sum of (265) (271) = Total CO2, kg/year (272) 1437.95 **Dwelling CO2 Emission Rate** (272) ÷ (4) = (273) 20.13 El rating (section 14) 83 (274)

			User D	etails:						
Assessor Name:	Oliver Morris			Strom	a Num	ber:		STRO	025430	
Software Name:	Stroma FSAP 20 ²	12		Softwa	are Ver	sion:		Versio	n: 1.0.3.12	
		Р	roperty A	Address:	Unit 5 p	proposed	d GREEI	N		
Address :	, London, NW6 1NF	र								
1. Overall dwelling dimen	isions:									
Ground floor				a(m²) ′3.1	(1a) x	Av. He	i ght(m) .91	(2a) =	Volume(m³) 212.79	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e	e)+(1n	I) 7	'3.1	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d)+(3e)+	.(3n) =	212.79	(5)
2. Ventilation rate:	-								<u> </u>	
		econdar neating	у	other		total			m ³ per hou	ſ
Number of chimneys	0 +	0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	<u> </u> + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent fan	s L					0	x	10 =	0	(7a)
Number of passive vents						0	x ^	10 =	0	 (7b)
Number of flueless gas fire	25					0	x 4	40 =	0	(7c)
					L	0		l	0	
								Air ch	anges per ho	ur
Infiltration due to chimney	s, flues and fans = (6	6b)+(6b)+(7	a)+(7b)+(7	7c) =	Г	0	<u> </u>	÷ (5) =	0	(8)
If a pressurisation test has be	en carried out or is intend	ed, proceed	d to (17), c	otherwise c	continue fro	om (9) to (-	
Number of storeys in the	e dwelling (ns)								0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2					•	uction			0	(11)
if both types of wall are pre deducting areas of opening		sponuing to	line great	er wall ale	a (allei					
If suspended wooden flo	oor, enter 0.2 (unsea	led) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter 0								0	(13)
Percentage of windows	and doors draught s	tripped							0	(14)
Window infiltration				0.25 - [0.2		-			0	(15)
Infiltration rate	50	••••••		(8) + (10)					0	(16)
Air permeability value, c If based on air permeabilit			•	•	•	etre of e	nvelope	area	5	(17)
Air permeability value applies	•					is beina us	sed	l	0.25	(18)
Number of sides sheltered		0.00011.0011	o o, u uog	, ee an pe		ie wenig de		[2	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporatin	ng shelter factor			(21) = (18)) x (20) =				0.21	(21)
Infiltration rate modified fo	r monthly wind spee	d								
Jan Feb M	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7									
(22)m= 5.1 5 4	4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	$m \div 4$									
	.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
	1.1 1.00	0.00	0.00	0.02	'	1.00	1.12	1.10		

Adjuste	d infiltr	ation rat	e (allow	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se					Г		(23a)
				endix N, (2	(23a) = (23a	a) × Fmv (e	equation (I	N5)), othe	rwise (23ł	(23a) = (23a)		L	0.5	(23a)
				ciency in %						.) ()		L	0.5 76.5	(23c)
			-	-	-					2h)m + (23h) x [L 1 – (23c)		(200)
(24a)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37	. 100]	(24a)
	alance	d mech	ı anical ve	ntilation	u without	heat rec	overv (N	I MV) (24t	m = (2)	1 2b)m + (23b)	11		
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,				ntilation of then (24)	•	•				.5 × (23t))	1		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,				ole hous m = (221						0.5]	•			
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effect	tive air	change	rate - er	nter (24a) or (24b	o) or (240	c) or (24	d) in bo	x (25)	-	-			
(25)m=	0.39	0.38	0.38	0.35	0.35	0.32	0.32	0.31	0.33	0.35	0.36	0.37		(25)
3. Hea	t losse	s and he	eat loss i	paramet	er:									
ELEM		Gros area	SS	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²⋅k		A X k kJ/K
Doors						1.79	x	1.5	=	2.685				(26)
Window	vs Type	e 1				1.17	x1	/[1/(1.4)+	0.04] =	1.55				(27)
Window	vs Type	e 2				1.17	x1	/[1/(1.4)+	0.04] =	1.55				(27)
Roofligh	nts					0.26		/[1/(1.6) +	0.04] =	0.416				(27b)
Walls T	ype1	34.3	33	0		34.33	x	0.25	=	8.58				(29)
Walls T	ype2	12.2	29	5.85	;	6.44	x	0.28	=	1.8	i F		<u> </u>	(29)
Walls T	уреЗ	19.6	62	1.79	,	17.83	x	0.25	=	4.46	i F		i —	(29)
Roof T	ype1	39.9	93	0.26	;	39.67	×	0.18	=	7.14	i F		i —	(30)
Roof T	ype2	26.9	97	0	=	26.97	×	0.18		4.85	i F		i —	(30)
Roof T	ype3	10.6	62	0		10.62	x	0.16		1.7	i F		i —	(30)
Total ar	ea of e	lements	, m²			143.7	6							(31)
Party w	all					34.37	×	0	=	0				(32)
Party w	all					14.13	x	0	=	0	= i		i —	(32)
Party flo	oor					63.63		L			[i —	(32a)
Party flo	oor					9.47					[(32a)
				effective wi nternal wal			ated using	g formula 1	l/[(1/U-valu	ue)+0.04] a	as given in	n paragraph	3.2	
Fabric h	naat loo	s. W/K :	= S (A x	U)				(26) (30) + (32) =			Г	39.37	(33)
		,	- (- /								L	00.01	

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

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

Indicative Value: Medium

250

(35)

can be i	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	K						21.56	(36)
if details	s of therma	al bridging	are not kr	own (36) =	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			60.93	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	27.28	26.9	26.53	24.67	24.29	22.43	22.43	22.05	23.17	24.29	25.04	25.78		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	88.21	87.84	87.46	85.6	85.22	83.36	83.36	82.99	84.1	85.22	85.97	86.72		
Heat lo	oss para	Imeter (H	HLP), W	/m²K			•	•		Average = = (39)m ÷	Sum(39)1 · (4)	₁₂ /12=	85.5	(39)
(40)m=	1.21	1.2	1.2	1.17	1.17	1.14	1.14	1.14	1.15	1.17	1.18	1.19		
										Average =	Sum(40)₁	₁₂ /12=	1.17	(40)
Numb	er of day	/s in mo	nth (Tab	le 1a)			_							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
													-	
4. Wa	ater hea	ting ene	rav reau	irement:								kWh/ye	ear:	
if TF	A > 13.			[1 - exp	(-0.0003	49 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		32		(42)
	A £ 13.	,	101.000	no in litro									I	
								(25 x N) to achieve		se target o		.28	_	(43)
not mor	e 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 wat	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)			•			
(44)m=	98.2	94.63	91.06	87.49	83.92	80.35	80.35	83.92	87.49	91.06	94.63	98.2		
								<u>. </u>		Total = Su	m(44) _{1 12} =	-	1071.31	(44)
Energy	content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x Ľ	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	145.63	127.37	131.44	114.59	109.95	94.88	87.92	100.89	102.09	118.98	129.88	141.04		
										Total = Su	m(45) _{1 12} =	=	1404.65	(45)
It instan		ater heatil	ng at point	t of use (no	hot water	· storage),	enter 0 in	boxes (46,) to (61)				1	
(46)m=	21.84	19.11	19.72	17.19	16.49	14.23	13.19	15.13	15.31	17.85	19.48	21.16		(46)
	storage		includir		alar or M		storago	within sa	movos	دما		•	l	(47)
		,					0			501		0		(47)
	•	-		nk in dw r (this ir	-			ombi boil	ers) ente	er '0' in (47)			
	storage		not mat			notantai				0 (,			
	•		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energ	y lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
-			-	ylinder l		or is not						•		~ /
		-		om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
		eating s		on 4.3									I	
		from Ta		2h								0		(52)
rempe	FIGULE	actor fro	III Table	20								0		(53)

0.			•	e, kWh/y	ear			(47) x (51) x (52) x (53) =		0	ļ	(54)
	. ,	(54) in (8										0	J	(55)
Water	storage	loss cal	culated	for each	month		-	((56)m = ((55) × (41)	m	-	-	_	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	∋ 3							0]	(58)
	•					59)m = ((58) ÷ 36	65 × (41))m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	a cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month	(61)m =	(60) ÷ 3	65 × (41))m						
(61)m=	50.04	43.56	46.4	43.15	42.76	39.62	40.94	42.76	43.15	46.4	46.67	50.04		(61)
Total h	neat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	195.68	170.93	177.84	157.73	152.71	134.5	128.86	143.65	145.24	165.38	176.54	191.08		(62)
Solar DI	HW input	calculated	using App	endix G o	r Appendix	H (negati	ve quantity	/) (enter '0)' if no sola	r contribut	ion to wate	er heating)	•	
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (G)				_	
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter											
(64)m=	195.68	170.93	177.84	157.73	152.71	134.5	128.86	143.65	145.24	165.38	176.54	191.08		
	-							Out	put from w	ater heate	r (annual)₁	12	1940.16	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)n	n] + 0.8 x	۲ ((46)m	+ (57)m	+ (59)m	1]	
(65)m=	60.93	53.24	55.3	48.89	47.25	41.45	39.47	44.24	44.73	51.16	54.85	59.41		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Int	ternal ga	ains (see	e Table S	5 and 5a):									
Metab	olic gair	is (Table	5) Wat	ts										
metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	115.95				<u> </u>		115.95	-	115.95			115.95		(66)
Lightin	ig gains	(calcula	ted in A	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				1	
(67)m=	27.23	24.18	19.67	14.89	11.13	9.4	10.15	13.2	17.71	22.49	26.25	27.98	1	(67)
Applia	nces ga	ins (calc	ulated ir	n Appeno	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	204.42	206.54	201.2	189.82	175.45	161.95	152.93	150.81	156.16	167.54	181.9	195.4]	(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a)), also se	ee Table	5			1	
(69)m=	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	34.59	1	(69)
Pumps	s and fa	ns gains	(Table :	ь 5а)	1			1	Į	1		1	1	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3]	(70)
Losses	s e.a. ev	aporatic	n (nega	tive valu	es) (Tab	le 5)	Į	1	I	1		1	1	
(71)m=	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76	-92.76]	(71)
Water	heating	gains (1	able 5)	!									I	
(72)m=	81.9	79.23	74.33	67.9	63.51	57.57	53.05	59.46	62.13	68.77	76.18	79.85]	(72)
	internal	gains =					I)m + (67)m	י 1 + (68)m ∙	+ (69)m +	ı (70)m + (7		m	I	
(73)m=	374.33	370.74	355.98	333.39	310.87	289.71	276.92	284.25	296.78	319.58	345.12	364.02		(73)
	lar gains		1	1	1	1	1	1	1	1	l	1		

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

Orientation:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	1.17	x	11.28	x	0.57	x	0.7	=	3.65	(75)
Northeast 0.9x	0.77	x	1.17	x	22.97	×	0.57	x	0.7	=	7.43	(75)
Northeast 0.9x	0.77	x	1.17	x	41.38	x	0.57	x	0.7	=	13.39	(75)
Northeast 0.9x	0.77	x	1.17	x	67.96	×	0.57	x	0.7	=	21.98	(75)
Northeast 0.9x	0.77	x	1.17	x	91.35	x	0.57	x	0.7	=	29.55	(75)
Northeast 0.9x	0.77	x	1.17	x	97.38	x	0.57	x	0.7	=	31.51	(75)
Northeast 0.9x	0.77	x	1.17	x	91.1	x	0.57	x	0.7	=	29.47	(75)
Northeast 0.9x	0.77	x	1.17	x	72.63	x	0.57	x	0.7	=	23.5	(75)
Northeast 0.9x	0.77	x	1.17	x	50.42	x	0.57	x	0.7	=	16.31	(75)
Northeast 0.9x	0.77	x	1.17	x	28.07	x	0.57	x	0.7	=	9.08	(75)
Northeast 0.9x	0.77	x	1.17	x	14.2	x	0.57	x	0.7	=	4.59	(75)
Northeast 0.9x	0.77	x	1.17	x	9.21	x	0.57	x	0.7	=	2.98	(75)
Northwest 0.9x	0.77	x	1.17	x	11.28	x	0.57	x	0.7	=	14.6	(81)
Northwest 0.9x	0.77	x	1.17	x	22.97	x	0.57	x	0.7	=	29.72	(81)
Northwest 0.9x	0.77	x	1.17	x	41.38	x	0.57	x	0.7	=	53.55	(81)
Northwest 0.9x	0.77	x	1.17	x	67.96	x	0.57	x	0.7	=	87.94	(81)
Northwest 0.9x	0.77	x	1.17	x	91.35	x	0.57	x	0.7	=	118.21	(81)
Northwest 0.9x	0.77	x	1.17	x	97.38	x	0.57	x	0.7	=	126.02	(81)
Northwest 0.9x	0.77	x	1.17	x	91.1	x	0.57	x	0.7	=	117.89	(81)
Northwest 0.9x	0.77	x	1.17	x	72.63	x	0.57	x	0.7	=	93.98	(81)
Northwest 0.9x	0.77	x	1.17	x	50.42	x	0.57	x	0.7	=	65.25	(81)
Northwest 0.9x	0.77	x	1.17	x	28.07	x	0.57	x	0.7	=	36.32	(81)
Northwest 0.9x	0.77	x	1.17	x	14.2	x	0.57	x	0.7	=	18.37	(81)
Northwest 0.9x	0.77	x	1.17	x	9.21	x	0.57	x	0.7	=	11.92	(81)
Rooflights 0.9x	1	x	0.26	x	26	x	0.63	x	0.7	=	2.68	(82)
Rooflights 0.9x	1	x	0.26	x	54	x	0.63	x	0.7	=	5.57	(82)
Rooflights 0.9x	(1	x	0.26	x	96	x	0.63	x	0.7	=	9.91	(82)
Rooflights 0.9x	(1	x	0.26	x	150	x	0.63	x	0.7	=	15.48	(82)
Rooflights 0.9x	1	x	0.26	x	192	x	0.63	x	0.7	=	19.81	(82)
Rooflights 0.9x	(1	x	0.26	x	200	x	0.63	x	0.7	=	20.64	(82)
Rooflights 0.9x	1	x	0.26	x	189	x	0.63	x	0.7	=	19.5	(82)
Rooflights 0.9x	1	x	0.26	x	157	x	0.63	x	0.7	=	16.2	(82)
Rooflights 0.9x	1	x	0.26	x	115	x	0.63	x	0.7	=	11.87	(82)
Rooflights 0.9x	(1	x	0.26	x	66	x	0.63	x	0.7	=	6.81	(82)
Rooflights 0.9x	(1	x	0.26	×	33	×	0.63	x	0.7	=	3.41	(82)
Rooflights 0.9x	1	x	0.26	x	21	x	0.63	x	0.7	=	2.17	(82)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m	(82)m			
(83)m=	20.93	42.72	76.84	125.4	167.57	178.16	166.87	133.68	93.43	52.21	26.37	17.07	(83)
Total g	ains – ii	nternal a	ind solar	(84)m =	= (73)m -	+ (83)m	, watts						
(84)m=	395.27	413.46	432.82	458.79	478.45	467.87	443.78	417.93	390.21	371.79	371.49	381.09	(84)

7. Me	an inter	nal temp	perature	(heating	season)								
		during h		, J		,	from Tab	ole 9, Th	1 (°C)			1	21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	1	0.99	0.97	0.88	0.75	0.8	0.95	0.99	1	1		(86)
Mean	Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													
(87)m=	19.63	19.73	19.93	20.26	20.58	20.85	20.95	20.94	20.73	20.34	19.95	19.63		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dwellina	from Ta	able 9. T	h2 (°C)					
(88)m=	19.91	19.92	19.92	19.94	19.95	19.97	19.97	19.97	19.96	19.95	19.94	19.93		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling	h2 m (se	e Table	9a)						
(89)m=	1	1	1	0.99	0.95	0.82	0.61	0.67	0.91	0.99	1	1		(89)
	interna	I I temper	I ature in	the rest	of dwalli	na T2 (f	l ollow ste	1	I 7 in Tabl					
(90)m=	18.08	18.23	18.54	19.02	19.48	19.84	19.95	19.94	19.7	19.14	18.57	18.09		(90)
()										LA = Livin	g area ÷ (4		0.5	(91)
Moon	intorno	l temper	oturo (fo	r tho wh	olo dwo	lling) – fl	ι Λ ν Τ1	ı (1 fl	۸) v To					
(92)m=	18.86	18.98	19.24	19.64	20.03	20.35	20.45	+ (1 – 1L 20.44	20.22	19.74	19.26	18.86		(92)
		nent to t									10.20	10.00		
(93)m=	18.71	18.83	19.09	19.49	19.88	20.2	20.3	20.29	20.07	19.59	19.11	18.71		(93)
8. Sp	ace hea	iting requ	uirement											
		mean int				ned at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	<u> </u>										I	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa (94)m=	ation fac	tor for g	ains, hm	0.98	0.95	0.83	0.66	0.71	0.92	0.99	1	1		(94)
		hmGm				0.83	0.00	0.71	0.92	0.99		I		(34)
(95)m=	394.31	412.04	430.02	450.89	452.62	390.12	291.85	297.82	358.83	366.46	369.95	380.33		(95)
		I age exte	rnal tem											
(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 rat	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1271.06	1223.54	1100.95	906.46	697.15	466.57	308.68	322.83	502.08	766.33	1032.38	1258.48		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	652.3	545.33	499.17	328.01	181.94	0	0	0	0	297.5	476.95	653.34		
								Tota	l per year	(kWh/yea) = Sum(9	8)15,912 =	3634.55	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								49.72	(99)
9a. En	ergy rea	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heati	-												
Fracti	on of sp	bace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	bace hea	at from m	nain syst	em(s)			(202) = 1 ·	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								90.9	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	ז, %						0	(208)

	Jan Fe	b Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heating requ	uirement (calculate	d above))								
	652.3 545.3	3 499.17	328.01	181.94	0	0	0	0	297.5	476.95	653.34		
(211)m	n = {[(98)m x (204)] } x	100 ÷ (20)6)									(211)
	717.61 599.9	2 549.14	360.85	200.15	0	0	0	0	327.28	524.7	718.75		_
							Total	l (kWh/yea	ar) =Sum(2	2 11) _{15,10. 12}	=	3998.4	(211)
•	e heating fuel	•	• ·	month									
= {[(90) (215)m=)m x (201)] } > 0 0	0	0	0	0	0	0	0	0	0	0		
I	I						Total	l (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
Water	heating												4
Output	from water h											I	
	195.68 170.9		157.73	152.71	134.5	128.86	143.65	145.24	165.38	176.54	191.08		٦
	ncy of water h	-										80.8	(216)
(217)m=			87.35	85.99	80.8	80.8	80.8	80.8	87.01	87.93	88.4		(217)
	r water heatir 1 = (64)m x 1												
(219)m=			180.57	177.59	166.46	159.48	177.79	179.75	190.07	200.78	216.16		
		-					Total	l = Sum(2	19a) ₁₁₂ =			2265.83	(219)
	I totals								k	Wh/year		kWh/year	-
Space	heating fuel u	ised, mair	n system	1								3998.4	
Water	heating fuel u	sed										2265.83	
Electric	city for pumps	, fans and	lelectric	keep-ho	t								
	city for pumps anical ventilat					nput fron	n outside	9			259.61		(230a)
mecha		ion - bala				nput fron	n outside	9			259.61 30		(230a) (230c)
mecha centra	anical ventilat	ion - bala np:	nced, ext	ract or p		nput fron		e of (230a)	(230g) =			289.61	
mecha centra Total e	anical ventilat	ion - bala np: ne above,	nced, ext	ract or p		nput fron			(230g) =			289.61 480.82	(230c)
mecha centra Total e Electric	anical ventilat al heating pun lectricity for th	ion - bala np: ne above, g	nced, ext	ract or p		nput fron			(230g) =				(230c) (231)
mecha centra Total e Electric Electric	anical ventilat al heating pun lectricity for th city for lighting	ion - bala np: ne above, g I by PVs	nced, ext kWh/yea	ract or p	oositive ii		sum	of (230a)	(230g) =			480.82	(230c) (231) (232)
mecha centra Total e Electric Electric	anical ventilat al heating pun lectricity for th city for lighting city generated	ion - bala np: ne above, g I by PVs	nced, ext kWh/yea	ract or p	ems inclu	uding mi	sum	of (230a)		ion fac	30	480.82 -564.81	(230c) (231) (232)
mecha centra Total e Electric Electric	anical ventilat al heating pun lectricity for th city for lighting city generated	ion - bala np: ne above, g I by PVs	nced, ext kWh/yea	ract or p	ems inclu En		sum	of (230a)		ion fac 2/kWh	30	480.82	(230c)](231)](232)](233)
mecha centra Total e Electric 12a. (anical ventilat al heating pun lectricity for th city for lighting city generated	ion - bala np: ne above, J I by PVs <u>s – Indivio</u>	nced, ext kWh/yea dual heati	ract or p	ems inclu En kW	uding mi	sum	of (230a)	Emiss	2/kWh	30	480.82 -564.81 Emissions	(230c)](231)](232)](233)
mecha centra Total e Electric 12a. (Space	anical ventilat al heating pun lectricity for th city for lighting city generated	tion - bala np: ne above, l by PVs s – Individ	nced, ext kWh/yea dual heati	ract or p	ems inclu En kW (21	uding min ergy /h/year	sum	of (230a)	Emiss kg CO	2/kWh	30 tor	480.82 -564.81 Emissions kg CO2/yea	(230c)](231)](232)](233)
mecha centra Total e Electric 12a. (Space Space	anical ventilat al heating pun lectricity for th city for lighting city generated CO2 emission	tion - bala np: ne above, l by PVs s – Individ	nced, ext kWh/yea dual heati	ract or p	ems inclu En kW (21 (21	uding mi ergy /h/year 1) x	sum	of (230a)	Emiss kg CO2	2/kWh 16	30 tor =	480.82 -564.81 Emissions kg CO2/yea 863.65	(230c)](231)](232)](233) I(233)
mecha centra Total e Electric 12a. (Space Space Water I	anical ventilat al heating pun lectricity for th city for lighting city generated CO2 emission heating (main heating (seco	tion - bala np: ne above, g I by PVs <u>s – Indivio</u> n system 1 ondary)	nced, ext kWh/yea dual heati	ract or p	ems inclu En kW (21 (21) (21)	uding mi ergy /h/year 1) x 5) x 9) x	sum	of (230a)	Emiss kg CO2 0.2	2/kWh 16	30 tor = =	480.82 -564.81 Emissions kg CO2/yea 863.65 0	(230c)](231)](232)](233)](233) Ir](261)](261)
mecha centra Total e Electric 12a. (Space Space Water I Space	anical ventilat al heating pun lectricity for th city for lighting city generated CO2 emission heating (main heating (seco heating	tion - bala np: ne above, g I by PVs <u>s – Indivio</u> n system 1 ondary) ating	nced, ext kWh/yea dual heati	ract or p	ems inclu En kW (21 (21) (21) (21) (21) (21)	uding mi ergy /h/year 1) x 5) x 9) x	sum	of (230a)	Emiss kg CO2 0.2	2/kWh 16 19 16	30 tor = =	480.82 -564.81 Emissions kg CO2/yea 863.65 0 489.42	(230c)](231)](232)](233) I(233) I(261)](263)](264)
mecha centra Total e Electric 12a. (Space Space Water I Space Electric	anical ventilat al heating pun lectricity for th city for lighting city generated CO2 emission heating (main heating (seco heating and water he	tion - bala np: ne above, g I by PVs <u>s – Indivio</u> n system 1 ondary) ating ting	nced, ext kWh/yea dual heati	ract or p	ems inclu En KW (21) (21) (21) (21) (26) t (23)	uding mi ergy /h/year 1) x 5) x 9) x 1) + (262) ·	sum	of (230a)	Emiss kg CO 0.2 0.5 0.2	2/kWh 16 19 16	30 tor = =	480.82 -564.81 Emissions kg CO2/yea 863.65 0 489.42 1353.07	(230c)](231)](232)](233)](233) Ir](261)](263)](264)](265)
mecha centra Total e Electric 12a. (Space Space Water I Space Electric Electric	anical ventilat al heating pun lectricity for th city for lighting city generated CO2 emission heating (main heating (seco heating and water he city for pumps	tion - bala np: ne above, g I by PVs s – Individ n system 1 ondary) ating , fans and	nced, ext kWh/yea dual heat l)	ract or p r ing syste	ems inclu En KW (21) (21) (21) (21) (26) t (23)	uding mi ergy /h/year 1) x 5) x 9) x 1) + (262) 1) x	sum	of (230a)	Emiss kg CO2 0.2 0.5 0.2	2/kWh 16 19 16 19 19	30 tor = = =	480.82 -564.81 Emissions kg CO2/yea 863.65 0 489.42 1353.07 150.31 249.55	(230c)](231)](232)](233)](233) I(233) I(261)](261)](264)](265)](267)](268)
mecha centra Total e Electric 12a. (Space Space Water I Space Electric Electric Energy Item 1	anical ventilat al heating pun lectricity for th city for lighting city generated CO2 emission heating (main heating (second heating and water he city for pumps city for lighting	tion - bala np: ne above, g I by PVs s – Individ n system 1 ondary) ating , fans and	nced, ext kWh/yea dual heat l)	ract or p r ing syste	ems inclu En KW (21) (21) (21) (21) (26) t (23)	uding mi ergy /h/year 1) x 5) x 9) x 1) + (262) 1) x	sum	of (230a) 264) =	Emiss kg CO 0.2 0.5 0.2	2/kWh 16 19 16 19 19	30 tor = = = =	480.82 -564.81 Emissions kg CO2/yea 863.65 0 489.42 1353.07 150.31	(230c)](231)](232)](233)](233)](233)](261)](261)](263)](264)](265)](267)

Dwelling CO2 Emission Rate

EI rating (section 14)

(272) ÷ (4) =

19.97	(273)
83	(274)