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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 London Borough of Camden and comprises th refurbishment and top extension of an existing development.	
Planning Policy	In accordance with the London Borough of Camden's Core Strategy, 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:	
	Use energy more efficiently	
	1 2 3 4 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)	13.40	9.34	-	7.90
CO ₂ emissions saving (Tonnes CO ₂ /yr)	-	4.06	-	1.43
Saving from each stage (%)	-	30.36	-	10.7
Total CO ₂ emissions saving (Tonnes CO ₂ /yr)		5	.49	L.

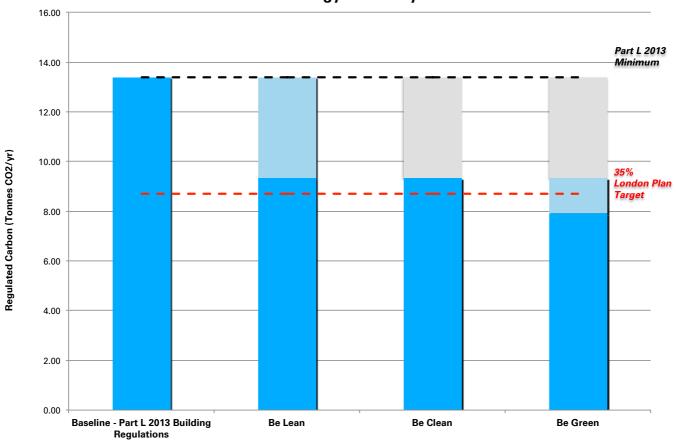
41.0% Total carbon emissions savings over Part L1A and 1B of the Building Regulations 2013 achieved

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 30.3% from the fabric energy efficiency measures described in the 'Be Lean' section and will reduce total carbon emissions by 41.0% 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 10.7% reduction in CO_2 emissions over the 'be lean' scenario.

A feasibility analysis of renewable technologies has been undertaken 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	4.06	30.3%	
Savings from 'Be Clean'-After CHP	0.00	0.0%	
Savings from 'Be Green'-After renewable energy	1.43	10.7%	
Total Cumulative Savings	5.49	41.0%	

Total Target Savings (35% reduction as set out in London Plan policy 5.2)	4.69	35%
Annual Surplus	0.80	

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.

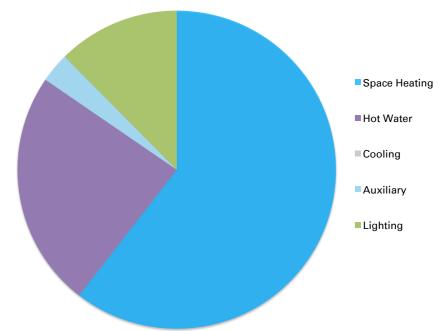
Carbon Dioxide Emissions – Regulated and Unregulated (Tonnes CO_2/yr)				
	Regulated Emissions	Unregulated Emissions	Total Emissions	
Baseline: Part L 2013	13.40	6.38	19.77	
Be Lean: After demand reduction	9.34	6.38	15.72	
Be Clean: After CHP	-	-	-	
Be Green: After Renewable energy	7.90	6.38	14.28	

Introduction Energy Assessment 40-42 Mill Lane

Aim of this study:	The purpose of an energy assessment is to demonstrate that climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy. It also ensures energy remains an integral part of the 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 (March 2016)"
	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 L1A (TER) and Part L1B (DER) 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 heat 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' car	bon emissions for th	e development ar	e 13.40 Tonnes CO	₂ /yr.
·	The pie chart below provides a breakdown of the scheme's baseline carbon em system over the course of one year.				n emissions by
Carbon Emissions in Tonnes CO ₂ /yr	Heating	Hot Water	Cooling	Auxiliary	Lighting
	8.28	3.12	0.00	0.39	1.61



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 60.5% of the residential scheme's total energy demand whilst domestic hot water accounts for approximately 24.1%.

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

Be Lean - Summary:

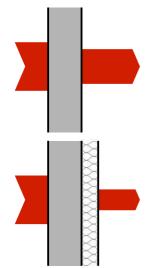
Demand reduction measures have reduced the scheme's carbon emissions by 30.3 % over the minimum Part L1A and 1B 2013 Building Regulations baseline.

Site Layout Passive Design measures:

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:

Element	Minimum Building Regulations U value	Proposed U value
	W/m ² K	W/m²K
External wall (new)	0.28	0.25
External wall (existing)	0.30	0.25
Party Wall	0.20	0.00
Exposed floors	0.25	0.25
Roof (new)	0.18	0.10
Roof (existing)	0.18	0.18
Windows	1.60	1.40
Doors	1.80	1.50



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

Airtightness:

Refurbished flats (Flat 1 to 5) will target an air permeability of 7 m³/(hr.m²) @ 50 pa. The target air permeability for the new flats (Flat 6 and 7) has been modelled as 3 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:

The refurbished part of the scheme has been indicatively modelled with the default thermal bridge y-values for all junction types, 0.15W/m²K. The two new flats (Flat 6 and 7) will target Accredited Construction Details (ACD) to all junctions.

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 by suitable arrangement of plumbing and electrical services and delayed thermostat. The heat will be distributed via radiators. The gas boiler will have a minimum efficiency of 89.5% and will provide space and domestic hot water heating.

Ventilation:

Balanced mechanical ventilation with heat recovery will be provided to the dwellings with the following specifications:

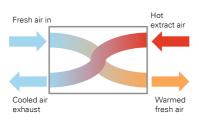
- 1 wet room: SFP of 0.53 and heat recovery of 89%
- 2 wet rooms: SFP of 0.60 and heat recovery of 88%
- 3 wet rooms: SFP of 0.71 and heat recovery of 86%

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.

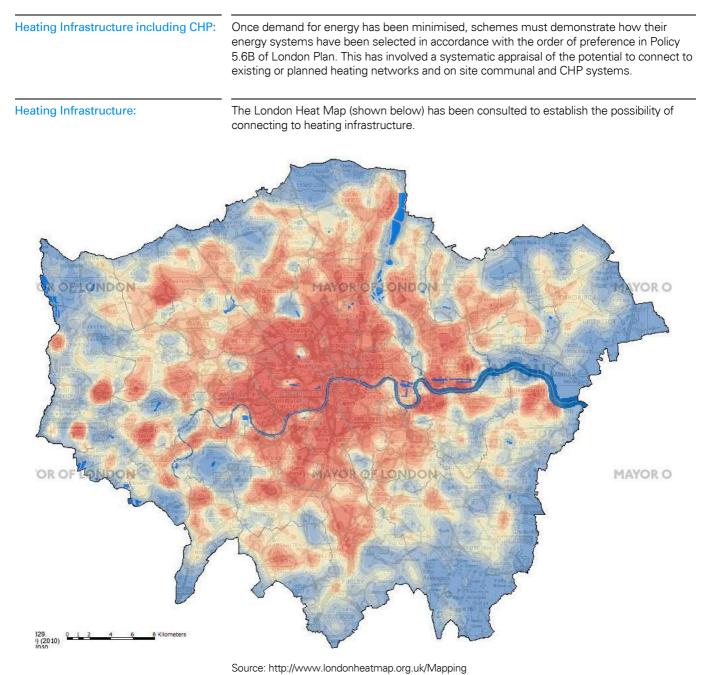
Lighting:

High efficiency LED lighting has been specified for the development (with a lumen efficacy of more than 45 lm/W).



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

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

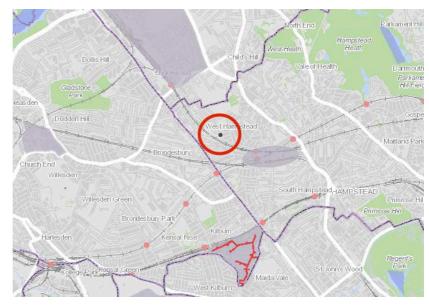


'Be Clean': Connection to Existing and Planned Networks Energy Assessment 40-42 Mill Lane

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 Networks
 Potential 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

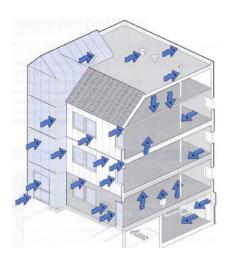
In accordance with section 8.2 of the GLA guidance for Energy Planning, where it is demonstrable that a site wide network is not feasible then an individual heating strategy can be implemented. A site wide network will not be adopted because the dwellings on site will not have adequate density and local 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.
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

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

Policy 5.9 Overheating and Cooling:	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.				
The Cooling Hierarchy:	Major developments should reduce potential overheating and reliance on air conditioning systems and demonstrate this with the Cooling Hierarchy:				
	1) Minimise internal heat generation through energy efficient design				
	2) Reduce the amount of heat entering the building in summer (e.g. shading and fenestration)				
	3) Manage the heat within the building through thermal mass, room height and green roofs				
	4) Passive ventilation				
	5) Mechanical ventilation				
	6) Active cooling systems (ensuring the lowest carbon option)				
Avoiding Overheating Measures taken:	The following measures have been taken in accordance with the cooling hierarchy to reduce overheating and the need for cooling:				
	1) Minimise internal heat generation through energy efficient design				
	Internal heat gains have been minimised where possible. Energy Efficient appliances will help reduce internal heat gain and reduce the cooling requirement.				
	Energy efficient LED lighting will also be specified (>45 lumens per circuit watt).				

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

Avoiding Overheating Measures taken:



Examples of possible air leakage points in a building



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

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

Direct solar gains will be controlled in the following ways:

- Solar control methods controlling solar gain to within tolerable limits have been considered. The location, design and type of window openings and new glazing have been optimised, and reduced solar gain factors from low emissivity windows with a g-value of 0.57 have been specified.
- Light-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 3 m³/(hr.m²) @ 50 pa has been targeted for the two new flats (Flat 6 and 7) to minimise uncontrolled air infiltration. All windows will be draught stripped. This will require attention to detailing and sealing. See 'Be Lean' section of this report for details of how this will be achieved.
- 3) Manage the heat within the building through thermal mass, room height and green roofs.

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

 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.

'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 2.5m. As the roof will be well insulated to achieve a U-value of 0.10 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.

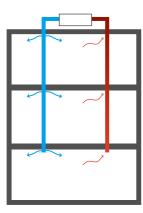
- Openable windows are specified on all exposed facades of the building.
- Night time cooling will also be utilised in the form of openable windows. This will work in tandem with high thermal mass materials part of the existing structure. The larger temperature differential that exists between internal 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.

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.
- 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 3 m³/(hr.m²) @ 50 pa.
- The mechanical systems will have the following efficiencies which are in compliance with the Domestic Building Services Compliance Guide:
 - 1 wet room: SFP of 0.53 and heat recovery of 89%
 - 2 wet rooms: SFP of 0.60 and heat recovery of 88%
 - 3 wet rooms: SFP of 0.71 and heat recovery of 86%

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	Not Significant
Flat 3	Slight
Flat 4	Not Significant
Flat 5	Slight
Flat 6	Not Significant
Flat 7	Slight

According to the GLA guidance on preparing energy assessments (March 2016), 3a 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.

Overheating Risk:

'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:	In line with Policy 5.7 of the London Plan the feasibility of renewable energy technologies has been considered. A detailed site-specific analysis and associated carbon saving calculations has also been provided for renewable energy technologies considered feasible. Each technology has been assessed under 5 broader categories. There are key criteria for each category on which the technology is evaluated. The key criteria have been given a weighting based on a tick-system, a graphical representation of this is shown below:						
Renewable Energy Technology Comparison:							
	\checkmark \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 table (example below) for each of the technologies. The score for each of the criteria will be summed and each of the technologies will then be ranked. The assessment of each						

summed and each of the technologies will then be ranked. The assessment of technology is undertaken on the following pages.

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

'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	CO₂ 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 flat roof area of approximately $95m^2$. This would allow 10 panels to be installed to provide additional electricity generation to the 2 new apartments (Flat 6 and 7)

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO₂ and sustainability
Photovoltaic	~~~~	~~ ~~	~~ ~~~	~ ~ ~	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~
	No local air quality impacts, use of unutilised roof space, no noise issues.	Can be added to the roof, good orientation, and slightly increased buildability issues for wiring and metering.	Increased capital costs of installation, typical payback of >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 flat roof area of approximately 95m².

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	CO ₂ and sustainability
Solar Thermal	~ ~ <i>~ ~</i> ~	<>> </th <th>~~~~</th> <th>~~~</th> <th><i></i></th>	~~~~	~~~	<i></i>
	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 £6,000.00.

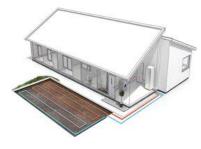
A detailed wind resource evaluation would be required for the site to fully understand the generation potential and payback period. Also, it is likely that planning restrictions and resistance from small groups within the local community could also affect the viability of wind energy for the project.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability
Wind Energy	No local air quality impacts, use of unutilised roof space, conservation officer will have concerns for the site, minor noise	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.	3			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 £80,000.00 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.	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 £30,000 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	<pre></pre>	13 out of 26
Photovoltaic	~~~	~ ~ ~ ~ ~	~~ ~~~	~ ~ / /	~ ~ ~ ~ ~ ~	18 out of 26
Solar Thermal	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~ ~ ~ ~	~~ ~~~	~~~	~~~~	16 out of 26
Wind Energy	• • • • •	~ ~ ~ ~ ~	<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 flat roof space.

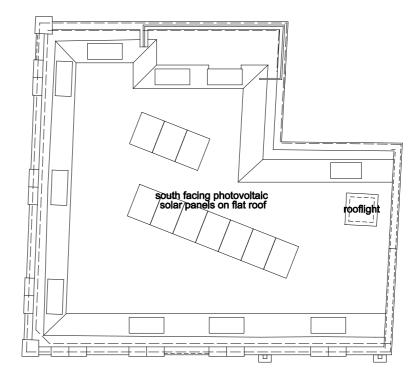
'Be Green': Photovoltaic Energy Assessment 40-42 Mill Lane

Summary:

A photovoltaic panel system of 3.20 kWp (10 PV panels assuming a nominal output of 320W per PV panel) 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.

Location:

The following drawing shows that there are approximately $95m^2$ of available flat roof that could be used to install photovoltaic modules. PV panels will be oriented south, covering approximately $16m^2$ of the roof.



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

Lifecycle Cost:	The lifecycle of the proposed high efficiency panels is 25 years. To calculate the lifecycle cost of the panels, the maintenance of the system and replacement cost will be included.							
	The total costs for the proposed system's lifetime is:							
	 Capital Cost and maintenance = £4,600 Maintenance = £1,500 Operation Cost = £900 (replacement inverters etc.) Total Costs = £7,000.00 							
Revenue and Payback Parameters:	• The cost of electricity to be displaced is 14p/kWh.							
	• The 3.20kWp system is estimated to generate 2,764 kWh/yr. Based on the assumption that 50% of the electricity will be used on site, an offset saving of £193yr will be achieved.							
	• With the current Feed in Tariff, a tariff of 4.32/kWh wil and 4.91/kWh will be received for export, which gives							
Summary Performance Calculations:	The following tables summarise the reduction in carbon emission the photovoltaic system.	ons and the life cycle cost of						
	Energy and Carbon Performance Criteria	Value						
	Predicted Annual Energy Saved (kWh/yr)	2,764						
	Annual Carbon Emissions Reductions (kg CO ₂ /year)	1,434						
	CO ₂ Emissions Reduction (%)	10.7						
	Cost Performance Criteria	Value						
	Total Cost Over Life Cycle (£)	7,000						
	Predicted Annual Savings (£)	381						
	Payback Period (years)	18.4						

Conclusion Energy Assessment 40-42 Mill Lane

Summary

The baseline carbon emissions for the scheme are 13.40 Tonnes CO_2 /yr.

As demonstrated above the development will reduce carbon emissions by 30.3% from the fabric energy efficiency measures described in the 'Be Lean' section and will reduce total carbon emissions by 41.0% 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)	13.40	9.34	-	7.90				
CO ₂ emissions saving (Tonnes CO ₂ /yr)	- 4.06		-	1.43				
Saving from each stage (%)	-	30.3	-	10.7				
Total CO ₂ emissions saving (Tonnes CO ₂ /γr)	yr) 5.49							

41.0% Total carbon emissions savings over Part L1A and 1B 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 for Flats 1 to 5, TER from TER Worksheets for Flats 6 and 7. Lean - DER from the Lean SAP DER Worksheets. Green – DER from the Green SAP DER Worksheets (Flat 6 and 7).



Appendix Energy Assessment 40-42 Mill Lane

Baseline Scenario

			User D	etails:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2	2012		Stroma Softwa					016363 n: 1.0.4.10	
		P	Property /	Address:	Unit 1-F	Part L1B				
Address :	Unit 1, 40-42 Mil	Lane, Lon	don, NW	/6 1NR						
1. Overall dwelling dimer	nsions:									
Ground floor				a(m²) 72	(1a) x	Av. He	ight(m) .75	(2a) =	Volume(m³) 198	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+	(1e)+(1ı	n)	72	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	198	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	main heating 0 +	secondar heating	r y + +	0 0] = [total 0 0		40 = 20 =	m ³ per hour	(6a) (6b)
Number of intermittent far		_		-		2	× ′	10 =	20	_\`
								10 =		
Number of passive vents						0			0	(7b)
Number of flueless gas fir	es					0	X 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney If a pressurisation test has be	en carried out or is inte				continue fre	20 om (9) to (÷ (5) =	0.1	(8)
Number of storeys in the Additional infiltration	e dwelling (ns)						(0)	11-0.4	0	(9)
Structural infiltration: 0.2	25 for steel or timb	er frame o	· 0 35 for	masonr	v constr	uction	[(9)	-1]x0.1 =	0	(10)
if both types of wall are pre deducting areas of opening	esent, use the value co gs); if equal user 0.35	rresponding to	o the great	er wall are	a (after	uction			0	(11)
If suspended wooden flo			.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente								·	0	(13)
Percentage of windows Window infiltration	and doors draugh	t stripped		0.25 - [0.2	$\mathbf{v}(14) \div 1$	001 -			0	(14)
Infiltration rate				(8) + (10)		- 1	+ (15) =		0	(15)
Air permeability value, o	150 expressed in	cubic metre						area	0 15	(16) (17)
If based on air permeabilit	• •			•	•		invelope	uicu	0.85	(17)
Air permeability value applies						is being us	sed		0.00	
Number of sides sheltered	ł								2	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporation	ng shelter factor			(21) = (18)) x (20) =				0.72	(21)
Infiltration rate modified for	r monthly wind sp	eed							1	
Jan Feb I	Mar Apr M	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7					-			L	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4									
(22a)m= 1.27 1.25 1	.23 1.1 1.0	8 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	-	-	-	_		
	0.92	0.9	0.89	0.8	0.78	0.69	0.69	0.67	0.72	0.78	0.81	0.85]		
	<i>ate effec</i> echanica		•	rate for t	he appli	cable ca	se								(23a)
				endix N (2	(23a) = (23a	ı) × Fmv (e	equation (N	√5)) , othei	wise (23h) = (23a)				0	4
								n Table 4h) (200)				0	(23b)
			-	-	-			HR) (24a		2h)m + (23h) x [*	1 _ (23c)) ÷ 1001	0	(23c)
(24a)m=				0		0		0	0			1 - (230)] · 100]]		(24a)
		-	-	-		-		//V) (24b	-	-	-	ů	J		
(24b)m=				0	0			0	0		0	0	1		(24b)
			-					n from c	-	Ĵ	Ĵ	Ĵ]		
,					•	•		c) = (22b		.5 × (23b))				
(24c)m=	<u> </u>	0	0	0	0	0	0	0	0	0	0	0]		(24c)
d) lf	natural	ventilatio	on or wh	ole hous	se positiv	/e input v	ventilatio	on from I	oft	1	1	1	1		
	if (22b)n	n = 1, th	en (24d)	m = (22l	o)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			-		
(24d)m=	0.93	0.91	0.89	0.82	0.8	0.74	0.74	0.72	0.76	0.8	0.83	0.86			(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24t	o) or (24	c) or (24	d) in boy	(25)				-		
(25)m=	0.93	0.91	0.89	0.82	0.8	0.74	0.74	0.72	0.76	0.8	0.83	0.86			(25)
3. He	at losse	s and he	eat loss p	paramete	er:										
	IENT	Gros	-	Openin		Net Ar	ea	U-valı	Je	AXU		k-value	е	АX	(k
		area	(m²)	. m		A ,n	n²	W/m2	K	(W/	K)	kJ/m²∙	K	kJ/l	K
Doors						2	x	3	=	6					(26)
Windo	ws Type	e 1				2.3	x1,	/[1/(4.8)+	0.04] =	9.26					(27)
Windo	ws Type	2				3.43	x1.	/[1/(4.8)+	0.04] =	13.81					(27)
Floor						72	x	0.25	=	18					(28)
Walls	Type1	48.2	2	17.2	3	30.97	' X	0.3	=	9.29					(29)
Walls	Type2	14.9	6	0		14.96	3 X	0.24	=	3.53					(29)
Walls	Туре3	9.9	,	2		7.9	x	0.27	=	2.1					(29)
Total a	area of e	lements	, m²			145.0	6								(31)
Party v	wall					40.96	3 X	0	=	0					(32)
Party of	ceiling					72					ī				(32b)
	ndows and le the area						ated using	formula 1	/[(1/U-valu	ie)+0.04] â	as given in	paragrapl	h 3.2		
Fabric	heat los	s, W/K :	= S (A x	U)				(26) (30)	+ (32) =				10	8.31	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	141	09.41	(34)
Therm	al mass	parame	ter (TMF	P = Cm ÷	+ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		2	250	(35)
	ign assess used inste				construct	ion are not	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 k	<						2	1.76	(36)
	s of therma		are not kn	own (36) =	= 0.15 x (3	1)									_
	abric he		. .							(36) =			13	80.07	(37)
Ventila	ation hea		1		í	. I					25)m x (5)	_	1		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			

(38)m=	60.46	59.38	58.32	53.35	52.42	48.1	48.1	47.3	49.76	52.42	54.31	56.27		(38)
L Heat tra	ansfer c	oefficier	nt. W/K						(39)m	= (37) + (3	1 38)m			
(39)m=	190.52	189.45	188.39	183.42	182.49	178.16	178.16	177.36	179.83	182.49	184.37	186.34		
										-	Sum(39)1	₁₂ /12=	183.42	(39)
г			HLP), W/		0.50					= (39)m ÷	r			
(40)m=	2.65	2.63	2.62	2.55	2.53	2.47	2.47	2.46	2.5	2.53	2.56	2.59	2.55	(40)
Numbe	r of day	s in moi	nth (Tab	le 1a)					,	-verage -	Sum(40)1	12/12-	2.55	(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. Wat	ter heat	ing enei	rgy requi	irement:								kWh/ye	ar:	
if TF/			N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	-13.9)2)] + 0.(0013 x (⁻	TFA -13.		29		(42)
Reduce t	he annua	al average	ater usag hot water person per	usage by a	5% if the a	welling is	designed t			se target o		6.68		(43)
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	r usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	97.54	94	90.45	86.9	83.35	79.81	79.81	83.35	86.9	90.45	94	97.54		
Energy c	ontent of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D)))))))))))))))))))			m(44) _{1 12} = ables 1b, 1		1064.1	(44)
(45)m=	144.65	126.51	130.55	113.82	109.21	94.24	87.33	100.21	101.41	118.18	129	140.09		
If instanta	aneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Total = Su	m(45) _{1 12} =	-	1395.2	(45)
(46)m=	21.7	18.98	19.58	17.07	16.38	14.14	13.1	15.03	15.21	17.73	19.35	21.01		(46)
Water s	-				I		1	I	1	1				
-			includin				-		ame ves	sel		0		(47)
	ise if no	stored	nd no ta hot wate		-			• •	ers) ente	er '0' in (47)			
	-		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
			m Table									0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49) =			0		(50)
			eclared of factor fr	•								0		(51)
		-	ee secti									-		
		from Ta										0		(52)
			m Table									0		(53)
•••		m water (54) in (5	storage	, kWh/ye	ear			(47) x (51) x (52) x (53) =		0		(54)
	,	. , .	culated f	or each	month			((56)m = (55) × (41)	m		0		(55)
(56)m=	0	0000 001			0	0	0		0	0	0	0		(56)
	-	-	-	-	-		-	-	-	-	-	m Appendi	хH	(00)
(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)
					•	,	· ·	65 × (41)						
•	dified by	factor fi	rom Tab	le H5 if t	here is s	olar wat	er heati	ng and a	cylinde	r thermo	stat)		ı	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	culated	for each	month	(61)m =	(60) ÷ 36	65 × (41)m						
(61)m=	49.71	43.26	46.09	42.86	42.48	39.36	40.67	42.48	42.86	46.09	46.35	49.71		(61)
Total h	eat requ	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=	194.36	169.78	176.64	156.67	151.69	133.6	128	142.69	144.26	164.27	175.36	189.8		(62)
Solar Dł	IW input of	alculated	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	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter							•	-	•		
(64)m=	194.36	169.78	176.64	156.67	151.69	133.6	128	142.69	144.26	164.27	175.36	189.8		
								Outp	out from wa	ater heate	r (annual)₁	12	1927.11	(64)
Heat g	ains froi	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m=	60.52	52.88	54.93	48.56	46.93	41.17	39.2	43.94	44.43	50.82	54.48	59.01		(65)
inclu	ıde (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	ernal da	ains (see	e Table 5	5 and 5a):	-		-				•	-	
			e 5), Wat		/									
metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68		(66)
Lightin	q qains	(calcula	ted in Ar	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	30.6	27.18	22.1	16.73	12.51	10.56	11.41	14.83	19.91	25.28	29.5	31.45		(67)
Applia	nces dai	ins (calc	ulated ir	Append	dix L. ea	uation L	13 or L1	3a), also	see Ta	ble 5			1	
(68)m=	201.92	204.01	198.73	187.49	173.3	159.97	151.06	148.96	154.24	165.48	179.67	193.01		(68)
	na aains	(calcula	L Ited in A	n npendix	L equat	ion I 15	or I 15a), also se	e Table	5			1	
(69)m=	<u> </u>	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47		(69)
			I (Table {										1	
(70)m=	10	10 94110	10	10	10	10	10	10	10	10	10	10		(70)
		anoratio		tive valu			_	-					1	. ,
(71)m=	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	1	(71)
		gains (T											1	. ,
(72)m=	81.35	78.69	73.83	67.44	63.08	57.19	52.69	59.06	61.71	68.3	75.67	79.31	1	(72)
		gains =		07.44	00.00			n + (68)m +					I	(/
(73)m=	381.28	377.29	362.08	339.08	316.3	295.12	282.57	290.26	303.27	326.47	352.25	371.18	1	(73)
. ,	ar gains		302.00	339.00	510.5	293.12	202.07	290.20	303.27	520.47	352.25	571.10		(10)
			usina sola	r flux from	Table 6a	and assoc	iated equa	itions to co	onvert to th	e applicat	ole orientat	ion.		
-		Access F	-	Area		Flu			g		FF		Gains	

				_			-		-, r				
Northeast 0.9x	0.77	×	3.43	×	4	1.38	×	0.85	_ ×	0.7	=	58.52	(75)
Northeast 0.9x		x	3.43	x	6	7.96	×	0.85	×	0.7	=	96.11	(75)
Northeast 0.9x	•	x	3.43	x	9	1.35	×	0.85	×	0.7	=	129.19	(75)
Northeast 0.9x	*	X	3.43	x	g	7.38	x	0.85	×	0.7	=	137.73	(75)
Northeast 0.9x	0.77	x	3.43	x		91.1	x	0.85	x	0.7	=	128.85	(75)
Northeast 0.9x	0.77	x	3.43	x	7	2.63	x	0.85	×	0.7	=	102.72	(75)
Northeast 0.9x	0.77	x	3.43	x	5	0.42	x	0.85	×	0.7	=	71.31	(75)
Northeast 0.9x	0.77	x	3.43	x	2	8.07	x	0.85	×	0.7	=	39.7	(75)
Northeast 0.9x	0.77	x	3.43	x		14.2	x	0.85	_ x [0.7	=	20.08	(75)
Northeast 0.9x	0.77	x	3.43	x		9.21	x	0.85	_ × [0.7	=	13.03	(75)
Northwest 0.9x	0.77	x	2.3	x	1	1.28	×	0.85	_ × [0.7	=	64.2	(81)
Northwest 0.9x	0.77	x	2.3	x	2	2.97	x	0.85	_ × [0.7	=	130.69	(81)
Northwest 0.9x	0.77	x	2.3	×	4	1.38	X	0.85	= × [0.7	=	235.45	(81)
Northwest 0.9x	0.77	x	2.3	x	6	7.96	x	0.85		0.7		386.68	(81)
Northwest 0.9x	0.77	x	2.3	×	9	1.35	X	0.85		0.7	=	519.78	(81)
Northwest 0.9x	0.77	×	2.3	×		7.38] ×	0.85	Ξ×Γ	0.7	= =	554.14	(81)
Northwest 0.9x	0.77	x	2.3	×		91.1] ×	0.85	Ξ×Γ	0.7	=	518.39	(81)
Northwest 0.9x	0.77	x	2.3	×	7	2.63] ×	0.85	= × [0.7	=	413.26	(81)
Northwest 0.9x	0.77	×	2.3	x	5	0.42	j ×	0.85	Ξ×Ϊ	0.7	= =	286.9	(81)
Northwest 0.9x	0.77	×	2.3	×	2	8.07] x	0.85	Ξ×Ϊ	0.7		159.71	(81)
Northwest 0.9x	0.77	×	2.3	×		14.2] x	0.85	Ξ×Ϊ	0.7		80.78	(81)
Northwest 0.9x	0.77	×	2.3	× ا		9.21] x	0.85	Ξ×Ϊ	0.7	-	52.43	(81)
							4						
Solar gains in	watts. calo	culated	for each m	onth			(83)m	ı = Sum(74)m	(82)m				
(83)m= 80.16		293.98	i		691.87	647.23	515	.98 358.22	199.4	100.86	65.46		(83)
Total gains –	internal and	d solar	(84)m = (7	3)m +	(83)m	, watts		I				1	
(84)m= 461.44	540.46	656.05	821.87 96	5.27	986.99	929.8	806	.24 661.48	525.88	453.11	436.64		(84)
7. Mean inte	rnal tempe	rature (heating se	ason)						•			
Temperature					area ·	from Tal	ble 9.	Th1 (°C)				21	(85)
Utilisation fa	•	•••			•								
Jan	Feb	Mar		May	Jun	Jul	A	ug Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.99	· · ·	0.9	0.79	0.68	0.7		0.98	0.99	1		(86)
Mean interna	l tomporat	turo in l	iving area -		ow sto	ne 3 to 7	I 7 in T					1	
(87)m= 18.21		18.85		0.14	20.62	20.84	20.		19.56	18.81	18.21		(87)
									10.00	10.01	10.21		
	1 <u> </u>		1	st of d	-		1		10	10.00	40.07	1	(88)
(88)m= 18.94	18.95	18.95	18.99	19	19.04	19.04	19.	04 19.02	19	18.99	18.97		(00)
Utilisation fa	<u> </u>	- I					T Ó					1	
(89)m= 0.99	0.99	0.98	0.94 0	.84	0.65	0.44	0.5	0.84	0.97	0.99	1		(89)
Mean interna	al temperat	ture in t	he rest of c	dwellin	g T2 (f	ollow ste	eps 3	to 7 in Tabl	e 9c)				
(90)m= 16.55	16.76	17.2	17.87 18	8.46	18.88	19.01	18.	99 18.67	17.93	17.18	16.57		(90)
								1	ila = Livi	ing area ÷ (4	4) =	0.34	(91)

Manage internet to see a				(in) (A T4		A) TO					
Mean internal tempe (92)m= 17.11 17.32	17.75	r the wh 18.42	ole dwei 19.02	ling) = fi 19.47	LA × 11 19.62	+ (1 — fL 19.59	.A) × 12 19.23	18.48	17.72	17.12		(92)
Apply adjustment to									11.12	17.12		(02)
(93)m= 17.11 17.32	17.75	18.42	19.02	19.47	19.62	19.59	19.23	18.48	17.72	17.12		(93)
8. Space heating rec	<u> </u>											. ,
Set Ti to the mean ir			e obtain	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the utilisation factor		•							-, -			
Jan Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for	ains, hm	:										
(94)m= 0.99 0.99	0.97	0.93	0.84	0.69	0.52	0.6	0.85	0.96	0.99	0.99		(94)
Useful gains, hmGm		, ,										(05)
(95)m= 457.59 533.24	638.25	766.74	815.18	682.95	484.5	484.34	561.25	506.03	447.38	433.58		(95)
Monthly average ext	<u> </u>				40.0	40.4	444	10.0	74			(06)
(96)m= 4.3 4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for me (97)m= 2439.8 2352.41		· · ·		_111 , VV - 867.2	538.1	565.86	- (90)m 922.76] 1437.86	1958 76	2408.23		(97)
Space heating requir										2400.20		(01)
(98)m= 1474.77 1222.48	1 1	705.53	387.83	0			0	693.28	1088.19	1469.14		
						Tota	l per vear	(kWh/year			8143.76	(98)
Space beating requir	omont in	$k M / m^2$	hoor					(,(-	- ,		
Space heating require			-							l	113.11	(99)
9a. Energy requireme	nts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space heating:	at from se	acondan	/sunnla	montary	evetom					1	0	(201)
Fraction of space heat from secondary/supplementary system								0	(201)			
Freetien of energy he	at frame m		a ma (a)		•	(202) = 1	(201) -					
Fraction of space he		-			-	(202) = 1 -		(202)] -			1	(202)
Fraction of total heat	ing from 1	main sys	stem 1		-	(202) = 1 - (204) = (24		(203)] =			1	(204)
Fraction of total heat Efficiency of main sp	ing from i ace heati	main sys	stem 1 em 1		-			(203)] =				
Fraction of total heat	ing from i ace heati	main sys	stem 1 em 1	g system	-			(203)] =			1	(204)
Fraction of total heat Efficiency of main sp	ing from i ace heati	main sys	stem 1 em 1	g system Jun				(203)] = Oct	Nov	Dec	1 88.8	(204) (206) (208)
Fraction of total heat Efficiency of main sp Efficiency of second Jan Feb Space heating requir	ing from r ace heati ary/supple Mar rement (c	main sys ing syste ementar Apr alculated	stem 1 em 1 y heating May d above)	Jun	n, %	(204) = (2 Aug	02) × [1 – Sep	Oct			1 88.8 0	(204) (206) (208)
Fraction of total heat Efficiency of main sp Efficiency of seconda Jan Feb	ing from r ace heati ary/supple Mar rement (c	main sys ing syste ementar Apr	stem 1 em 1 y heating May	Jun	1, %	(204) = (2	02) × [1 –		Nov 1088.19		1 88.8 0	(204) (206) (208)
Fraction of total heat Efficiency of main sp Efficiency of second Jan Feb Space heating requir [1474.77] 1222.48 (211)m = {[(98)m x (2	ing from r ace heati ary/supple Mar rement (c 1102.54 04)] } x 1	main syste ementar Apr alculated 705.53	stem 1 em 1 y heating May d above) 387.83	Jun	n, %	(204) = (2 Aug	02) × [1 – Sep	Oct	1088.19	1469.14	1 88.8 0	(204) (206) (208)
Fraction of total heat Efficiency of main sp Efficiency of second Jan Feb Space heating requir 1474.77 1222.48	ing from r ace heati ary/supple Mar rement (c 1102.54 04)] } x 1	main syste ementar Apr alculated 705.53	stem 1 em 1 y heating May d above) 387.83	Jun	n, %	(204) = (2 Aug 0	02) × [1 – Sep 0	Oct 693.28 780.72	1088.19 1225.44	1469.14 1654.44	1 88.8 0	(204) (206) (208) ar (211)
Fraction of total heat Efficiency of main sp Efficiency of second Jan Feb Space heating requir [1474.77] 1222.48 (211)m = {[(98)m x (2	ing from r ace heati ary/supple Mar rement (c 1102.54 04)] } x 1	main syste ementary Apr alculated 705.53 00 ÷ (20	stem 1 em 1 y heating May d above) 387.83 6)	Jun 0	1, % Jul 0	(204) = (2 Aug 0	02) × [1 – Sep 0	Oct 693.28	1088.19 1225.44	1469.14 1654.44	1 88.8 0	(204) (206) (208) ar
Fraction of total heat Efficiency of main sp Efficiency of seconds Jan Feb Space heating require 1474.77 1222.48 (211)m = {[(98)m x (2) 1660.77 1376.66 Space heating fuel (4)	ing from r ace heati ary/supple Mar rement (c 1102.54 04)] } x 1 1241.6 secondar	main syste ementary Apr alculated 705.53 00 ÷ (20 794.52	stem 1 em 1 y heating May d above) 387.83 6) 436.75	Jun 0	1, % Jul 0	(204) = (2 Aug 0	02) × [1 – Sep 0	Oct 693.28 780.72	1088.19 1225.44	1469.14 1654.44	1 88.8 0 kWh/ye	(204) (206) (208) ar (211)
Fraction of total heat Efficiency of main sp Efficiency of second Jan Feb Space heating require 1474.77 1222.48 (211)m = {[(98)m x (2) 1660.77 1376.66 Space heating fuel (second = {[(98)m x (201)] } x	ing from r ace heati ary/supple ement (c 1102.54 04)] } x 1 1241.6 secondary 100 ÷ (20	main sys ing syste ementar Apr alculated 705.53 00 ÷ (20 794.52 y), kWh/ 8)	stem 1 em 1 y heating May d above) 387.83 6) 436.75 month	Jun 0 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – 1 Sep 0 1 (kWh/yea	Oct 693.28 780.72 ar) =Sum(2	1088.19 1225.44 211) _{15,10.12}	1469.14 1654.44 =	1 88.8 0 kWh/ye	(204) (206) (208) ar (211)
Fraction of total heat Efficiency of main sp Efficiency of seconds Jan Feb Space heating require 1474.77 1222.48 (211)m = {[(98)m x (2) 1660.77 1376.66 Space heating fuel (4)	ing from r ace heati ary/supple Mar rement (c 1102.54 04)] } x 1 1241.6 secondar	main syste ementary Apr alculated 705.53 00 ÷ (20 794.52	stem 1 em 1 y heating May d above) 387.83 6) 436.75	Jun 0	1, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – Sep 0 1 (kWh/yea	Oct 693.28 780.72 ar) =Sum(2 0	1088.19 1225.44 211) _{15,10.12} 0	1469.14 1654.44 -	1 88.8 0 kWh/ye	(204) (206) (208) ar (211) (211)
Fraction of total heat Efficiency of main sp Efficiency of seconds Jan Feb Space heating require 1474.77 1222.48 $(211)m = \{[(98)m x (2)] \\ 1660.77$ 1376.66 Space heating fuel (second second seco	ing from r ace heati ary/supple ement (c 1102.54 04)] } x 1 1241.6 secondary 100 ÷ (20	main sys ing syste ementar Apr alculated 705.53 00 ÷ (20 794.52 y), kWh/ 8)	stem 1 em 1 y heating May d above) 387.83 6) 436.75 month	Jun 0 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – Sep 0 1 (kWh/yea	Oct 693.28 780.72 ar) =Sum(2	1088.19 1225.44 211) _{15,10.12} 0	1469.14 1654.44 -	1 88.8 0 kWh/ye	(204) (206) (208) ar (211)
Fraction of total heat Efficiency of main sp Efficiency of seconda Jan Feb Space heating requir 1474.77 1222.48 (211)m = {[(98)m x (2) 1660.77 1376.66 Space heating fuel (s = {[(98)m x (201)] } x (215)m 0 0 Water heating	ing from r ace heati ary/supple Mar rement (c 1102.54 04)] } x 1 1241.6 secondary 100 ÷ (20 0	main sys ing syste ementar Apr alculated 705.53 00 ÷ (20 794.52 y), kWh/ 8) 0	stem 1 em 1 y heating d above) 387.83 (6) 436.75 month	Jun 0 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – Sep 0 1 (kWh/yea	Oct 693.28 780.72 ar) =Sum(2 0	1088.19 1225.44 211) _{15,10.12} 0	1469.14 1654.44 -	1 88.8 0 kWh/ye	(204) (206) (208) ar (211) (211)
Fraction of total heat Efficiency of main sp Efficiency of seconds Jan Feb Space heating require 1474.77 1222.48 (211)m = {[(98)m x (2) 1660.77 1376.66 Space heating fuel (second = {[(98)m x (201)] } x (215)m 0 0 Water heating Output from water heat	ing from r ace heati ary/supple ement (c 1102.54 04)] } x 1 1241.6 secondary 100 ÷ (20 0	main sys ing syste ementar Apr alculated 705.53 00 ÷ (20 794.52 y), kWh/ 8) 0	stem 1 em 1 y heating May d above) 387.83 6) 436.75 month 0	0 0	n, % Jul 0	(204) = (2) Aug 0 Tota 0 Tota	02) × [1 – Sep 0 1 (kWh/yea	Oct 693.28 780.72 ar) =Sum(2 0	1088.19 1225.44 211) _{15,10.12} 0 215) _{15,10.12}	1469.14 1654.44 = 0	1 88.8 0 kWh/ye	(204) (206) (208) ar (211) (211)
Fraction of total heat Efficiency of main sp Efficiency of seconda Jan Feb Space heating requir 1474.77 1222.48 (211)m = {[(98)m x (2) 1660.77 1376.66 Space heating fuel (s = {[(98)m x (201)] } x (215)m 0 0 Water heating	ing from r ace heati ary/supple mement (c 1102.54 (1102.54) (100 ÷ (20) (100 ÷ (20) (100 ÷ (20) (100 ÷ (20) (176.64)	main systementary Apr alculated 705.53 00 ÷ (20 794.52 y), kWh/ 8) 0	stem 1 em 1 y heating d above) 387.83 (6) 436.75 month	Jun 0 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – - Sep 0 0 I (kWh/yea I (kWh/yea	Oct 693.28 780.72 ar) =Sum(2 0 ar) =Sum(2	1088.19 1225.44 211) _{15,10.12} 0	1469.14 1654.44 -	1 88.8 0 kWh/ye	(204) (206) (208) ar (211) (211)
Fraction of total heat Efficiency of main sp Efficiency of seconds Jan Feb Space heating require 1474.77 1222.48 (211)m = {[(98)m x (2) 1660.77 1376.66 Space heating fuel (second second	ing from r ace heati ary/supple mement (c 1102.54 (1102.54) (100 ÷ (20) (100 ÷ (20) (100 ÷ (20) (100 ÷ (20) (176.64)	main systementary Apr alculated 705.53 00 ÷ (20 794.52 y), kWh/ 8) 0	stem 1 em 1 y heating May d above) 387.83 6) 436.75 month 0	0 0	n, % Jul 0	(204) = (2) Aug 0 Tota 0 Tota	02) × [1 – - Sep 0 0 I (kWh/yea I (kWh/yea	Oct 693.28 780.72 ar) =Sum(2 0 ar) =Sum(2	1088.19 1225.44 211) _{15,10.12} 0 215) _{15,10.12}	1469.14 1654.44 = 0	1 88.8 0 kWh/ye 9170.9 0	(204) (206) (208) ar (211) (211) (211)
Fraction of total heat Efficiency of main sp Efficiency of seconda Jan Feb Space heating requir 1474.77 1222.48 (211)m = {[(98)m x (2 1660.77 1376.66 Space heating fuel (s = {[(98)m x (201)] } x (215)m 0 0 Water heating Output from water heat 194.36 169.78 Efficiency of water heat (217)m 87.61 87.55	ing from r ace heati ary/supple Mar rement (c 1102.54 04)] } x 1 1241.6 secondary 100 ÷ (20 0 100 ÷ (20 0 ater (calco 176.64 ater 87.39	main sys ing syste ementary Apr alculated 705.53 00 ÷ (20 794.52 y), kWh/ 8) 0 ulated al 156.67 86.95	stem 1 em 1 y heating May d above) 387.83 6) 436.75 month 0	Jun 0 0 0 0 133.6	n, % Jul 0 0	(204) = (2) Aug 0 Tota 0 Tota 142.69	02) × [1 – Sep 0 0 I (kWh/yea 144.26	Oct 693.28 780.72 ar) =Sum(2 0 ar) =Sum(2 164.27	1088.19 1225.44 211) _{15,10.12} 0 215) _{15,10.12} 175.36	1469.14 1654.44 = 0 = 189.8	1 88.8 0 kWh/ye 9170.9 0	(204) (206) (208) ar (211) (211) (211) (215)
Fraction of total heat Efficiency of main sp Efficiency of seconds Jan Feb Space heating requir 1474.77 1222.48 (211)m = {[(98)m x (2 1660.77 1376.66 Space heating fuel (second) (215)m 0 0 Water heating Output from water heat 194.36 169.78 Efficiency of water heat (217)m 87.61 87.55 Fuel for water heating (219)m = (64)m x 10	ing from r ace heati ary/supple mement (c 1102.54 (1102.54) (102.5	main systementary Apr alculated 705.53 00 ÷ (20 794.52 y), kWh/ 8) 0 ulated al 156.67 86.95 onth	stem 1 em 1 y heating May d above) 387.83 6) 436.75 month 0	0 0 133.6 79.5	n, % Jul 0 0	(204) = (2) Aug 0 Tota 0 Tota 142.69	02) × [1 – Sep 0 0 I (kWh/yea 144.26	Oct 693.28 780.72 ar) =Sum(2 0 ar) =Sum(2 164.27	1088.19 1225.44 211) _{15,10.12} 0 215) _{15,10.12} 175.36	1469.14 1654.44 = 0 = 189.8 87.63	1 88.8 0 kWh/ye 9170.9 0	(204) (206) (208) ar (211) (211) (211) (215)
Fraction of total heat Efficiency of main sp Efficiency of seconda Jan Feb Space heating requir 1474.77 1222.48 (211)m = {[(98)m x (2) 1660.77 1376.66 Space heating fuel (s = {[(98)m x (201)] } x (215)m 0 0 Water heating Output from water heating Efficiency of water heating Efficiency of water heating Fuel for water heating	ing from r ace heati ary/supple mement (c 1102.54 (1102.54) (102.5	main systementary Apr alculated 705.53 00 ÷ (20 794.52 y), kWh/ 8) 0 ulated al 156.67 86.95 onth	stem 1 em 1 y heating May d above) 387.83 6) 436.75 month 0	Jun 0 0 0 0 133.6	n, % Jul 0 0	(204) = (2 Aug 0 Tota 0 Tota 142.69 79.5	02) × [1 – Sep 0 0 I (kWh/yea 144.26	Oct 693.28 780.72 ar) =Sum(2 0 ar) =Sum(2 164.27 86.85 189.14	1088.19 1225.44 211) _{15,10.12} 0 215) _{15,10.12} 175.36	1469.14 1654.44 = 0 = 189.8	1 88.8 0 kWh/ye 9170.9 0	(204) (206) (208) ar (211) (211) (211) (215)

Annual totals		kWh/year		kWh/year	
Space heating fuel used, main system 1				9170.9	
Water heating fuel used			[2270.93]
Electricity for pumps, fans and electric keep-hot			-		
central heating pump:		[120		(230c)
Total electricity for the above, kWh/year	sum of (230a	a) (230g) =	[120	(231)
Electricity for lighting			[540.44	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP		-		
	Energy kWh/year	Emission fact kg CO2/kWh	or	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	= [1980.91	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	490.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =		[2471.44	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= [62.28	(267)
Electricity for lighting	(232) x	0.519	= [280.49	(268)
Total CO2, kg/year	sum	of (265) (271) =	[2814.21	(272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	[39.09	(273)
El rating (section 14)			[68	(274)

				User D	etails:						
Assessor Name:	Chris Hock	nell			Strom	a Num	ber:		STRO	016363	
Software Name:	Stroma FS	AP 2012	2		Softwa	are Ver	sion:		Versic	on: 1.0.4.10	
			P	roperty A	Address:	Unit 2-F	Part L1B				
Address :	Unit 2, 40-42	2 Mill Lar	ne, Lono	don, NW	6 1NR						
1. Overall dwelling dime	nsions:										
Ground floor				-	a(m²) 8.56	(1a) x	Av. He i	i ght(m) .75	(2a) =	Volume(m ³) 106.04	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e))+(1n) 3	8.56	(4)			_		_
Dwelling volume						(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	106.04	(5)
2. Ventilation rate:			_								
Number of chimneys	main heating	+	condar eating 0	y] + [_	0 0] = [total 0		40 =	m ³ per hour	(6a)
Number of open flues	0	+	0	+	0	=	0	x2	20 =	0	(6b)
Number of intermittent fai	ns						2	x ?	10 =	20	(7a)
Number of passive vents						Γ	0	x ^	10 =	0	(7b)
Number of flueless gas fi	res					Ē	0	x 4	40 =	0	(7c)
									Air ch	anges per ho	ur
Infiltration due to chimney	/s, flues and fa	ans = (6a	ı)+(6b)+(7	a)+(7b)+(7	7c) =	Г	20	<u> </u>	÷ (5) =	0.19	(8)
If a pressurisation test has b						continue fro	om (9) to (
Number of storeys in th	ne dwelling (ne	;)								0	(9)
Additional infiltration								[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0. if both types of wall are pr deducting areas of openin	resent, use the va	lue corresp					uction			0	(11)
If suspended wooden f	loor, enter 0.2	(unseale	ed) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ent	ter 0.05, else e	enter 0								0	(13)
Percentage of windows	s and doors dr	aught str	ipped							0	(14)
Window infiltration					0.25 - [0.2		-			0	(15)
Infiltration rate					(8) + (10)					0	(16)
Air permeability value,				•	•	•	etre of e	nvelope	area	15	(17)
If based on air permeabilit Air permeability value applies	•						ia haina w	ad		0.94	(18)
Number of sides sheltere		ni lest nas	Deen uon	e or a deg	ilee all pei	Πεαρπικγ	is being us	seu		3	(19)
Shelter factor	-				(20) = 1 - [[0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporat	ing shelter fac	tor			(21) = (18)) x (20) =				0.73	(21)
Infiltration rate modified for	or monthly win	d speed									
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Tabl	e 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	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 infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
<u> </u>	0.93	0.91	0.89	0.8	0.78	0.69	0.69	0.67	0.73	0.78	0.82	0.85		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	√5)) , othe	rwise (23b) = (23a)			0	(23b)
			• • • •		, ,	, .	actor (from			, , ,			0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with he	at recove	erv (MVł	HR) (24a	a)m = (22	2b)m + ()	23b) × [1 – (23c)	-	(===)
, (24a)m=		0	0	0	0	0	0	0	0	0	0	0		(24a)
b) lf	balance	d mecha	anical ve	ntilation	without	heat rec	covery (N	и ЛV) (24b)m = (22	2b)m + (2	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	tilation o	or positiv	ve input v	ventilatio	on from o	outside					
i	if (22b)r	n < 0.5 ×	< (23b), t	hen (240	c) = (23b); other	wise (24	c) = (22t	o) m + 0.	5 × (23b)		L	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
							ventilatio		oft 2b)m² x	0 51				
ا =(24d)m	r`´´	0.91	0.9	0.82	0.81	0.74	0.74	0.5 + [(2	0.76	0.5]	0.83	0.87		(24d)
							c) or (24			0.01	0.00	0.07		()
(25)m=	0.93	0.91	0.9	0.82	0.81	0.74	0.74	0.73	0.76	0.81	0.83	0.87		(25)
		l	1			0			0.1.0		0.00			(-)
		s and he												
ELEN	IENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²·ł		∖Xk J/K
Doors						2	x	3	=	6				(26)
Window	WS					3.43	x1.	/[1/(4.8)+	0.04] =	13.81				(27)
Floor						38.56	3 X	0.25	=	9.64	\Box [(28)
Walls ⁻	Type1	16.5	51	3.43		13.08	3 X	0.3	=	3.92				(29)
Walls ⁻	Type2	3.9	5	2		1.95	x	0.27	=	0.52				(29)
Total a	area of e	elements	, m²			59.02	2							(31)
Party v	wall					57.49) X	0	=	0				(32)
Party c	ceiling					38.56	3				[(32b)
		l roof wind as on both					ated using	ı formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	3.2	
Fabric	heat los	ss, W/K :	= S (A x	U)				(26) (30)) + (32) =				33.89	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	8050.62	(34)
Therm	al mass	parame	eter (TMF	• = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
	0	sments wh ad of a de			construct	ion are not	t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						8.85	(36)
	<i>of therma</i> abric he	a <i>l bridging</i> at loss	are not kn	own (36) =	= 0.15 x (3	1)			(33) +	(36) =			42.75	(37)
Ventila	ation hea	at loss ca	alculated	I monthly	y				(38)m	= 0.33 × (25)m x (5)	-	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.55	31.96	31.39	28.7	28.2	25.85	25.85	25.42	26.75	28.2	29.21	30.28		(38)
Heat tr	ansfer o	coefficie	nt, W/K	-		-		-	(39)m	= (37) + (3	- 38)m	-	•	
(39)m=	75.29	74.71	74.14	71.45	70.94	68.6	68.6	68.17	69.5	70.94	71.96	73.03		
										Average =	Sum(39)1	12 /12=	71.44	(39)

Heat lo	oss para	imeter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	1.95	1.94	1.92	1.85	1.84	1.78	1.78	1.77	1.8	1.84	1.87	1.89		
Numbe	er of day	/s in mo	nth (Tab	le 1a)					/	Average =	Sum(40)1	₁₂ /12=	1.85	(40)
- turnot	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	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
if TF				: [1 - exp	(-0.0003	849 x (TF	FA -13.9	9)2)] + 0.()013 x (⁻	TFA -13.		37		(42)
Reduce	the annua	al average	hot water	usage by		lwelling is	designed	(25 x N) to achieve		se target o		6.7		(43)
	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	Table 1c x	(43)						
(44)m=	73.37	70.71	68.04	65.37	62.7	60.03	60.03	62.7	65.37	68.04	70.71	73.37		
-						100 V.d.					m(44) _{1 12} =		800.45	(44)
			. <u> </u>		-	i		DTm / 3600		-			l	
(45)m=	108.81	95.17	98.21	85.62	82.15	70.89	65.69	75.38	76.28	88.9	97.04	105.38	1010 -0	
lf instant	aneous w	vater heati	ng at point	of use (no	o hot water	storage),	enter 0 in	boxes (46		Total = Su	m(45) _{1 12} =		1049.52	(45)
(46)m=	16.32	14.28	14.73	12.84	12.32	10.63	9.85	11.31	11.44	13.33	14.56	15.81		(46)
· · ·	storage													
Storag	e volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
Otherw	ise if no	o stored			/elling, e ncludes i			n (47) ombi boil	ers) ente	er '0' in (47)			
	storage		oclarod I	occ fact	or is kno	wp (k\//	v/dav/):					•		(49)
,		actor fro					i/uay).					0		(48) (49)
•				, kWh/ye	ar			(48) x (49)) =			0		(49)
			-	-	loss fact	or is not	known:					0		(50)
		-			le 2 (kW	h/litre/da	ay)					0		(51)
	-	eating s from Ta		on 4.3										(50)
		actor fro		2b								0		(52) (53)
				_~ , kWh/ye	Par			(47) x (51)) x (52) x (53) =		0		(54)
		(54) in (5	-	,	Jul			x / x-)	((-) (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 cylinde	er contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	50), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	loss (ar	nual) fro	om Table	e 3							0		(58)
	•	•	,			59)m = ((58) ÷ 36	65 × (41)	m				I	
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	olar 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 ca	lculated	for ea	ich	month (61)m =	(60)) ÷ 36	65 × (41))m									
(61)m=	37.39	32.54	34.6	7	32.24	31.95	2	29.61	30.59	31.	95	32.24	34.6	67	34.87	37.	39		(61)
Total h	eat req	uired for	water	he	ating ca	alculated	d fo	r eacl	h month	(62)	m =	0.85 × ((45)m	ו +	(46)m +	(57)	m +	(59)m + (61)m	
(62)m=	146.2	127.71	132.8	38	117.86	114.1	1	00.5	96.28	107	.33	108.52	123.	57	131.91	142	.77		(62)
Solar DH	IW input	calculated	using A	Appe	ndix G or	Appendi	κΗ	(negati	ve quantity	/) (ent	er '0'	' if no sola	r contr	ibut	tion to wate	er hea	iting)		
(add ag	dditiona	al lines if	FGHF	RS a	and/or V	VWHR	S ap	plies	, see Ap	penc	lix C	G)	-						
(63)m=	0	0	0		0	0		0	0	0)	0	0		0	C)		(63)
Output	from w	ater hea	ter										_						
(64)m=	146.2	127.71	132.8	38	117.86	114.1	1	00.5	96.28	107	.33	108.52	123.	57	131.91	142	2.77		_
											Outp	out from wa	ater he	eate	r (annual)₁	1 12		1449.64	(64)
Heat g	ains fro	m water	heatir	ng,	kWh/mo	onth 0.2	5 ′	[0.85	× (45)m	+ (6	1)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (5	9)m]	
(65)m=	45.53	39.78	41.3	2	36.53	35.3	3	80.97	29.49	33.	05	33.42	38.2	23	40.98	44.	39		(65)
inclu	de (57)	m in calo	culatio	on o	f (65)m	only if o	cylir	nder i	s in the o	dwell	ing	or hot w	ateri	s fi	rom com	imun	ity h	eating	
5. Int	ernal g	ains (see	e Tabl	e 5	and 5a)):													
Metabo	olic gair	ns (Table	e 5), W	/att	S														
	Jan	Feb	Ma		Apr	May		Jun	Jul	A	ug	Sep	0	ct	Nov	D	ec		
(66)m=	68.43	68.43	68.4	3	68.43	68.43	6	68.43	68.43	68.	43	68.43	68.4	13	68.43	68.	43		(66)
Lightin	g gains	(calcula	ted in	Ар	pendix l	L, equa	tion	L9 oi	r L9a), a	lso s	ee ⁻	Table 5			-				
(67)m=	20.64	18.33	14.9	1	11.28	8.44		7.12	7.69	1(0	13.42	17.0)5	19.89	21.	21		(67)
Appliar	nces ga	ins (calc	ulated	d in	Append	dix L, ec	uat	tion L	13 or L1	3a), a	also	see Ta	ble 5						
(68)m=	117.93	119.15	116.0)7	109.5	101.22	g	93.43	88.23	8	7	90.09	96.0	65	104.94	112	.73		(68)
Cookin	g gains	s (calcula	ted in	Ар	pendix	L, equa	tior	า L15	or L15a)), als	o se	e Table	5		•				
(69)m=	29.84	29.84	29.8	4	29.84	29.84	2	9.84	29.84	29.	84	29.84	29.8	34	29.84	29.	84		(69)
Pumps	and fa	ns gains	(Tabl	e 5	a)														
(70)m=	10	10	10	- 1	10	10	Γ	10	10	1(0	10	10)	10	1	0		(70)
Losses	e.g. ev	vaporatic	n (ne	gati	ve valu	es) (Tal	ble	5)							1				
(71)m=	-54.74	-54.74	-54.7	'4	-54.74	-54.74	-{	54.74	-54.74	-54.	.74	-54.74	-54.	74	-54.74	-54	.74		(71)
Water	heating	ı gains (T	able :	 5)			!								<u>I</u>				
(72)m=	61.19	59.2	55.5	4	50.73	47.45	4	3.02	39.64	44.	43	46.42	51.3	38	56.92	59.	66		(72)
Total i	nterna	l gains =	:					(66))m + (67)m	ı + (68	3)m +	+ (69)m + ((70)m	+ (7	1 1)m + (72))m			
(73)m=	253.29	- -	240.0)4	225.05	210.63	1	97.1	189.09	194	.96	203.46	218.	61	235.28	247	.12		(73)
6. Sol	ar gain	s:											1		1	1			
Solar g	ains are	calculated	using s	olar	flux from	Table 6a	and	assoc	iated equa	tions	to co	nvert to th	ie app	lical	ole orientat	tion.			
Orienta		Access F			Area			Flu			_	g			FF			Gains	
		Table 6d			m²			Tal	ble 6a		Т	able 6b		Т	able 6c			(W)	
Northea	ist <mark>0.9x</mark>	0.77		x	3.4	3	x	1	1.28	x		0.85	X		0.7		=	15.96	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	3.4	3	x	2	22.97	x		0.85	X		0.7		=	32.48	(75)
Northea	ist <mark>0.9x</mark>	0.77		x	3.4	3	x	4	1.38	x		0.85	×		0.7		=	58.52	(75)
Northea	ist <mark>0.9x</mark>	0.77		x	3.4	-3	x	6	67.96	x		0.85	x		0.7		=	96.11	(75)
Northea	ist <mark>0.9x</mark>	0.77		x	3.4	3	x	9	91.35	x		0.85	×	Γ	0.7		=	129.19	(75)

														_
Northeast 0.9x	0.77	×	3.4	43	x	97.38	×	۲ ــــــــــــــــــــــــــــــــــــ	0.85	×	0.7	=	137.73	(75)
Northeast 0.9x	0.77	×	3.4	13	x	91.1	×	¢	0.85	x	0.7	=	128.85	(75)
Northeast 0.9x	0.77	x	3.4	43	x	72.63	×	(0.85	x	0.7	=	102.72	(75)
Northeast 0.9x	0.77	x	3.4	43	x	50.42	×	(0.85	_ × [0.7	=	71.31	(75)
Northeast 0.9x	0.77	x	3.4	13	x	28.07	x	۲	0.85	×	0.7	=	39.7	(75)
Northeast 0.9x	0.77	x	3.4	13	x	14.2	×	(0.85	x	0.7	=	20.08	(75)
Northeast 0.9x	0.77	x	3.4	13	x	9.21	×	(0.85	x	0.7	=	13.03	(75)
Solar <u>g</u> ains ii	n watts, ca	alculated	for eac	h month			(83))m = S	um(74)m	(82)m	-	-		
<mark>(83)</mark> m= 15.96	32.48	58.52	96.11	129.19	1:	37.73 128.8	5 10	02.72	71.31	39.7	20.08	13.03		(83)
Total gains –		nd solar	(84)m =	= (73)m	+ (8	33)m , watte	S							
(84)m= 269.25	5 282.69	298.57	321.16	339.82	3	34.83 317.9	3 29	97.67	274.77	258.3	255.36	260.16		(84)
7. Mean inte	ernal temp	erature	(heating	seasor)									
Temperatur	e during h	eating p	eriods ir	n the livi	ng	area from T	able	9, Th	1 (°C)				21	(85)
Utilisation fa	actor for ga	ains for I	iving are	ea, h1,m	ı (s	ee Table 9a	a)							
Jan	Feb	Mar	Apr	May		Jun Jul		Aug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.99	0.98	0.95	(0.87 0.76	; (0.8	0.94	0.98	0.99	1		(86)
Mean intern	al temper	ature in l	iving ar	ea T1 (f	ollo	w steps 3 to	0 7 in	Table	 e 9c)					
(87)m= 18.9	19.04	19.34	19.81	20.27	1	0.68 20.87	_	0.84	20.52	19.95	19.39	18.92		(87)
Tomporatur			oriode ir	L roct of		olling from	 Table							
Temperatur (88)m= 19.37		19.39	19.43	19.44	T	9.48 19.48		9.49	19.47	19.44	19.42	19.41		(88)
					I				10.47	10.44	10.42	10.41		()
Utilisation fa				r – –	1	<u> </u>		,		0.07	0.00	0.00		(90)
(89)m= 0.99	0.99	0.99	0.97	0.92		0.78 0.57		0.63	0.88	0.97	0.99	0.99		(89)
Mean intern	<u> </u>	ature in t	the rest	of dwell	ing	T2 (follow s	steps	3 to 7	7 in Tabl	e 9c)	-		1	
<mark>(90)</mark> m= 17.52	17.67	17.97	18.48	18.93	1	9.33 19.45	5 1	9.44	19.18	18.63	18.06	17.58		(90)
									f	LA = Livir	ng area ÷ (4	4) =	0.69	(91)
Mean intern	al temper	ature (fo	r the wh	ole dwe	llin	g) = fLA × T	[1 + (1 – fL	A) × T2					
<mark>(92)</mark> m= 18.47	18.61	18.91	19.4	19.85	2	0.26 20.43	3 2	20.4	20.1	19.54	18.98	18.51		(92)
Apply adjus	tment to th	ne mean	interna	l temper	atu	re from Tab	ole 4e	e, whe	ere appro	priate		r		
(93)m= 18.47		18.91	19.4	19.85	2	0.26 20.43	3 2	20.4	20.1	19.54	18.98	18.51		(93)
8. Space he														
Set Ti to the the utilisation			•		ned	at step 11	of Ta	ble 9t	o, so that	t Ti,m=(76)m an	d re-calo	culate	
Jan		Mar	Apr	May	Γ	Jun Jul		Aug	Sep	Oct	Nov	Dec		
Utilisation fa				inay				, tug	000	000	1101	200		
(94)m= 0.99	0.99	0.99	0.97	0.93	(0.84 0.7	0).75	0.91	0.97	0.99	0.99		(94)
Useful gains	s, hmGm ,	W = (94)m x (8	4)m	I		- 1							
(95)m= 267.3	280.07	294.18	311.51	316.08	28	30.11 223.4	1 22	22.75	249.95	251.69	252.68	258.53		(95)
Monthly ave	erage exte	rnal tem	perature	e from T	abl	e 8						-		
(96)m= 4.3	4.9	6.5	8.9	11.7	-	14.6 16.6	1	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	1 1			-	Lm	, W =[(39)r	m x [(93)m	– (96)m]			L	
(97)m= 1066.9			750.11	578.5		38.21 262.6		72.93	417.15	634.34	854.68	1044.7		(97)
Space heat				r	Wh		.024 >		i i		ŕ		I	
(98)m= 594.94	4 500.17	465.8	315.79	195.24		0 0		0	0	284.69	433.44	584.91		

								Tota	l per year	(kWh/yea	r) = Sum(9	8)15,912 =	3375	(98)
Space	e heating	g require	ement in	ı kWh/m²	²/year								87.53	(99)
9a. En	ergy req	luiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	g micro-C	CHP)					
•	e heatin	•												_
	•			econdar		mentary	v system						0	(201)
	•			nain syst				(202) = 1 -	· · ·				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ting syste	em 1								88.8	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heatin	g systen	n, %		-				0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space		· ·	<u>`</u>	calculate	i		ı	1	ı —	1	1	1	I	
	594.94	500.17	465.8	315.79	195.24	0	0	0	0	284.69	433.44	584.91	_	
(211)m				100 ÷ (20	r			,	i		1	1	I	(211)
	669.98	563.26	524.55	355.62	219.86	0	0	0	0	320.6	488.11	658.69		
		.		、 .				lota	ii (kvvn/yea	ar) =Sum(2	211) _{15,10. 1}	2	3800.67	(211)
•		•	econdar 00 ÷ (20	ˈy), kWh/ ນອນ	month									
- {[(90 (215)m=	0	0	00 ÷ (20	0	0	0	0	0	0	0	0	0		
()	Ĵ	Ū	Ĵ	ů	Ĵ	Ĵ	-	-	-	÷	215) _{15.10. 12}		0	(215)
Water	heating										· 1	-		
	-		ter (calc	ulated a	bove)								_	
-	146.2	127.71	132.88	117.86	114.1	100.5	96.28	107.33	108.52	123.57	131.91	142.77		
Efficier	ncy of w	ater hea	iter										79.5	(216)
(217)m=	86.8	86.74	86.55	86.06	85.13	79.5	79.5	79.5	79.5	85.76	86.44	86.81		(217)
		•	kWh/m											
(219)m (219)m=		m x 100 147.24) ÷ (217) 153.52)m 136.94	134.04	126.41	121.11	135.01	136.5	144.08	152.6	164.47		
									l = Sum(2				1720.38	(219)
Annua	I totals									k	Wh/yea	r	kWh/year	
Space	heating	fuel use	ed, main	system	1								3800.67	7
Water	heating	fuel use	d										1720.38	Ī
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatin	g pump	:		·							120		(230c
Total e	lectricity	/ for the	above, l	kWh/yea	r			sum	of (230a)	(230g) =	I.	L	120	(231)
Electric	city for li	ghting											364.43	(232)
12a. (CO2 em	issions -	– Individ	lual heati	ing syste	ems inclu	uding mi	icro-CHF)					_
						E	oray			Emico	ion for	tor	Emissions	
							lergy /h/year			kg CO	ion fac 2/kWh	lor	Emissions kg CO2/yea	
Space	heating	(main s	ystem 1)			1) x			0.2		=	820.95	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	 (263)

Water heating	(219) x	0.216	=	371.6	(264)
Space and water heating	(261) + (262) + (263) + (26	64) =		1192.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	62.28	(267)
Electricity for lighting	(232) x	0.519	=	189.14	(268)
Total CO2, kg/year		sum of (265) (271) =		1443.96	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		37.45	(273)
El rating (section 14)				77	(274)

			User D	etails:						
Assessor Name: Software Name:	Chris Hocknel Stroma FSAP			Stroma Softwa					016363 on: 1.0.4.10	
		P	roperty /	Address:	Unit 3-F	Part L1B				
Address :	Unit 3, 40-42 M	ill Lane, Lon	don, NW	/6 1NR						
1. Overall dwelling dimer	nsions:									
Ground floor			-	a(m²) 6.45	(1a) x	Av. He i	i ght(m) .75	(2a) =	Volume(m ³) 155.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)	+(1e)+(1r	ר) <u>5</u>	6.45	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	155.24	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	0	secondar heating + 0 + 0	r y + +	0 0 0] = [total 0 0		40 = 20 =	m ³ per hour	r (6a) (6b)
Number of intermittent far						1	x.^	10 =	10	(7a)
								10 =	-	
Number of passive vents						0			0	(7b)
Number of flueless gas fir	es					0	X 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney If a pressurisation test has be	en carried out or is ir				continue fro	10 om (9) to (÷ (5) =	0.06	(8)
Number of storeys in the	e dwelling (ns)								0	(9)
Additional infiltration		h f	0.05 fee				[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2 if both types of wall are pre deducting areas of opening	esent, use the value o gs); if equal user 0.35	corresponding to	o the great	er wall area	a (after	uction			0	_(11)
If suspended wooden flo			.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente									0	(13)
Percentage of windows	and doors draug	nt stripped		0.25 - [0.2	$\mathbf{v}(14) \pm 1$	001 -			0	(14)
Window infiltration Infiltration rate				(8) + (10)		- 1	+ (15) =	·	0	(15)
Air permeability value, o	150 expressed ir	, cubic metre						area	0	(16) (17)
If based on air permeabilit			•		•		nvelope	arca	15 0.81	(17)
Air permeability value applies						is being us	sed		0.01	
Number of sides sheltered	ł								2	(19)
Shelter factor				(20) = 1 - [[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporation	ng shelter factor			(21) = (18)) x (20) =				0.69	(21)
Infiltration rate modified for	r monthly wind s	peed								
Jan Feb I	Var Apr M	/lay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	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	.23 1.1 1.	08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted in	filtration rat	e (allow	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
0.8		0.85	0.76	0.74	0.66	0.66	0.64	0.69	0.74	0.78	0.81		
Calculate e	<i>ffective air</i> nical ventila	-	rate for t	he appli	cable ca	se							(22.2)
	ir heat pump		endix N (2	⁽²³ h) = (23a	a) x Emv (e	equation (I	N5)) othe	rwise (23h	(23a) = (23a)			0	(23a)
	with heat reco								,) (200)			0	(23b)
		-	-	-					2b) m i (1	00h) v [1 (22a)	0	(23c)
(24a)m= 0	nced mech							$\frac{1}{0}$		230) ^ [1 - (230)] ÷ 100]]	(24a)
. ,	nced mech		-	_	÷	-	÷	-	-	Ů	0		(= :)
(24b)m= 0							0	0		230)	0	1	(24b)
			-		-		-	-	0	0	0	J	(210)
,	e house ex b)m < 0.5 ›			•	•				5 × (23b))			
(24c)m= 0		0			0	0		0		0	0	1	(24c)
	ral ventilati	I on or wh	L Nole hous	L se nositiv	l ve input :	L ventilatio	I on from l	I loft	<u> </u>	1	<u> </u>	1	
,	b)m = 1, th				•				0.5]				
(24d)m= 0.8	9 0.87	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.8	0.83		(24d)
Effective	air change	rate - e	nter (24a) or (24	o) or (24	c) or (24	d) in bo	x (25)	-	-	-	-	
(25)m= 0.8	9 0.87	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.8	0.83		(25)
3. Heat los	sees and he	aat loee	naramet	or:			-		-		-	-	
ELEMEN			Openin		Net Ar	еа	U-val		AXU		k-value	<u>_</u>	AXk
		(m²)	n		A ,r		W/m2		(W/I	K)	kJ/m²·l		kJ/K
Doors					2	x	3	=	6				(26)
Windows T	ype 1				3.43	x1	/[1/(4.8)+	0.04] =	13.81				(27)
Windows T	ype 2				2.38		/[1/(4.8)+	0.04] =	9.58	=			(27)
Windows T	уре 3				5		/[1/(4.8)+	0.04] =	20.13	=			(27)
Windows T	vpe 4				1.35		/[1/(4.8)+	0.04] =	5.44	=			(27)
Windows T					1.35		/[1/(4.8)+	0.04] =	5.44	=			(27)
Windows T	•••				0.32		/[1/(4.8)+		1.29	\dashv			(27)
Floor) 0 0				56.45		0.25			 [(28)
Walls Type	1 07	70	454			_			14.112			\dashv	
			15.1	8	52.54	_	0.3	=	15.76			\dashv	(29)
Walls Type			2		14.86		0.27	=	3.95			\dashv	(29)
Roof	27.1		0		27.19) X	0.18	=	4.89				(30)
Total area	of elements	s, m²			168.2	2							(31)
Party wall					37.33	x	0	=	0				(32)
Party ceiling	g				29.26	;							(32b)
* for windows ** include the						ated using	g formula 1	/[(1/U-valı	ıe)+0.04] a	as given in	paragraph	n 3.2	
Fabric heat				is anu par	uuuns		(26) (30)) + (32) =				105.8	4 (33)
Heat capac			-)						(30) + (32	2) + (32a)	(32e) =	8891.	
	., 0	、···· /						(()		, ()	× -/		

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 u	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	<						25.23	(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) =			131.08	(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=	45.57	44.79	44.03	40.47	39.8	36.69	36.69	36.12	37.89	39.8	41.15	42.56		(38)
Heat ti	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	176.65	175.87	175.11	171.54	170.88	167.77	167.77	167.19	168.97	170.88	172.23	173.64		
										-	Sum(39)1	₁₂ /12=	171.54	(39)
	· ·	· · · ·	HLP), W/	i						= (39)m ÷	· · ·		1	
(40)m=	3.13	3.12	3.1	3.04	3.03	2.97	2.97	2.96	2.99	3.03	3.05	3.08		
Numbe	er of dav	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1	₁₂ /12=	3.04	(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	tina ene	rgy requi	irement [.]								kWh/ye	ear:	
			igy ioqu											
		upancy, I		[1 over	(0.000	040 v /T	- 120		040	TEA 40		88		(42)
	A 2 13. A £ 13.		+ 1.76 x	[i-exp	(-0.0003	949 X (11	-A - 13.9)2)] + 0.0	JU 13 X (IFA - 13.	.9)			
		,	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		78	.84		(43)
		-	hot water			-	-	to achieve	a water us	se target o	f			
not more	e that 125	litres per j	person per	r day (all w	ater use, i I	not and co	ia) 						I	
	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	able 1c x	(43)			i			
(44)m=	86.73	83.57	80.42	77.27	74.11	70.96	70.96	74.11	77.27	80.42	83.57	86.73		
Energy	content of	^t hot water	used - cal	culated mo	onthly = 4.	190 x Vd.r	n x nm x D)) Tm / 3600			m(44) _{1 12} = ables 1b, 1		946.11	(44)
(45)m=	128.61	112.49	116.08	101.2	97.1	83.79	77.65	89.1	90.16	105.08	114.7	124.56		
(-)											 m(45)1_12 =		1240.51	(45)
lf instan	taneous v	vater heati	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46			. ,			
(46)m=	19.29	16.87	17.41	15.18	14.57	12.57	11.65	13.36	13.52	15.76	17.2	18.68		(46)
	storage										-			
-		. ,) includir				-		ame ves	sel		0		(47)
	•	-	and no ta		-			• •	.					
			hot wate	er (this ir	ICIUDES I	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	storage nanufact		eclared I	oss facto	or is kno	wn (kWł	n/dav):					0		(48)
			m Table				"aay).					-		(40)
			storage		əər			(48) x (49)	. =			0		
			eclared of	-		or is not		(-TO) A (-TO)	_			0		(50)
			factor fr	•								0		(51)
	•	-	ee secti	on 4.3										
		from Ta										0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)

Enter (50) or (54) in (55)00 </th <th>(55) (56) (57) (58) (59)</th>	(55) (56) (57) (58) (59)
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	(57) (58)
If 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 (57)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(57) (58)
Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	(58)
Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	(59)
	(59)
	· · · · ·
Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	(61)
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m - (59)m$	
(62)m = 172.81 150.95 157.06 139.3 134.87 118.78 113.8 126.87 128.27 146.06 155.91 168.75	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	()
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(63)
Output from water heater	
(64)m= 172.81 150.95 157.06 139.3 134.87 118.78 113.8 126.87 128.27 146.06 155.91 168.75	
	3.43 (64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]	
(65)m= 53.81 47.02 48.84 43.17 41.73 36.61 34.86 39.07 39.51 45.18 48.44 52.46	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(66)m= 93.99 <t< td=""><td>(66)</td></t<>	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 24.84 22.06 17.94 13.58 10.15 8.57 9.26 12.04 16.16 20.52 23.95 25.53	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 163.91 165.61 161.33 152.2 140.68 129.86 122.63 120.93 125.21 134.34 145.86 156.68	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	. ,
(69)m= 32.4 32.4 32.4 32.4 32.4 32.4 32.4 32.4	(69)
Pumps and fans gains (Table 5a)	()
(70)m= 10 10 10 10 10 10 10 10	(70)
Losses e.g. evaporation (negative values) (Table 5)	
(71)m= -75.19 -7	(71)
	(11)
Water heating gains (Table 5) (72)m= 72.33 69.97 65.65 59.96 56.09 50.85 46.85 52.51 54.87 60.73 67.28 70.52	(72)
	(12)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m (73)m= 322.28 318.84 306.11 286.95 268.12 250.47 239.94 246.67 257.44 276.78 298.28 313.93	(73)
(73)m= 322.28 318.84 306.11 286.95 268.12 250.47 239.94 246.67 257.44 276.78 298.28 313.93 6. Solar gains:	(13)

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 0.9	0.77	x	3.43	×	11.28	×	0.85	x	0.7	=	15.96	(75)
Northeast 0.9	0.77	x	1.35	x	11.28	x	0.85	x	0.7	=	6.28	(75)
Northeast 0.9	0.77	x	3.43	×	22.97	×	0.85	x	0.7	=	32.48	(75)
Northeast 0.9	0.77	x	1.35	×	22.97	×	0.85	x	0.7	=	12.78	(75)
Northeast 0.9	0.77	x	3.43	×	41.38	x	0.85	x	0.7	=	58.52	(75)
Northeast 0.9	0.77	x	1.35	×	41.38	×	0.85	x	0.7	=	23.03	(75)
Northeast 0.9	0.77	x	3.43	×	67.96	x	0.85	x	0.7	=	96.11	(75)
Northeast 0.9	0.77	x	1.35	x	67.96	x	0.85	x	0.7	=	37.83	(75)
Northeast 0.9	0.77	x	3.43	×	91.35	×	0.85	x	0.7	=	129.19	(75)
Northeast 0.9	0.77	x	1.35	×	91.35	x	0.85	x	0.7	=	50.85	(75)
Northeast 0.9	0.77	x	3.43	×	97.38	×	0.85	x	0.7	=	137.73	(75)
Northeast 0.9	0.77	x	1.35	×	97.38	x	0.85	x	0.7	=	54.21	(75)
Northeast 0.9	0.77	x	3.43	×	91.1	x	0.85	x	0.7	=	128.85	(75)
Northeast 0.9	0.77	x	1.35	×	91.1	×	0.85	x	0.7	=	50.71	(75)
Northeast 0.9	0.77	x	3.43	×	72.63	x	0.85	x	0.7	=	102.72	(75)
Northeast 0.9	0.77	x	1.35	×	72.63	x	0.85	x	0.7	=	40.43	(75)
Northeast 0.9	0.77	x	3.43	×	50.42	×	0.85	x	0.7	=	71.31	(75)
Northeast 0.9	0.77	x	1.35	×	50.42	×	0.85	x	0.7	=	28.07	(75)
Northeast 0.9	0.77	x	3.43	×	28.07	x	0.85	x	0.7	=	39.7	(75)
Northeast 0.9	0.77	x	1.35	×	28.07	×	0.85	x	0.7	=	15.62	(75)
Northeast 0.9	0.77	x	3.43	×	14.2	x	0.85	x	0.7	=	20.08	(75)
Northeast 0.9	0.77	x	1.35	×	14.2	×	0.85	x	0.7	=	7.9	(75)
Northeast 0.9	0.77	x	3.43	×	9.21	×	0.85	x	0.7	=	13.03	(75)
Northeast 0.9	0.77	x	1.35	×	9.21	x	0.85	x	0.7	=	5.13	(75)
Southeast 0.9	••••	x	2.38	×	36.79	x	0.85	x	0.7	=	36.11	(77)
Southeast 0.9	0.77	x	5	×	36.79	x	0.85	x	0.7	=	75.86	(77)
Southeast 0.9	0.77	x	1.35	×	36.79	x	0.85	x	0.7	=	40.96	(77)
Southeast 0.9	0.77	x	2.38	×	62.67	×	0.85	x	0.7	=	61.51	(77)
Southeast 0.9		x	5	×	62.67	×	0.85	x	0.7	=	129.21	(77)
Southeast 0.9		x	1.35	×	62.67	×	0.85	x	0.7	=	69.77	(77)
Southeast 0.9		x	2.38	×	85.75	×	0.85	x	0.7	=	84.15	(77)
Southeast 0.9		x	5	×	85.75	×	0.85	x	0.7	=	176.79	(77)
Southeast 0.9		x	1.35	×	85.75	×	0.85	x	0.7	=	95.47	(77)
Southeast 0.9		x	2.38	×	106.25	×	0.85	x	0.7	=	104.27	(77)
Southeast 0.9		x	5	×	106.25	×	0.85	x	0.7	=	219.06	(77)
Southeast 0.9		x	1.35	×	106.25	×	0.85	x	0.7	=	118.29	(77)
Southeast 0.9		x	2.38	×	119.01	×	0.85	x	0.7	=	116.79	(77)
Southeast 0.9		x	5	×	119.01	×	0.85	x	0.7	=	245.36	(77)
Southeast 0.9	0.77	x	1.35	×	119.01	×	0.85	x	0.7	=	132.5	(77)

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Southeast 0.9x	0.77	×	2.38	×	118.15	x	0.85	×	0.7	=	115.95	(77)
Southeast 0.9x	0.77	X	5	×	118.15	x	0.85	×	0.7	=	243.59	(77)
Southeast 0.9x	0.77	x	1.35	×	118.15	x	0.85	×	0.7	=	131.54	(77)
Southeast 0.9x	0.77	x	2.38	×	113.91	x	0.85	x	0.7	=	111.79	(77)
Southeast 0.9x	0.77	x	5	×	113.91	x	0.85	×	0.7	=	234.84	(77)
Southeast 0.9x	0.77	x	1.35	×	113.91	x	0.85	×	0.7	=	126.82	(77)
Southeast 0.9x	0.77	x	2.38	×	104.39	x	0.85	×	0.7	=	102.44	(77)
Southeast 0.9x	0.77	x	5	×	104.39	x	0.85	x	0.7	=	215.22	(77)
Southeast 0.9x	0.77	x	1.35	×	104.39	x	0.85	x	0.7	=	116.22	(77)
Southeast 0.9x	0.77	x	2.38	×	92.85	x	0.85	×	0.7	=	91.12	(77)
Southeast 0.9x	0.77	x	5	×	92.85	x	0.85	×	0.7	=	191.43	(77)
Southeast 0.9x	0.77	x	1.35	×	92.85	x	0.85	×	0.7	=	103.37	(77)
Southeast 0.9x	0.77	x	2.38	×	69.27	x	0.85	×	0.7	=	67.98	(77)
Southeast 0.9x	0.77	x	5	×	69.27	x	0.85	×	0.7	=	142.81	(77)
Southeast 0.9x	0.77	x	1.35	×	69.27	x	0.85	×	0.7	=	77.12	(77)
Southeast 0.9x	0.77	x	2.38	×	44.07	×	0.85	×	0.7	=	43.25	(77)
Southeast 0.9x	0.77	x	5	×	44.07	x	0.85	×	0.7	=	90.86	(77)
Southeast 0.9x	0.77	x	1.35	×	44.07	x	0.85	×	0.7	=	49.06	(77)
Southeast 0.9x	0.77	x	2.38	×	31.49	×	0.85	×	0.7	=	30.9	(77)
Southeast 0.9x	0.77	x	5	×	31.49	x	0.85	×	0.7	=	64.92	(77)
Southeast 0.9x	0.77	x	1.35	×	31.49	x	0.85	×	0.7	=	35.06	(77)
Southwest _{0.9x}	0.77	x	0.32	×	36.79]	0.85	×	0.7	=	4.85	(79)
Southwest _{0.9x}	0.77	x	0.32	×	62.67]	0.85	×	0.7	=	8.27	(79)
Southwest _{0.9x}	0.77	x	0.32	×	85.75]	0.85	×	0.7	=	11.31	(79)
Southwest _{0.9x}	0.77	x	0.32	×	106.25]	0.85	×	0.7	=	14.02	(79)
Southwest _{0.9x}	0.77	x	0.32	×	119.01]	0.85	×	0.7	=	15.7	(79)
Southwest _{0.9x}	0.77	x	0.32	×	118.15]	0.85	×	0.7	=	15.59	(79)
Southwest _{0.9x}	0.77	x	0.32	×	113.91]	0.85	×	0.7	=	15.03	(79)
Southwest _{0.9x}	0.77	x	0.32	×	104.39]	0.85	×	0.7	=	13.77	(79)
Southwest0.9x	0.77	x	0.32	×	92.85]	0.85	×	0.7	=	12.25	(79)
Southwest0.9x	0.77	x	0.32	×	69.27	1	0.85	×	0.7	=	9.14	(79)
Southwest _{0.9x}	0.77	x	0.32	×	44.07	1	0.85	×	0.7	=	5.81	(79)
Southwest0.9x	0.77	x	0.32	×	31.49	Ī	0.85	×	0.7	=	4.15	(79)
-				•		•						
Solar gains in	watts, calc	ulated	for each mon	th		(83)m	n = Sum(74)m	(82)m				
(83)m= 180.02	314.03 4	149.29	589.58 690.3	9	698.6 668.03	590).8 497.55	352.36	216.97	153.19		(83)
Total gains – i	nternal and	d solar	(84)m = (73)n	1 + (83)m , watts							
(84)m= 502.3	632.87	755.4	876.52 958.5	1 9	49.08 907.97	837	.47 754.99	629.14	515.25	467.11		(84)

7. Mean internal temperature (heating season)

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

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

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

21

(85)

(86)m=	0.99	0.98	0.97	0.93	0.87	0.76	0.64	0.69	0.85	0.95	0.98	0.99		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Table	e 9c)					
(87)m=	18	18.29	18.78	19.44	20.06	20.56	20.81	20.76	20.35	19.54	18.67	17.98		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	able 9, Ti	h2 (°C)					
(88)m=	18.69	18.69	18.7	18.73	18.74	18.76	18.76	18.77	18.75	18.74	18.72	18.71		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.97	0.95	0.9	0.79	0.6	0.38	0.43	0.73	0.92	0.98	0.99		(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=	16.18	16.48	16.96	17.62	18.19	18.61	18.74	18.73	18.46	17.73	16.87	16.18		(90)
									f	fLA = Livin	g area ÷ (4	4) =	0.42	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	A) × T2			-		
(92)m=	16.94	17.24	17.72	18.38	18.97	19.42	19.6	19.58	, 19.25	18.49	17.62	16.93		(92)
Apply	adjustn	nent to tl	ne mear	internal	l temper	ature fro	m Table	e 4e, whe	ere appro	opriate				
(93)m=	16.94	17.24	17.72	18.38	18.97	19.42	19.6	19.58	19.25	18.49	17.62	16.93		(93)
8. Spa	ace hea	ting requ	uirement											
						ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the ut			- -	using Ta	i	<u> </u>								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.98	tor for g	0.94	0.89	0.8	0.66	0.49	0.54	0.77	0.92	0.97	0.98		(94)
· · ·				4)m x (84		0.00	0.49	0.54	0.77	0.92	0.97	0.90		(04)
(95)m=	492.62	611.62	710.89	780.72	769.02	625.99	446.97	455.82	579.11	576.75	499.51	459.58		(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)
	oss rate	e for mea	an interr	al tempe	erature.			r x [(93)m		I 1				
(97)m=		2169.42	1964.69		1242.36	809.23	503.58	531.18	870.4	1347.76	1812.27	2210.4		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Nh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	1295.18	1046.84	932.83	608.73	352.16	0	0	0	0	573.64	945.18	1302.61		
I								Tota	l per year	(kWh/year	.) = Sum(9	8) _{15,912} =	7057.17	(98)
Space	e heatin	a require	ement in	kWh/m ²	²/vear								125.02	(99)
		• •			•	veteme i	ncluding	micro-C	עחי			L		
	e heatir			iviuuai n	cauny s	ysterns i	nciuuing	f fillero-c	, , ,					
•		-	It from s	econdar	y/supple	mentary	system]	0	(201)
				nain syst		-	-	(202) = 1 -	- (201) =			l l	1	(202)
				main sys				(204) = (2	02) × [1 –	(203)] =			1	(204)
			-	ing syste					<i>.</i>			l		(206)
	•	-		ementar		a evetor	n %					l	00.0	(208)
LIIICIC	-				- 								-	
Snoo	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space		g require 1046.84	· · ·	alculate 608.73	d above 352.16) 0	0	0	0	573.64	945.18	1302.61		
(044)										0,0.04	0-0.10	1002.01		(04.4)
(211)m				00 ÷ (20 685.5	396.58	0	0	0	0	645.99	1064.4	1466.91		(211)
	1-50.04	1170.00	1000.40	000.0	330.30	Ŭ		-	l (kWh/yea				7947.27	(211)
											···/15,10. 12		1941.21	()

Space heating fuel (secondary), kWh/month

= {[(98)m x (20	01)]}x1	00 ÷ (20)8)									_	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	ll (kWh/yea	ar) =Sum(2	215) _{15,10. 1}	2	0	(215)
	heating	-												
Outpu	t from w 172.81	ater hea	ter (calc 157.06	ulated a 139.3	bove) 134.87	118.78	113.8	126.87	128.27	146.06	155.91	168.75		
Efficie		ater hea											79.5	(216)
(217)m=	<u> </u>	87.51	87.33	86.91	86.01	79.5	79.5	79.5	79.5	86.74	87.35	87.62		(217)
Fuel fo	or water	heating,	kWh/m	onth									1	
)m x 100			450.0		440.45	450.50		400.00	470.40	400 50	1	
(219)m=	197.28	172.5	179.85	160.29	156.8	149.41	143.15	159.58 Tota	161.34 I = Sum(2	168.38	178.49	192.58	0040.00	
Δοριμ	al totals							TOLA	ii – Suni(z		Wh/yea	-	2019.66 kWh/year	(219)
		, g fuel use	ed, main	system	1					ĸ	wii/yea	1	7947.27	7
Water	heating	fuel use	ed										2019.66	Ī
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								
centr	al heatir	ng pump	:									120		(230c)
Total e	electricit	y for the	above, l	kWh/yea	ır			sum	of (230a)	(230g) =			120	(231)
Electri	city for I	ighting											438.72	(232)
12a.	CO2 err	nissions	– Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHF)					
						En	ergy			Fmice	ion fac	tor	Emissions	
							/h/year			kg CO			kg CO2/yea	
Space	heating	g (main s	system 1)		(21	1) x			0.2	16	=	1716.61	(261)
Space	heating	g (secon	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.2	16	=	436.25	(264)
Space	and wa	ter heat	ing			(261	1) + (262)	+ (263) + ((264) =				2152.86	(265)
Electri	city for p	pumps, f	ans and	electric	keep-ho	t (23 ⁻	1) x			0.5	19	=	62.28	(267)
Electri	city for I	ighting				(232	2) x			0.5	19	=	227.7	(268)
Total (CO2, kg	/year							sum o	of (265) (2	271) =		2442.83	(272)
Dwelli	ng CO2	2 Emissi	ion Rate	;					(272)	÷ (4) =			43.27	(273)
El rati	ng (sect	ion 14)											68	(274)

			User D	etails:						
Assessor Name: Software Name:	Chris Hocknel Stroma FSAP			Stroma Softwa					016363 on: 1.0.4.10	
		P	roperty /	Address:	Unit 4-F	Part L1B				
Address :	Unit 4, 40-42 M	ill Lane, Lon	don, NW	/6 1NR						
1. Overall dwelling dimer	nsions:									
Ground floor				a(m²) 3.27	(1a) x	Av. He i	i ght(m) 6	(2a) =	Volume(m ³) 190.5	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)	+(1e)+(1r	ז) 🛛 7	3.27	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	190.5	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	0	secondar heating + 0 + 0	ſ y] + [_] + [_	0 0] = [total 0 0		40 = 20 =	m ³ per hour	(6a) (6b)
Number of intermittent fan				Ū			,	10 =	-	
	5				Ľ	3			30	(7a)
Number of passive vents					L	0	X '	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 If a pressurisation test has be					continue fro	30 om (9) to (÷ (5) =	0.16	(8)
Number of storeys in th Additional infiltration								-1]x0.1 =	0 0	(9) (10)
Structural infiltration: 0.2 if both types of wall are pre- deducting areas of opening	esent, use the value o gs); if equal user 0.35	corresponding to	o the great	er wall area	a (after	uction			0	(11)
If suspended wooden flo			.1 (seale	a), eise	enter U				0	(12)
If no draught lobby, ente Percentage of windows									0	(13)
Window infiltration	and doors draug	ni sinppeu		0.25 - [0.2	x (14) ÷ 1	001 =		-	0	(14) (15)
Infiltration rate				(8) + (10)		1	+ (15) =		0	(15)
Air permeability value, o	150, expressed ir	o cubic metre						area	15	(17)
If based on air permeabilit			•		•		•		0.91	(18)
Air permeability value applies	if a pressurisation te	st has been dor	ne or a deg	gree air pei	rmeability i	is being us	sed	I		
Number of sides sheltered	1								2	(19)
Shelter factor				(20) = 1 - [9)] =			0.85	(20)
Infiltration rate incorporation	-			(21) = (18)) x (20) =				0.77	(21)
Infiltration rate modified fo								_	I	
		/lay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe								· _ 1	I	
(22)m= 5.1 5	4.9 4.4 4	.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4									
(22a)m= 1.27 1.25 1	.23 1.1 1.	08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltr	ation rat	e (allowi	ng for sh	elter an	d wind s	peed) =	(21a) x	(22a)m			-		
<u> </u>	0.98	0.96	0.94	0.85	0.83	0.73	0.73	0.71	0.77	0.83	0.87	0.91		
		<i>ctive air</i> al ventila	-	rate for t	he applic	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a) × Fmv (e	equation (N	(15)) othe	rwise (23b) = (23a)			0	(23a)
				iency in %) (200)			0	
			-	entilation	-					$(h) m \pm (h)$	22h) v [/	1 (23a)	0 ÷ 1001	(23c)
(24a)m=						0	0	0		0	230) ~ [$\frac{1}{0}$	÷ 100]	(24a)
	-	-	-	entilation	-		Ţ	-	-	-	ů	Ů		(/
(24b)m=				0				0	0		0	0		(24b)
	-		-	tilation c	-	-	-	-	-	Ŭ	Ů	Ů		(/
,				hen (240	•	•				5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ı ventilatio	n or wh	ole hous	e positiv	e input v	ventilatio	n from l	oft					
,				m = (22t	•	•				0.5]	-		_	
(24d)m=	0.98	0.96	0.95	0.86	0.84	0.77	0.77	0.75	0.8	0.84	0.88	0.91		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24b) or (240	c) or (24	d) in box	(25)					
(25)m=	0.98	0.96	0.95	0.86	0.84	0.77	0.77	0.75	0.8	0.84	0.88	0.91		(25)
3 He	at losse	s and he	eat loss i	paramete	er.									
ELEN		Gros		Openin		Net Ar	ea	U-valı	Je	AXU		k-value	9	AXk
		area		m		A ,n		W/m2		(W/I	<)	kJ/m²·l		kJ/K
Doors						2	x	3	=	6				(26)
Window	ws Type	e 1				1.35	x1/	/[1/(4.8)+	0.04] =	5.44				(27)
Window	ws Type	e 2				1.35	x1/	/[1/(4.8)+	0.04] =	5.44				(27)
Walls ⁻	Гуре1	45.5	57	6.75		38.82	x	0.3	=	11.65				(29)
Walls ⁻	Гуре2	11.7	'3	2		9.73	x	0.27	= =	2.61			$\neg \square$	(29)
Walls ⁻	Гуре3	12.8	38	0		12.88	x	0.24	= =	3.04	ז ר		$\exists \square$	(29)
Roof		15.0)7	0		15.07	×	0.18	;	2.71	i T			(30)
Total a	rea of e	lements	, m²			85.25			I					(31)
Party v	vall					37.7	×	0	= [0				(32)
Party f	loor					73.27			I				\dashv	(32a)
Party c						58.2					L L		\dashv	(32b)
* for win	dows and			effective wil nternal wall		lue calcula	ated using	formula 1	/[(1/U-valu	ie)+0.04] a	L Is given in	paragraph	 1 3.2	(````
Fabric	heat los	s, W/K :	= S (A x	U)				(26) (30)	+ (32) =				53.19	(33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	13327.	59 (34)
Therm	al mass	parame	ter (TMF	o = Cm ÷	· TFA) in	⊨kJ/m²K			Indica	tive Value:	Medium		250	(35)
	-	sments wh ad of a de		tails of the ulation.	constructi	on are not	^r known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated ı	using Ap	pendix k	<						12.79	(36)
			are not kn	own (36) =	= 0.15 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			65.98	(37)

Ventila	ation hea	at loss c	alculated	d monthl	у				(38)m	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	61.84	60.66	59.5	54.06	53.05	48.31	48.31	47.43	50.14	53.05	55.1	57.25		(38)
Heat t	ransfer	coefficie	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	127.81	126.63	125.47	120.04	119.02	114.29	114.29	113.41	116.11	119.02	121.08	123.23		
Heat l	oss para	ameter (I	HLP). W	/m²K						Average = = (39)m ÷	- Sum(39)₁ - (4)	₁₂ /12=	120.03	(39)
(40)m=	1.74	1.73	1.71	1.64	1.62	1.56	1.56	1.55	1.58	1.62	1.65	1.68		
Numb	er of da	ys in mo	nth (Tab	le 1a)			1	1	1	Average =	Sum(40)₁	₁₂ /12=	1.64	(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 ene	rgy requ	irement:								kWh/ye	ear:	
if TF if TF	A > 13. A £ 13.	9, N = 1	+ 1.76 ×)2)] + 0.(TFA -13	.9)	.32		(42)
Reduce	the annu	al average	hot water		5% if the c	lwelling is	designed	(25 x N) to achieve		se target o		9.37		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pe	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)			<u>.</u>			
(44)m=	98.3	94.73	91.15	87.58	84.01	80.43	80.43	84.01	87.58	91.15	94.73	98.3		
Energy	content of	f hot water	used - ca	lculated m	onthly = 4.	190 x Vd,r	m x nm x E)))))))))))))))))))			m(44) _{1 12} = ables 1b, 1		1072.41	(44)
(45)m=	145.78	127.5	131.57	114.71	110.06	94.98	88.01	100.99	102.2	119.1	130.01	141.18		
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} =		1406.09	(45)
(46)m=	21.87	19.13	19.74	17.21	16.51	14.25	13.2	15.15	15.33	17.87	19.5	21.18		(46)
	storage										·			
-							-	within sa	ame ves	sel		0		(47)
Other	•	o stored		ank in dw er (this ir	•			(47) ombi boil	ers) ente	er '0' in ((47)			
	-		eclared I	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	ear			(48) x (49) =			0		(50)
b) If n	nanufac	turer's d	eclared	cylinder	loss fact							-		
		-		rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
	-	neating s from Ta		on 4.3										(50)
		actor fro		2b								0 0		(52) (53)
				, kWh/y₀	oor			(47) v (51) v (52) v (53) -				
-	-	(54) in (-	, KVVII/Y	cai			(47) x (51	,			0 0		(54) (55)
	. ,	. , .		for each	month			((56)m = (55) × (41)	m	L	•		(00)
(56)m=	0	0			0	0	0		0	0	0	0		(56)
(50)11-											U U	U U		(00)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H	
(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (57)	
Primary circuit loss (annual) from Table 3	
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (59)	
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 50.09 43.6 46.45 43.19 42.81 39.66 40.99 42.81 43.19 46.45 46.72 50.09 (61)	
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m	
(62)m= 195.88 171.1 178.02 157.9 152.87 134.64 129 143.8 145.39 165.55 176.73 191.28 (62)	
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 (63)	
Output from water heater	
(64)m= 195.88 171.1 178.02 157.9 152.87 134.64 129 143.8 145.39 165.55 176.73 191.28	
Output from water heater $(annual)_{1/12}$ 1942.15 (64)	
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]	
(65)m= 61 53.29 55.36 48.94 47.3 41.5 39.51 44.28 44.78 51.21 54.91 59.47 (65)	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(66)m= 116.14 116.14 116.14 116.14 116.14 116.14 116.14 116.14 116.14 116.14 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 35.57 31.59 25.69 19.45 14.54 12.28 13.26 17.24 23.14 29.38 34.3 36.56 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 204.81 206.93 201.58 190.17 175.78 162.26 153.22 151.09 156.45 167.85 182.24 195.77 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 34.61 34.61 34.61 34.61 34.61 34.61 34.61 34.61 34.61 34.61 (69)	
Pumps and fans gains (Table 5a)	
(70)m= 10 10 10 10 10 10 10 10 10 10 10 10 (70)	
Losses e.g. evaporation (negative values) (Table 5)	
(71)m= -92.91 -92.91 -92.91 -92.91 -92.91 -92.91 -92.91 -92.91 -92.91 -92.91 (71)	
Water heating gains (Table 5)	
(72)m= 81.98 79.31 74.41 67.97 63.57 57.63 53.1 59.52 62.19 68.84 76.26 79.93 (72)	
Total internal gains = $(66)m + (67)m + (68)m + (70)m + (71)m + (72)m$	
(73)m= 390.2 385.68 369.52 345.44 321.74 300.01 287.43 295.7 309.63 333.91 360.64 380.1 (73)	
(73)m= 390.2 385.68 369.52 345.44 321.74 300.01 287.43 295.7 309.63 333.91 360.64 380.1 (73) 6. Solar gains: (73) (73) (73) (73) (73) (73)	

							-		_				_
Northeast 0.9x	0.77	×	1.3	5	x	11.28	×	0.85	X	0.7	=	6.28	(75)
Northeast 0.9x	0.77	X	1.3	5	x	22.97	x	0.85	x	0.7	=	12.78	(75)
Northeast 0.9x	0.77	X	1.3	5	x	41.38	x	0.85	x	0.7	=	23.03	(75)
Northeast 0.9x	0.77	x	1.3	5	x	67.96	x	0.85	x	0.7	=	37.83	(75)
Northeast 0.9x	0.77	x	1.3	5	x	91.35	x	0.85	x	0.7	=	50.85	(75)
Northeast 0.9x	0.77	x	1.3	5	x	97.38	x	0.85	x	0.7	=	54.21	(75)
Northeast 0.9x	0.77	x	1.3	5	x	91.1	x	0.85	x	0.7	=	50.71	(75)
Northeast 0.9x	0.77	x	1.3	5	x	72.63	x	0.85	x	0.7	=	40.43	(75)
Northeast 0.9x	0.77	x	1.3	5	x	50.42	x	0.85	x	0.7	=	28.07	(75)
Northeast 0.9x	0.77	x	1.3	5	x	28.07	x	0.85	x	0.7	=	15.62	(75)
Northeast 0.9x	0.77	x	1.3	5	x	14.2	x	0.85	x	0.7	= =	7.9	(75)
Northeast 0.9x	0.77	x	1.3	5	x	9.21	x	0.85	x	0.7	=	5.13	(75)
Northwest 0.9x	0.77	x	1.3	5	x	11.28] x	0.85	×	0.7	=	25.12	(81)
Northwest 0.9x	0.77	x	1.3	5	x	22.97] x	0.85	×	0.7	=	51.14	(81)
Northwest 0.9x	0.77	x	1.3	5	x	41.38	X	0.85	×	0.7	=	92.13	(81)
Northwest 0.9x	0.77	x	1.3	5	x	67.96	j ×	0.85	×	0.7	= =	151.31	(81)
Northwest 0.9x	0.77	x	1.3	5	x	91.35] x	0.85	×	0.7	= =	203.39	(81)
Northwest 0.9x	0.77	x	1.3	5	x	97.38	X	0.85	×	0.7	=	216.84	(81)
Northwest 0.9x	0.77	x	1.3	5	x 🗌	91.1	j ×	0.85	×	0.7	= =	202.85	(81)
Northwest 0.9x	0.77	x	1.3	5	x	72.63] x	0.85	×	0.7	= =	161.71	(81)
Northwest 0.9x	0.77	x	1.3	5	x	50.42	x	0.85	x	0.7		112.27	(81)
Northwest 0.9x	0.77	x	1.3	5	x	28.07	x	0.85	×	0.7	=	62.49	(81)
Northwest 0.9x	0.77	x	1.3	5	x	14.2	x	0.85	×	0.7		31.61	(81)
Northwest 0.9x	0.77	x	1.3	5	x	9.21] x	0.85	×	0.7		20.52	(81)
L							-						
Solar gains in	watts, ca	alculated	for eac	n month	1		(83)m	n = Sum(74)m	(82)m				
(83)m= 31.4	63.92	115.17	189.14	254.24	271.05	253.56	202	.14 140.33	78.12	39.51	25.65		(83)
Total gains – i	nternal a	nd solar	(84)m =	= (73)m	+ (83)n	ı, watts		•		-		I	
(84)m= 421.61	449.6	484.69	534.58	575.98	571.05	540.99	497	.84 449.96	412.0	3 400.15	405.75		(84)
7. Mean inter	nal temp	erature	(heating	seasor	1)				-	-	-		
Temperature			` · · ·		, ,	from Ta	ble 9	, Th1 (°C)				21	(85)
Utilisation fac	-	• •			-								
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.99	0.96	0.88	0.77	0.8		0.99	1	1		(86)
Mean interna		atura in	living ar		ullow st	ens 3 to .		able 9c)		I		1	
(87)m= 19.02	19.16	19.45	19.91	20.35	20.73	20.9	20.		20.02	19.49	19.05		(87)
												l	
Temperature (88)m= 19.51	auring n 19.52	eating p	eriods ir 19.59	1 rest of 19.6	19.64	19.64	19.		19.6	19.58	19.55	1	(88)
							I	19.02	19.0	19.00	19.00	l	
Utilisation fac					<u> </u>		T Ó	-			<u> </u>	1	(00)
(89)m= 1	1	0.99	0.98	0.94	0.8	0.6	0.6	67 0.91	0.98	1	1	l	(89)
Moon interna	Itompor	oturo in i	the reat	of dwall	ing TO	follow		to 7 in Tab					

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

(90)m=	17.75	17.89	18.19	18.69	19.12	19.5	19.61	19.61	19.35	18.81	18.27	17.82		(90)
									f	fLA = Livin	g area ÷ (4	1) =	0.34	(91)
Mean	interna	l temner	ature (fo	or the wh	ole dwe	llina) = fl	I A x T1	+ (1 – fL	A) x T2			-		
(92)m=	18.18	18.33	18.62	19.11	19.54	19.92	20.05	20.04	19.76	19.23	18.69	18.24		(92)
								4e, whe						~ /
(93)m=	18.18	18.33	18.62	19.11	19.54	19.92	20.05	20.04	19.76	19.23	18.69	18.24		(93)
			uirement					[· ,
					re obtain	od at st	en 11 of	Table 0	h so tha	t Ti m-('	76)m an	d re-calc	ulate	
				using Ta			epiioi	Table 3	0, 50 tha	it 11,111–(<i>i 0)</i> in an		ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	· ·	,									
(94)m=	1	0.99	0.99	0.98	0.93	0.82	0.66	0.72	0.92	0.98	0.99	1		(94)
Usefu	ul gains,	hmGm	, W = (94	4)m x (84	4)m		1	1						
(95)m=	419.92	447.11	479.88	521.74	537.94	470.08	356.13	357.74	412.01	404.61	397.72	404.4		(95)
Mont	hly avera	age exte	rnal tem	perature	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 mea	an intern	al tempe	erature,	Lm , W =	- =[(39)m	r x [(93)m	– (96)m]				
(97)m=	1774.45	1700.19	1520.84	1225.62	933.41	608.4	394.76	412.64	657.61	1026.7	1403.16	1730.25		(97)
Spac	e heatin	g require	ement fo	r each n	nonth, k	Nh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	1007.77	842.07	774.47	506.79	294.23	0	0	0	0	462.84	723.92	986.43		
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	5598.52	(98)
Spac	e heatin	a require	ement in	kWh/m²	/vear							L L	76.41	(99)
					•		a a baadha a					l	10.41	
			its – indi	ividual n	eating s	ystems i	nciuaing	micro-C	HP)					
•	e heatir	•	at from s	econdar	v/sunnle	mentary	vsvetem					ſ	0	(201)
					,	mentary		(202) = 1	(201) -			l	-	
				nain syst	. ,								1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								88.8	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	า, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	⊐ ar
Spac				alculate					1-				, s	
•	1007.77	· ·	774.47	506.79	294.23	0	0	0	0	462.84	723.92	986.43		
(211)m	ے n = ا(08)m x (20	ן 14)1 עע 1	00 ÷ (20	L	1	1	1		1				(211)
(211)11	1134.88	· · · ·	872.15	570.71	331.34	0	0	0	0	521.22	815.22	1110.85		(211)
		0.0121	0.7.0	0.011					l (kWh/yea				6304.64	(211)
Cree	o hootin	a fund (a								,	- 715,10. 12	l	0304.04	
•		- ·	econdar 00 ÷ (20	y), kWh/ way	month									
(215)m=	<u> </u>	0	00 . (20	0	0	0	0	0	0	0	0	0		
(<u>~</u> 10)III-		0			0				l (kWh/yea	-		-	0	(215)
\A/_+-	h a a thu	_						. 010					U	
	heating		tor (oolo	ulated e	hovo									
Juipu	195.88	171.1	178.02	ulated a	152.87	134.64	129	143.8	145.39	165.55	176.73	191.28		
Efficie		ater hea											79.5	(216)
	-, -, 1												10.0	T 7

(217)m= 87														
	7.14	87.08	86.9	86.4	85.38	79.5	79.5	79.5	79.5	86.15	86.81	87.14		(217)
Fuel for wa		-												
(219)m = (219)m= 224		1 x 100 196.49) ÷ (217) 204.86	m 182.75	179.04	169.36	162.26	180.88	182.88	192.18	203.58	219.49		
				I			I	Tota	I = Sum(2	19a) ₁₁₂ =	1	1	2298.55	(219)
Annual to	otals									k	Wh/year	r	kWh/yea	 r
Space hea	ating f	uel use	d, main	system	1								6304.64	
Water hea	ating fu	uel use	d										2298.55	
Electricity	for pu	imps, fa	ans and	electric l	keep-ho	t								
central he	eating	pump:										120]	(230c)
Total elect	tricity	for the	above, ł	(Wh/yea	r			sum	of (230a)	(230g) =			120	(231)
Electricity	for lig	hting											628.21	(232)
12a. CO2	2 emis	ssions -	- Individ	ual heati	na svste	ems inclu	ıdina mi	cro-CHF)					
						En	ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emission kg CO2/ye	
Space hea	ating (En kW	ergy				2/kWh	tor =		
	•	main s	ystem 1)			En kW (211	ergy /h/year			kg CO	2/kWh		kg CO2/ye	ar
Space hea	ating (main s	ystem 1)			En kW (21 [,]	ergy /h/year 1) x			kg CO	2/kWh 16 19	=	kg CO2/ye	ar (261)
Space hea Space hea	ating (ating	ímain s _í íseconc	ystem 1) lary)			En kW (21 ⁻ (21) (21)	ergy /h/year 1) x 5) x			kg CO 0.2 0.5	2/kWh 16 19	=	kg CO2/ye	ear (261) (263)
Space hea Space hea Water hea	ating (ating d wate	main s seconc	ystem 1) lary) ng)		En kW (21* (21) (21) (26*	ergy /h/year 1) x 5) x 9) x			kg CO 0.2 0.5	2/kWh 16 19 16	=	kg CO2/ye	ear (261) (263) (264)
Space hea Space hea Water hea Space and	ating (ating d wate for pu	main s seconc er heati umps, fa	ystem 1) lary) ng)		En kW (21 ⁻ (219 (219 (26 ⁻ t (23 ⁻	ergy /h/year 1) x 5) x 9) x 1) + (262)			kg CO	2/kWh 16 19 16 19	= =	kg CO2/ye 1361.8 0 496.49 1858.29	ear (261) (263) (264) (265)
Space hea Space hea Water hea Space and Electricity	ating (ating d wate for pu for lig	main s second er heati umps, fa hting	ystem 1) lary) ng)		En kW (21 ⁻ (219 (219 (26 ⁻ t (23 ⁻	ergy /h/year 1) x 5) x 9) x 1) + (262) 1) x		(264) =	kg CO. 0.2 0.5 0.2	2/kWh 16 19 16 19 19	= = =	kg CO2/ye 1361.8 0 496.49 1858.29 62.28	ear (261) (263) (264) (265) (265) (267)
Space hea Space hea Water hea Space and Electricity Electricity	ating (ating d wate for pu for lig 2, kg/y	main s second er heatil umps, fa hting ear	ystem 1 lary) ng ans and) electric I		En kW (21 ⁻ (219 (219 (26 ⁻ t (23 ⁻	ergy /h/year 1) x 5) x 9) x 1) + (262) 1) x		(264) =	kg CO 0.2 0.5 0.2 0.5 f (265) (2	2/kWh 16 19 16 19 19	= = =	kg CO2/ye 1361.8 0 496.49 1858.29 62.28 326.04	ear (261) (263) (264) (265) (267) (268)

			User D	etails:						
Assessor Name: Software Name:	Chris Hockne Stroma FSAF			Stroma Softwa					016363 n: 1.0.4.10	
		Р	roperty A	Address:	Unit 5-F	Part L1B				
Address :	Unit 5, 40-42 N	Mill Lane, Long	don, NW	6 1NR						
1. Overall dwelling dimer	nsions:									
Ground floor				a(m²) 8.31	(1a) x	Av. Hei	i ght(m) 6	(2a) =	Volume(m ³) 177.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d	l)+(1e)+(1r	1) <u>6</u>	8.31	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	177.61	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues	main heating	secondar heating + 0 + 0	y] + [_] + [_	0 0] = [total 0 0		40 = 20 =	m ³ per hour	(6a) (6b)
		0		0		-			-	
Number of intermittent fan	S				Ľ	3		10 =	30	(7a)
Number of passive vents					L	0	X ?	10 =	0	(7b)
Number of flueless gas fire	es					0	× 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimney If a pressurisation test has be					continue fro	30 om (9) to (÷ (5) =	0.17	(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 gs); if equal user 0.3	corresponding to 35	the greate	er wall area	a (after	uction			0	(11)
If suspended wooden flo			1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente									0	(13)
Percentage of windows Window infiltration		gni sinpped		0.25 - [0.2	x (14) ÷ 1	001 =			0	(14)
Infiltration rate				(8) + (10)		1	+ (15) =		0	(15) (16)
Air permeability value, c	150. expressed i	in cubic metre						area	15	(17)
If based on air permeabilit			•	•	•				0.92	(18)
Air permeability value applies	if a pressurisation t	est has been don	e or a deg	iree air pei	meability i	is being us	sed	I		
Number of sides sheltered	ł								2	(19)
Shelter factor				(20) = 1 - [9)] =			0.85	(20)
Infiltration rate incorporation	-			(21) = (18)) x (20) =				0.78	(21)
Infiltration rate modified fo		· ·			-			_	I	
		May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe								,	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	ation rat	e (allowi	ng for sł	nelter an	id wind s	peed) =	(21a) x	(22a)m	-			_	
	1	0.98	0.96	0.86	0.84	0.74	0.74	0.72	0.78	0.84	0.88	0.92		
		<i>ctive air</i> al ventila	0	rate for t	he appli	cable ca	se						0	(23a)
				endix N. (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) . othe	rwise (23b) = (23a)			0	(23a)
		• •	0		, ,	for in-use fa	• •	,, .	,	, (,			0	(23c)
			-	-	-	at recove				2h)m + ()	23b) × [1 – (23c	-	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0		0]	(24a)
b) lf	balance	d mech	anical ve	ntilation	without	heat rec	overv (N	и ЛV) (24b)m = (22	1 2b)m + (2	23b)	l	1	
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If	whole h	ouse ex	tract ver	tilation of	or positiv	/e input \	/entilatic	n from o	outside			1	1	
í	f (22b)n	י < 0.5 ×	، (23b), t	hen (24)	c) = (23b	o); otherv	vise (24	c) = (22k	o) m + 0	.5 × (23b))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,						ve input								
1			<u> </u>	· · · ·		erwise (2			r [′]	<u> </u>	0.00	0.00	1	(244)
(24d)m=		0.98	0.96	0.87	0.85	0.78	0.78	0.76	0.81	0.85	0.89	0.92		(24d)
1			1	· · ·	, ,	o) or (240	, .	<u>,</u>	r í	0.05	0.00	0.00	1	(25)
(25)m=	1	0.98	0.96	0.87	0.85	0.78	0.78	0.76	0.81	0.85	0.89	0.92		(25)
3. He	at losse	s and he	eat loss p	paramet	er:									
ELEN	IENT	Gros area		Openin m		Net Ar A ,n		U-valı W/m2		A X U (W/ł	<)	k-valu kJ/m²·		A X k kJ/K
Doors						2	x	3	=	6				(26)
Window	ws Type	e 1				1.35	x1/	/[1/(4.8)+	0.04] =	5.44				(27)
Window	ws Type	2				1.35	x1/	/[1/(4.8)+	0.04] =	5.44				(27)
Window	ws Type	93				1.35	x1/	/[1/(4.8)+	0.04] =	5.44				(27)
Window	ws Type	e 4				2.66	x1/	/[1/(4.8)+	0.04] =	10.71				(27)
Walls 7	Гуре1	60.4	1	8.06	;	52.35	x	0.3	=	15.71				(29)
Walls 7	Гуре2	5.6	5	2		3.65	x	0.27	=	0.98				(29)
Roof		22.6	i5	0		22.65	x	0.18	=	4.08				(30)
Total a	rea of e	lements	, m²			88.71								(31)
Party v	vall					30.66	; x	0	=	0				(32)
Party f	loor					68.31								(32a)
Party c	eiling					45.66	;				[(32b)
			ows, use e sides of in			alue calcula titions	ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	is given in	n paragrapi	h 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26) (30)) + (32) =				59.22	2 (33)
Heat c	apacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	11384	.7 (34)
Therma	al mass	parame	ter (TMF	⊃ = Cm ÷	- TFA) ir	ר kJ/m²K			Indica	tive Value:	Medium		250	(35)
	-		ere the de tailed calcu		construct	ion are not	^t known pr	ecisely the	e indicative	e values of	TMP in T	able 1f		
Therma	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix k	<						13.3	1 (36)
if details	of therma	al bridging	are not kn	own (36) =	= 0.15 x (3	31)								

Total fa	abric he	at loss							(33) +	(36) =			72.52	(37)
Ventila	tion hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × (25)m x (5)		-	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	58.37	57.24	56.13	50.94	49.97	45.44	45.44	44.6	47.18	49.97	51.93	53.99		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m		_	
(39)m=	130.89	129.76	128.66	123.46	122.49	117.96	117.96	117.12	119.71	122.49	124.45	126.51		
Heat lo	oss para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷		₁₂ /12=	123.46	(39)
(40)m=	1.92	1.9	1.88	1.81	1.79	1.73	1.73	1.71	1.75	1.79	1.82	1.85]	
N I I		· · · · · · · · · · · · · · · · · · ·	- 41- (T - 1-1						,	Average =	Sum(40)1	₁₂ /12=	1.81	(40)
Numbe	er of day Jan	rs in moi Feb	nth (Tab Mar	le 1a) Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	-	-			-					-			1	
4 \\/-	ten heed													
4. 882	iter neat	ing ener	gy requi	rement:								kWh/y	ear:	
		ipancy, I										.2]	(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0)013 x (⁻	TFA -13.	9)		•	
			ater usad	ne in litre	s per da	av Vd.av	erage =	(25 x N)	+ 36		86	.55	1	(43)
Reduce	the annua	al average	hot water	usage by a	5% if the a	lwelling is	designed	to achieve		se target o			1	(10)
not more	e that 125	litres per p	person per	day (all w	ater use, l	hot and co	ld)	-		-	-	-	_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)		-	-	-	_	
(44)m=	95.21	91.75	88.29	84.82	81.36	77.9	77.9	81.36	84.82	88.29	91.75	95.21		
Energy o	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D)Tm / 3600		Total = Su hth (see Ta	· · ·		1038.66	(44)
(45)m=	141.19	123.49	127.43	111.1	106.6	91.99	85.24	97.81	98.98	115.35	125.92	136.74]	
						I	I	11		Total = Su	∎ m(45)1 12 =		1361.84	(45)
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46)) to (61)					
(46)m=	21.18	18.52	19.11	16.66	15.99	13.8	12.79	14.67	14.85	17.3	18.89	20.51]	(46)
	storage											-	-	
-		. ,					•	within sa	ime ves	sel		0		(47)
	•	-			-	nter 110		. ,			47)			
	nse ir no storage		not wate	er (unis in	iciudes i	nstantar	ieous co	ombi boile	ers) ente	er u in (47)			
	-		eclared l	oss facto	or is kno	wn (kWł	n/dav):					0	1	(48)
			m Table			,	,					0]	(49)
				, kWh/ye	ar			(48) x (49)	=			0]	(50)
			-	-		or is not		(,,				0	J	(00)
Hot wa	iter stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
	-	-	ee secti	on 4.3									1	
		from Tal		0 h								0	-	(52)
			m Table									0]	(53)
•••			-	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
⊨nter	(50) or ((54) in (5) (CO									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	1	(56)
If cylind	er contain	s dedicate	d solar sto	rage, (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	v circuit	loss (ar	nual) fro	om Table	e 3					•		0	ĺ	(58)
	•	•	,			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	ostat)		_	
(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) ÷ 36	65 × (41))m						
(61)m=	48.52	42.23	44.99	41.83	41.46	38.42	39.7	41.46	41.83	44.99	45.25	48.52		(61)
Total h	neat requ	uired for	water h	eating ca	alculated	l for eacl	n month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	189.71	165.72	172.42	152.93	148.06	130.4	124.94	139.27	140.81	160.34	171.16	185.26		(62)
Solar DI	HW input	calculated	using App	endix G o	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	tion 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	iter	_	-	-		-	-		_		_	
(64)m=	189.71	165.72	172.42	152.93	148.06	130.4	124.94	139.27	140.81	160.34	171.16	185.26		-
								Outp	out from w	ater heate	r (annual)₁	12	1881.03	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	[]	
(65)m=	59.08	51.62	53.62	47.4	45.81	40.19	38.27	42.89	43.37	49.6	53.18	57.6		(65)
inclu	ude (57)	m in calo	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is f	rom com	munity h	leating	
5. In	ternal ga	ains (see	e Table 5	5 and 5a):									
Metab	olic gair	is (Table	<u>e 5), Wat</u>	ts								-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22		(66)
-		<u>`</u>	· · · ·	opendix	L, equat	ion L9 oi	r L9a), a	lso see	Table 5					
(67)m=	31.8	28.25	22.97	17.39	13	10.97	11.86	15.41	20.69	26.27	30.66	32.69		(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=	193.32	195.33	190.27	179.51	165.92	153.16	144.63	142.62	147.68	158.44	172.02	184.79		(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5		-	_	
(69)m=	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02		(69)
Pumps	s and fai	ns gains	(Table	5a)										
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losse	s e.g. ev	aporatic	on (nega	tive valu	es) (Tab	le 5)								
(71)m=	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18		(71)
Water	heating	gains (T	Table 5)		-	-		-	-					
(72)m=	79.4	76.81	72.07	65.83	61.57	55.82	51.43	57.65	60.24	66.67	73.86	77.41		(72)
	10.1	10.01		00.00	•								1	
Total		gains =		00.00		(66)	m + (67)m	n + (68)m +	⊦ (69)m +	(70)m + (7	(1)m + (72))m		
Total i (73)m=				328.8	306.56	(66) 286.02	m + (67)m 273.99	1 + (68)m + 281.75	+ (69)m + 294.67	(70)m + (7 317.44	71)m + (72) 342.61)m 360.96		(73)

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	1.35	×	11.28	×	0.85	x	0.7	=	6.28	(75)
Northeast 0.9x	0.77	x	1.35	x	22.97	x	0.85	x	0.7	=	12.78	(75)
Northeast 0.9x	0.77	x	1.35	x	41.38	×	0.85	x	0.7	=	23.03	(75)
Northeast 0.9x	0.77	x	1.35	×	67.96	×	0.85	x	0.7	=	37.83	(75)
Northeast 0.9x	0.77	x	1.35	x	91.35	x	0.85	x	0.7	=	50.85	(75)
Northeast 0.9x	0.77	x	1.35	×	97.38	x	0.85	x	0.7] =	54.21	(75)
Northeast 0.9x	0.77	x	1.35	×	91.1	x	0.85	x	0.7	=	50.71	(75)
Northeast 0.9x	0.77	x	1.35	×	72.63	×	0.85	x	0.7	=	40.43	(75)
Northeast 0.9x	0.77	x	1.35	×	50.42	×	0.85	x	0.7	=	28.07	(75)
Northeast 0.9x	0.77	x	1.35	×	28.07	x	0.85	x	0.7	=	15.62	(75)
Northeast 0.9x	0.77	x	1.35	×	14.2	×	0.85	x	0.7	=	7.9	(75)
Northeast 0.9x	0.77	x	1.35	×	9.21	×	0.85	x	0.7	=	5.13	(75)
Southeast 0.9x	0.77	x	1.35	×	36.79	×	0.85	x	0.7	=	20.48	(77)
Southeast 0.9x	0.77	x	1.35	×	36.79	×	0.85	x	0.7	=	40.96	(77)
Southeast 0.9x	0.77	x	2.66	×	36.79	×	0.85	x	0.7	=	40.36	(77)
Southeast 0.9x	0.77	x	1.35	×	62.67	×	0.85	x	0.7	=	34.89	(77)
Southeast 0.9x	0.77	x	1.35	×	62.67	×	0.85	x	0.7] =	69.77	(77)
Southeast 0.9x	0.77	x	2.66	×	62.67	×	0.85	x	0.7	=	68.74	(77)
Southeast 0.9x	0.77	x	1.35	×	85.75	x	0.85	x	0.7	=	47.73	(77)
Southeast 0.9x	0.77	x	1.35	×	85.75	×	0.85	x	0.7	=	95.47	(77)
Southeast 0.9x	0.77	x	2.66	×	85.75	×	0.85	x	0.7	=	94.05	(77)
Southeast 0.9x	0.77	x	1.35	×	106.25	×	0.85	x	0.7	=	59.15	(77)
Southeast 0.9x	0.77	x	1.35	×	106.25	x	0.85	x	0.7	=	118.29	(77)
Southeast 0.9x	0.77	x	2.66	×	106.25	x	0.85	x	0.7] =	116.54	(77)
Southeast 0.9x		x	1.35	×	119.01	×	0.85	x	0.7	=	66.25	(77)
Southeast 0.9x		x	1.35	×	119.01	×	0.85	x	0.7	=	132.5	(77)
Southeast 0.9x		x	2.66	×	119.01	×	0.85	x	0.7	=	130.53	(77)
Southeast 0.9x		x	1.35	×	118.15	×	0.85	x	0.7	=	65.77	(77)
Southeast 0.9x		x	1.35	×	118.15	x	0.85	x	0.7	=	131.54	(77)
Southeast 0.9x		x	2.66	×	118.15	×	0.85	x	0.7	=	129.59	(77)
Southeast 0.9x		x	1.35	×	113.91	×	0.85	x	0.7	=	63.41	(77)
Southeast 0.9x		x	1.35	×	113.91	×	0.85	x	0.7	=	126.82	(77)
Southeast 0.9x	-	x	2.66	×	113.91	x	0.85	x	0.7	=	124.94	(77)
Southeast 0.9x		x	1.35	×	104.39	×	0.85	x	0.7	=	58.11	(77)
Southeast 0.9x		x	1.35	×	104.39	×	0.85	×	0.7] =	116.22	(77)
Southeast 0.9x	-	x	2.66	×	104.39	×	0.85	x	0.7] =	114.5	(77)
Southeast 0.9x		x	1.35	×	92.85	×	0.85	x	0.7] =	51.69	(77)
Southeast 0.9x	-	x	1.35	×	92.85	×	0.85	×	0.7] =	103.37	(77)
Southeast 0.9x	0.77	x	2.66	×	92.85	×	0.85	x	0.7	=	101.84	(77)

Southeast 0.9x	0.77	x	1.3	35	×	6	9.27	x	0	.85	×	0.7	=	38.56	(77)
Southeast 0.9x	0.77	×	1.3	35	x	6	9.27	x	0	.85	×	0.7	=	77.12	(77)
Southeast 0.9x	0.77	x	2.6	66	×	6	9.27	x	0	.85	x	0.7	=	75.97	(77)
Southeast 0.9x	0.77	x	1.3	35	x	4	4.07	x	0	.85	×	0.7	=	24.53	(77)
Southeast 0.9x	0.77	x	1.3	35	x [4	4.07	x	0	.85	×	0.7	=	49.06	(77)
Southeast 0.9x	0.77	x	2.6	66	x [4	4.07	x	0	.85	×	0.7	=	48.34	(77)
Southeast 0.9x	0.77	x	1.3	35	× [3	1.49	x	0	.85	×	0.7	=	17.53	(77)
Southeast 0.9x	0.77	x	1.3	35	×	3	1.49	x	0	.85	_ × [0.7	=	35.06	(77)
Southeast 0.9x	0.77	x	2.6	66	×	3	1.49	x	0	.85	_ × [0.7	=	34.54	(77)
•					-			•							
Solar gains in	watts, ca	alculated	l for eac	h month	1			(83)m	n = Sum	ı(74)m	(82)m				
(83)m= 108.08	186.19	260.29	331.8	380.12	1	81.1	365.87	329	.25 2	84.97	207.27	129.84	92.25		(83)
Total gains – i	nternal a	nd solar	. (84)m =	= (73)m	+ (8	33)m	, watts								
(84)m= 478.67	552.64	611.67	660.6	686.69	66	67.12	639.86	61	1 5	79.63	524.72	472.45	453.2		(84)
7. Mean inte	rnal temr	oraturo	(heating	l seasor)			·	<u> </u>			1	•		
			``````````````````````````````````````		<i>.</i>	oroo i	rom Tok		Th1 /	(°C)				04	
Temperature	•	• •			•			Jie 9,	, 1111 (	()				21	(85)
Utilisation fac	<u> </u>			1	T Ì		,			0	0.1		Du		
Jan	Feb	Mar	Apr	May	-	Jun	Jul		ug	Sep	Oct	Nov	Dec		(00)
(86)m= 1	0.99	0.99	0.97	0.93		).83	0.7	0.7	4	0.9	0.98	0.99	1		(86)
Mean interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	7 in T	able 9	9c)					
(87)m= 18.94	19.14	19.47	19.95	20.38	20	0.75	20.91	20.	89 2	20.62	20.06	19.46	18.96		(87)
Temperature	during h	eating p	eriods i	n rest of	dw	elling	from Ta	able 9	9, Th2	(°C)					
(88)m= 19.39	19.4	19.41	19.46	19.47	-	9.52	19.52	19.	1	19.5	19.47	19.45	19.43		(88)
Utilisation fac	tor for a	aine for i	rest of d	welling	h2	m (se	a Tahla	(a)				1	•		
(89)m= 0.99	0.99	0.98	0.95	0.89	<u> </u>	).73	0.51	0.5	56	0.83	0.96	0.99	1		(89)
Mean interna	· · ·			i	<u> </u>			r –	<u> </u>		,	1		l	
(90)m= 17.58	17.79	18.12	18.64	19.05	1	9.4	19.5	19	.5	19.29	18.76	18.14	17.63		(90)
										Ť	'LA = LIVI	ng area ÷ (	4) =	0.33	(91)
Mean interna	l temper	ature (fo	r the wh	ole dwe	elling	g) = fl	_A × T1	+ (1	– fLA)	) × T2					
(92)m= 18.03	18.23	18.57	19.07	19.49	1	9.85	19.96	19.	96 ⁻	19.73	19.19	18.58	18.07		(92)
Apply adjust	nent to th	ne mean	interna	l temper	atu	re fro	m Table	4e, '	where	appro	opriate	1			
(93)m= 18.03	18.23	18.57	19.07	19.49	1	9.85	19.96	19.	96 ⁻	19.73	19.19	18.58	18.07		(93)
8. Space hea	ating requ	uirement		<u>A</u>			L					•	A		
Set Ti to the	mean int	ernal ter	nperatu	re obtair	ned	at ste	ep 11 of	Tabl	e 9b, :	so tha	t Ti,m=	(76)m an	d re-calo	ulate	
the utilisation	factor fo	or gains	using Ta	able 9a	_										
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac	ctor for g	ains, hm	:												
(94)m= 0.99	0.99	0.98	0.95	0.89	0	).76	0.57	0.6	62	0.84	0.96	0.99	0.99		(94)
Useful gains	, hmGm ,	W = (94	4)m x (8	4)m											
(95)m= 474.83	545.14	596.63	627.02	610.61	50	04.36	367.77	378	.12 4	86.62	501.99	466.11	450.25		(95)
Monthly aver	age exte	rnal tem	perature	e from T	able	e 8			<b>,</b>				i		
(96)m= 4.3	4.9	6.5	8.9	11.7	1	14.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat loss rat	e for mea	an intern	al temp	erature,	Lm	, W =	=[(39)m	x [(9	3)m– (	(96)m	]			L	
(97)m= 1796.82	1729.83	1552.48	1255.59	954.33	61	19.03	396.85	416	.62 6	74.15	1051.78	1428.2	1754.79		(97)

							<b>ergy</b> /h/year			<b>Emiss</b> kg CO2	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/yea	
12a. (	CO2 em	issions -	– Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHP	)					
Electric	city for li	ghting										[	561.63	(232)
Total e	lectricity	for the	above,	kWh/yea	ır			sum	of (230a)	(230g) =			120	(231)
centra	al heatin	g pump:	:									120		(230c)
Electric	city for p	umps, fa	ans and	electric	keep-ho	t						L		-
Water	heating	fuel use	d									[	2227.61	ī
		fuel use	ed, main	system	1					K.	, in year	[	5936.31	7
∆nnua	l totals							TOLA	n – Suffi(Z		Wh/year	. [	2227.61 kWh/year	(219)
• •	217.68	m x 100 190.38	198.6	177.3	173.89	164.03	157.15	175.19 Tota	177.12 I = Sum(2	186.52	197.22	212.53	0007.04	
		heating,												
(217)m=	87.15	87.05	86.82	86.25	85.15	79.5	79.5	79.5	79.5	85.97	86.79	87.17		(217)
Efficier	ncy of w	ater hea	iter										79.5	(216)
Output	189.71	ater hea 165.72	ter (calc 172.42	ulated a 152.93	bove) 148.06	130.4	124.94	139.27	140.81	160.34	171.16	185.26		
	heating		tor (oclo		herre)			TOLA	ii (Kvvii/yea	ar) =Sum(2	215) _{15,10. 12}	-	0	(215)
(215)m=	0	0	0	0	0	0	0	0 Tota		0 ar) =Sum(2	0	0		7(215)
= {[(98	)m x (20	1)] } x 1	00 ÷ (20	T										_
				I				Tota	l I (kWh/yea	ar) =Sum(2	2 <b>11)</b> _{15,10. 12}	=	5936.31	(211)
(211)m	1 = {[(98)	)11 X (20 896.52	4)] } X 800.84	100 ÷ (20 509.65	287.99	0	0	0	0	460.63	780.07	1092.99		(211)
(211)m						0	0	0	U	409.04	092.7	970.56		(011)
Space	e heatin 983.56	g require 796.11	ement (c 711.15	452.57	d above) 255.73	) 0	0	0	0	409.04	692.7	970.58		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	ı, %						0	(208)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								88.8	(206)
Fracti	on of to	al heati	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =		[	1	(204)
Fracti	on of sp	ace hea	at from n	nain syst	em(s)			(202) = 1 -	- (201) =			ĺ	1	(202)
•	<b>e heatir</b> on of sp	-	at from s	econdar	y/supple	mentary	system		,			[	0	(201)
9a. En	ergy req	uiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)			l		
Space	e heating	g require	ement in	ı kWh/m²	²/year						, , , ,		77.17	_ (99)
(50)11-	000.00	750.11	711.10	402.07	200.10	0	Ŭ	-	-	(kWh/year			5271.44	(98)
Space (98)m=	983.56	796.11	711.15	452.57	255.73	0	0.02	4 X [(97)	0	409.04	692.7	970.58		

Space heating (main system 1)	(211) x	0.216	=	1282.24	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	481.16	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1763.41	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	62.28	(267)
Electricity for lighting	(232) x	0.519	=	291.49	(268)
Total CO2, kg/year	sum	of (265) (271) =		2117.17	(272)
Dwelling CO2 Emission Rate	(272)	÷ (4) =		30.99	(273)
El rating (section 14)				75	(274)

			User D	etails:						
Assessor Name:	Chris Hocknell			Stroma					016363	
Software Name:	Stroma FSAP 20			Softwa				Versio	n: 1.0.4.10	
				Address:	Unit 6-F	Propose	d-Lean			
Address :	Unit 6, 40-42 Mill L	ane, Lon	don, NW	/6 1NR						
1. Overall dwelling dimer	ISIONS:		Area	(m ² )			abt(m)		Volumo(m ³ )	
Ground floor				<b>a(m²)</b> 4.36	(1a) x	<b>Av. He</b> i	.16	(2a) =	Volume(m ³ ) 139.02	(3a)
Total floor area TFA = (1a	)+(1b)+(1c)+(1d)+(1	e)+(1r	1) <u>6</u>	4.36	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	139.02	(5)
2. Ventilation rate:										
	main heating	secondar heating	У	other		total			m ³ per hour	•
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				-   	2	<b>x</b> 1	0 =	20	(7a)
Number of passive vents					Г	0	x 1	0 =	0	(7b)
Number of flueless gas fire	es				Г	0	x 4	+0 =	0	(7c)
								Δir ch	anges per ho	⊐ ur
Infiltration due to chimney	a fluce and fans -	(6a)+(6b)+(7	(2)+(7b)+(	7c) -	Г					-
Infiltration due to chimney If a pressurisation test has be					continue fro	20 om (9) to (		÷ (5) =	0.14	(8)
Number of storeys in the						.,,,,	,	[	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		esponding to	the greate	er wall area	a (after					
If suspended wooden fle		aled) 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	stripped						İ	0	(14)
Window infiltration				0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value, o					•	etre of e	nvelope	area	5	(17)
If based on air permeabilit									0.39	(18)
Air permeability value applies		as been dor	ne or a deg	ree air pei	rmeability	is being us	sed	ſ		
Number of sides sheltered Shelter factor	1			(20) = 1 - [	0.075 x (1	9)] =			1 0.92	(19) (20)
Infiltration rate incorporation	ng shelter factor			(21) = (18)	) x (20) =				0.32	(21)
Infiltration rate modified for	-	ed		. , . ,				l	0.50	
	Mar Apr May		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		
$\frac{1}{1}$										
Wind Factor (22a)m = (22 (22a)m = 1.27 1.25 1	)m ÷ 4 .23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
	1.00		0.00	0.02					l	

Adjust	ed infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
	0.46	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.36	0.39	0.41	0.43		
	<i>ate effec</i> echanica		-	rate for t	he appli	cable ca	se			-				(220)
				andix N (2	3h) = (23a	) x Emv (e	auation (N	N5)) , other	wise (23h	(23a) = (23a)			0	(23a)
								n Table 4h)		) = (20a)			0	(23b)
					0		,			0h)m ⊥ (	00h) v [	1 (220)	0	(23c)
(24a)m=								HR) (24a	$r_{0}$ $r_{0}$ $r_{0}$ $r_{0}$	$\frac{2}{0}$	230) × [ 0	1 – (23c) 0	÷ 100j	(24a)
i í		-	-	-	-		-			-	Ĵ	0		(240)
D) IT (24b)m=						neat rec		VV) (24b	o)m = (22	20)m + (. 0	230)	0	l	(24b)
	_	-	-		-	-	-		-	0	0	0		(240)
,					•	•		on from c c) = (22b		5 × (23h	))			
(24c)m=	r <u>`</u> ı	0	0	0	0		0		0		0	0		(24c)
	Ļ	ventilatio	n or wh	ole hous	e nositiv	/e innut v	ventilatio	on from l	oft			-		
,						•		0.5 + [(2		0.5]				
(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(24d)
Effe	ctive air	change	rate - er	nter (24a	) or (24t	o) or (24	c) or (24	d) in box	(25)	-				
(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)
2 40	at losses	and he	at loss r	aramot	or:							•		
		Gros		Openin		Net Ar	00	U-valı		AXU		k-value		AXk
ELEN		area		m		A,r		W/m2		(W/I	K)	kJ/m ² ·ł		kJ/K
Doors						2	x	1	=	2				(26)
Windo	ws Type	1				0.99	x1.	/[1/( 1.4 )+	0.04] =	1.31	=			(27)
Windo	ws Type	2				0.99	x1.	/[1/( 1.4 )+	0.04] =	1.31	=			(27)
Walls -	Type1	30.1	2	4.95		25.17	' x	0.18	=	4.53	= r			(29)
Walls ⁻	Type2	4.78	8	2		2.78	x	0.18		0.5	i F		7 6	(29)
Walls ⁻	Туре3	3.8	5	0		3.85	x	0.18		0.69				(29)
Walls ⁻	Type4	21.5	5	0		21.55	5 x	0.18		3.88	i F		$\dashv$	(29)
Walls ⁻	Type5	8.89	9	0		8.89	×	0.18	=	1.6	= i		$\dashv$	(29)
Roof -	•••	53.8		0		53.89	) x	0.13	=	7.01			$\dashv$	(30)
Roof ⁻		2.6		0		2.6	x	0.13		0.34			4 2	(30)
	area of el					125.6		0.10		0.04	L			(31)
Party v			,			22.68		0		0	r			(32)
Party f						64.36				0	L 		$\dashv$	(32a)
raityi	loor					04.30	)				L			(32a)
* for win		roof wind	nws lise e	ffective wi	ndow H-v	alue calcul	ated using	n formula 1	/[(1/   -vali	ie)+0 041 a	as aiven in	naranranh	132	
							ated using	g formula 1.	/[(1/U-valı	le)+0.04] â	as given in	n paragraph	3.2	
** inclua	ndows and	s on both	sides of in	ternal wal			-	g formula 1. (26) (30)		ıe)+0.04] ғ	as given in	n paragraph	27.1	1 (33)
** <i>includ</i> Fabric	dows and le the area	s on both s, W/K =	sides of in = S (A x	ternal wal			-			ue)+0.04] a (30) + (32	-			
** <i>inclua</i> Fabric Heat c	dows and le the area heat los	<i>s on both</i> s, W/K = Cm = S(	sides of in = S (A x A x k )	iternal wal U)	ls and pari	titions	-		((28)) + (32) =		2) + (32a)		27.1	27 (34)

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

			are not kr	10wn (36) :	= 0.15 x (3	1)								_
Total f	abric he	at loss							(33) +	(36) =			45.93	(37)
Ventila	ation he	at loss ca	alculated	d monthl	у	-			(38)m	= 0.33 × (	(25)m x (5)	)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	27.89	27.7	27.51	26.62	26.46	25.69	25.69	25.54	25.98	26.46	26.79	27.14		(38)
Heat t	ransfer	coefficie	nt, W/K						(39)m	= (37) + (	38)m			
(39)m=	73.81	73.62	73.43	72.55	72.38	71.61	71.61	71.47	71.91	72.38	72.72	73.07		
	•				•					Average =	Sum(39)1	12 <b>/12=</b>	72.55	(39)
	oss para	ameter (H	HLP), W	/m²K		r	i		(40)m	= (39)m ÷	• (4)		1	
(40)m=	1.15	1.14	1.14	1.13	1.12	1.11	1.11	1.11	1.12	1.12	1.13	1.14		<b>-</b>
Numb	er of da	ys in mo	nth (Tab	ole 1a)		-	-			Average =	Sum(40)₁	12 <b>/12=</b>	1.13	(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 ene	rgy requ	irement:								kWh/y	ear:	
A			NI										1	(10)
		upancy, 9. N = 1		([1 - exp	(-0.0003	349 x (TF	- A -13.9	)2)] + 0.(	)013 x ( ⁻	TFA -13		1		(42)
	A £ 13.				( 0.0000			/_/] 010			,			
								(25 x N)				.12		(43)
		-		' usage by r day (all w		-	-	to achieve	a water us	se target o	ſ			
			1	1					0	0.1	N	Dec	1	
Hot wat	Jan	Feb	Mar	Apr ach month	May	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
	92.53	89.17	85.8	82.44	79.07	75.71	75.71	79.07	82.44	85.8	89.17	92.53	1	
(44)m=	92.05	09.17	00.0	02.44	79.07	75.71	75.71	79.07			m(44) _{1 12} =		1009.43	(44)
Energy	content of	f hot water	used - ca	lculated m	onthly = 4.	190 x Vd,r	n x nm x L	) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) )					1009.43	
(45)m=	137.22	120.01	123.84	107.97	103.6	89.4	82.84	95.06	96.2	112.11	122.37	132.89		
				I						I Total = Su	I m(45)₁ ₁₂ =	-	1323.52	(45)
lf instan	taneous v	vater heati	ng at poin	t of use (no	o hot water	r storage),	enter 0 in	boxes (46	) to (61)					
(46)m=	20.58	18	18.58	16.2	15.54	13.41	12.43	14.26	14.43	16.82	18.36	19.93		(46)
	storage			•										
-				• •			-	within sa	ame ves	sel		0		(47)
	•	-		ank in dw	-			. ,	1	(O) : (	47)			
	storage		not wate	er (this ir	iciudes i	nstantar	ieous co	ombi boil	ers) ente	er u in (	47)			
	-		eclared	loss fact	or is kno	wn (kWł	n/dav):					0		(48)
		actor fro										0		(49)
•				e, kWh/y	ear			(48) x (49)	) =			0		(50)
-			-	cylinder		or is not		(40) X (40)	,			0		(50)
				rom Tab								0		(51)
		neating s		on 4.3										
		from Ta		0								0		(52)
		factor fro										0		(53)
-			-	e, kWh/y	ear			(47) x (51)	) x (52) x (	53) =		0		(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 cylind	er contain	s dedicate	d solar sto	rage, (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	v circuit	: loss (ar	nual) fro	om Table	e 3					•		0		(58)
	•	loss cal	,			59)m = (	(58) ÷ 36	65 × (41)	m				1	
(mo	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	ostat)		_	
(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=	47.15	41.04	43.72	40.65	40.29	37.33	38.58	40.29	40.65	43.72	43.97	47.15		(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=	184.37	161.05	167.57	148.62	143.89	126.73	121.42	135.36	136.85	155.83	166.35	180.04		(62)
Solar DI	HW input	calculated	using App	endix G o	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=	184.37	161.05	167.57	148.62	143.89	126.73	121.42	135.36	136.85	155.83	166.35	180.04		_
								Outp	out from w	ater heate	r (annual)₁	12	1828.09	(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=	57.41	50.16	52.11	46.06	44.52	39.06	37.19	41.68	42.15	48.21	51.68	55.97		(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 fi	rom com	munity h	eating	
5. In	ternal ga	ains (see	e Table 5	5 and 5a	):									
Metab	olic gair	s (Table	e 5), Wat	ts	-	-	-	-	-		-	-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	105.09	105.09	105.09	105.09	105.09	105.09	105.09	105.09	105.09	105.09	105.09	105.09		(66)
Lightin	ig gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5			-		
(67)m=	19.92	17.69	14.39	10.89	8.14	6.88	7.43	9.66	12.96	16.46	19.21	20.48		(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=	183.79	185.7	180.9	170.66	157.75	145.61	137.5	135.59	140.4	150.63	163.55	175.68		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a	), also se	ee Table	5			_	
(69)m=	33.51	33.51	33.51	33.51	33.51	33.51	33.51	33.51	33.51	33.51	33.51	33.51		(69)
Pumps	s and fa	ns gains	(Table !	5a)			-	-					-	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losse	s e.g. ev	vaporatio	on (nega	tive valu	es) (Tab	ole 5)								
(71)m=	-84.07	-84.07	-84.07	-84.07	-84.07	-84.07	-84.07	-84.07	-84.07	-84.07	-84.07	-84.07		(71)
Water	heating	gains (T	able 5)										-	
(72)m=	77.17	74.65	70.04	63.98	59.84	54.25	49.99	56.02	58.54	64.79	71.78	75.23		(72)
Total i	internal	gains =				(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72)	)m	-	
(73)m=	338.41	335.57	322.85	303.06	283.26	264.26	252.44	258.8	269.43	289.41	312.06	328.92		(73)
0.0-	lar gains	o												

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

Orientation:	Access Fac Table 6d	ctor	Area m²			Flux Table	6a		g_ Table 6l	b	Tab	FF ble 6c			Gains (W)	
Northeast 0.9x	0.77	x	0.9	9	x	11.2	8	x	0.63	×		0.7		=	6.83	(75)
Northeast 0.9x	0.77	x	0.9	9	x	22.9	7	x	0.63	×		0.7		=	13.9	(75)
Northeast 0.9x	0.77	x	0.9	9	x	41.3	8	x	0.63	×		0.7		=	25.04	(75)
Northeast 0.9x	0.77	x	0.9	9	x	67.9	6	x	0.63	×		0.7		=	41.12	(75)
Northeast 0.9x	0.77	x	0.9	9	x	91.3	5	x	0.63	×		0.7		=	55.27	(75)
Northeast 0.9x	0.77	x	0.9	9	x	97.3	8	x	0.63	×		0.7		=	58.93	(75)
Northeast 0.9x	0.77	x	0.9	9	x	91.1	1	x	0.63	×		0.7		=	55.13	(75)
Northeast 0.9x	0.77	x	0.9	9	x	72.6	3	x	0.63	x		0.7		=	43.95	(75)
Northeast 0.9x	0.77	x	0.9	9	x	50.4	2	x	0.63	×		0.7		=	30.51	(75)
Northeast 0.9x	0.77	x	0.9	9	x	28.0	7	x	0.63	×		0.7		=	16.98	(75)
Northeast 0.9x	0.77	x	0.9	9	x	14.2	2	x	0.63	×		0.7		=	8.59	(75)
Northeast 0.9x	0.77	x	0.9	9	x	9.21	1	x	0.63	×		0.7		=	5.58	(75)
Northwest 0.9x	0.77	x	0.9	9	x	11.2	8	x	0.63	×		0.7		=	10.24	(81)
Northwest 0.9x	0.77	x	0.9	9	x	22.9	7	x	0.63	×		0.7		=	20.85	(81)
Northwest 0.9x	0.77	x	0.9	9	x	41.3	8	x	0.63	×		0.7		=	37.56	(81)
Northwest 0.9x	0.77	x	0.9	9	x	67.9	6	x	0.63	×		0.7		=	61.68	(81)
Northwest 0.9x	0.77	x	0.9	9	x	91.3	5	x	0.63	×		0.7		=	82.91	(81)
Northwest 0.9x	0.77	x	0.9	9	x	97.3	8	x	0.63	×		0.7		=	88.39	(81)
Northwest 0.9x	0.77	x	0.9	9	x	91.1	1	x	0.63	×		0.7		=	82.69	(81)
Northwest 0.9x	0.77	x	0.9	9	x	72.6	3	x	0.63	×		0.7		=	65.92	(81)
Northwest 0.9x	0.77	x	0.9	9	x	50.4	2	x	0.63	×		0.7		=	45.77	(81)
Northwest 0.9x	0.77	x	0.9	9	x	28.0	7	x	0.63	×		0.7		=	25.48	(81)
Northwest 0.9x	0.77	x	0.9	9	x	14.2	2	x	0.63	×		0.7		=	12.89	(81)
Northwest 0.9x	0.77	x	0.9	9	x	9.21	1	x	0.63	×		0.7		=	8.36	(81)
Solar gains i	n watts calc		for each	mont	n			(83)m	= Sum(74)n	n (82)						_
(83)m= 17.07	<u> </u>	62.6	102.8	138.19	-	47.32 1	37.82	109		-		21.48	13.9	94		(83)
Total gains -	internal and	d solar	(84)m =	(73)m	+ (	83)m , w	atts	1	<b>I</b>	1	I					
(84)m= 355.4	8 370.32 3	85.45	405.87	421.45	4	11.58 3	90.26	368	.67 345.7	331	87 3	333.54	342.	.86		(84)
7. Mean inte	ernal temper	ature (	heating	seaso	n)	•			•							
	e during hea					area froi	m Tat	ole 9,	Th1 (°C)						21	(85)
•	actor for gair	•••			•				~ /							
Jan	<u> </u>	Mar	Apr	May	Ť		Jul	A	ug Sep		ct	Nov	De	ес		
(86)m= 1	1	1	0.99	0.96		0.88 (	0.74	0.7	9 0.95	0.9	9	1	1			(86)
Mean interr	al temperatu	ure in l	iving are	ea T1 (†	follo	w steps	3 to 7	r in T	able 9c)							
(87)m= 19.72	<u> </u>	20	20.3	20.61	-	i	20.96	20.	<u>_</u>	20.3	38	20.01	19.7	71		(87)
Temperatur	e during hea		ariode in	rest o	 f_dw		om Ta	hla (	 Th2 (°C)	_! \						
(88)m= 19.96	<u> </u>	19.97	19.98	19.98	_	<u> </u>	9.99	19.	<u> </u>		98	19.98	19.9	97		(88)
					_											
(89)m= 1	actor for gain	0.99	0.98	velling, 0.94	-	<u> </u>	1 able 0.6	9a) 0.6	6 0.91	0.9	a l	1	1			(89)
		0.99	0.90	0.94		0.01	0.0	0.0	0.91	0.9	5	I				(00)

Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (fe	ollow ste	eps 3 to ⁻	7 in Tabl	e 9c)				
(90)m=	18.25	18.38	18.67	19.11	19.55	19.88	19.97	19.96	19.75	19.23	18.68	18.24		(90)
()										fLA = Livin		4) =	0.38	(91)
											<b>0</b> • • • (	, ,	0.00	
Mean		l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	<u>A) × T2</u>	-	-			
(92)m=	18.81	18.93	19.18	19.57	19.95	20.25	20.35	20.34	20.13	19.67	19.19	18.8		(92)
Apply	adjustn	nent to t	he mear	n interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.81	18.93	19.18	19.57	19.95	20.25	20.35	20.34	20.13	19.67	19.19	18.8		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti	to the r	mean int	ernal te	mperatu	re obtain	ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
the ut	ilisation	factor fo	or gains	using Ta	able 9a		-	-		-				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for g	ains, hm	n:										
(94)m=	1	1	0.99	0.98	0.94	0.83	0.65	0.71	0.92	0.98	1	1		(94)
Usefu	l gains,	hmGm	, W = (9	4)m x (8	4)m	-	-	-	-	-	-	-		
(95)m=	354.56	368.97	382.83	398.57	397.82	341.85	254.99	261.07	316.68	326.78	332.05	342.13		(95)
Month	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)
Heat I	oss rate	e for me	an interr	al temp	erature,	Lm , W =	- =[(39)m :	x [(93)m	– (96)m	]				
(97)m=	1071.06	1032.68	931.17	773.81	597.4	404.73	268.5	281.4	433.91	656.23	878.97	1066.58		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mont	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
(98)m=	533.07	446.01	407.97	270.17	148.49	0	0	0	0	245.11	393.78	538.99		
								Tota	l per year	l (kWh/year	) = Sum(9	8)15.912 =	2983.59	(98)
Snoo	bootin	a roquir		k\A/b/m	lucar						, , , , , , , , , , , , , , , , , , ,		40.00	
Space	eneaun	g require	ementin	kWh/m ²	year								46.36	(99)
9a. En	ergy rec	luiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
-	e heatir	-												-
Fracti	on of sp	ace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	at from n	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 r	main spa	ace heat	ing syste	em 1								93.4	(206)
	,	•		0,		a ovetor	<b>0</b> /							(208)
EIIICIE		seconda	ry/suppi		y heating		1, 70						0	(200)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above)	)								
	533.07	446.01	407.97	270.17	148.49	0	0	0	0	245.11	393.78	538.99		
(211)m	ı = {[(98	)m x (20	4)] } x 1	00 ÷ (20	06)									(211)
	570.74	477.53	436.8	289.26	158.98	0	0	0	0	262.44	421.6	577.07		
I								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	3194.42	(211)
Snace	heatin	a fuel (s	econdar	y), kWh/	month									
•		•	00 ÷ (20		montin									
(215)m=	0	0		0	0	0	0	0	0	0	0	0		
()	Ŭ		Ĵ		Ĵ	Ŭ	, , , , , , , , , , , , , , , , , , ,		l (kWh/yea	-			0	(215)
\A/-+	h a - 11	_							(	, can(2	· · / 15,10. 12		U	
	heating		tor (ant-	ulotodic	hove)									
Juiput	184.37	ater nea 161.05	ter (caic 167.57	ulated a 148.62	bove) 143.89	126.73	121.42	135.36	136.85	155.83	166.35	180.04		
Efficier		ater hea		1-10.02	1-10.00	120.70	121.72	100.00	100.00	100.00	100.00	100.04	00.0	(216)
Enciel													80.3	(210)

(217)m= 8	37.57	87.48	87.21	86.54	85.13	80.3	80.3	80.3	80.3	86.19	87.14	87.64		(217)
Fuel for v		•												
(219)m = 2		<u>n x 100</u> 184.1	) ÷ (217) 192.15	m 171.75	169.03	157.83	151.21	168.56	170.42	180.81	190.89	205.44	1	
(219)11-2	10.55	104.1	192.15	171.75	109.03	157.05	151.21		I = Sum(2		190.69	205.44	2152.72	(219)
Annual t	otals										Wh/year		kWh/year	
Space he		fuel use	ed, main	system	1						, , , , , , , , , , , , , , , , , , ,		3194.42	7
Water he	eating	fuel use	d										2152.72	Ī
Electricity	y for p	umps, fa	ans and	electric l	keep-ho	t								
central l	heating	g pump:	:									30		(230c)
boiler w	rith a fa	an-assis	ted flue									45		(230e)
Total ele	ctricity	for the	above, ł	(Wh/yea	r			sum	of (230a)	(230g) =			75	(231)
Electricity	y for lig	ghting											351.84	(232)
12a. CC	)2 emi	ssions -	– Individ	ual heati	ng syste	ems inclu	uding mi	cro-CHF	)					
						_								
							<b>ergy</b> /h/year			kg CO	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/yea	
Space he	eating	(main s	ystem 1)	)		(211	l) x			0.2	16	=	689.99	(261)
Space he	eating	(second	lary)			(215	5) x			0.5	19	=	0	(263)
Water he	eating					(219	9) x			0.2	16	=	464.99	(264)
Space ar	nd wat	er heati	ng			(26)	I) + (262)	+ (263) + (	(264) =				1154.98	(265)
Electricity	y for p	umps, fa	ans and	electric l	keep-ho	t (23 ⁻	l) x			0.5	19	=	38.93	(267)
Electricity	y for lig	ghting				(232	2) x			0.5	19	=	182.6	(268)
Total CO	02, kg/y	year							sum o	of (265) (2	271) =		1376.51	(272)
														_

TER =

21.39 (273)

			User D	etails:						
Assessor Name:	Chris Hockne	ell		Strom	a Num	ber:			016363	
Software Name:	Stroma FSAF			Softwa				Versio	n: 1.0.4.10	
				Address:	Unit 7-F	Propose	d-Lean			
Address :	Unit 7, 40-42 N	Mill Lane, Lond	don, NW	6 1NR						
1. Overall dwelling dime	nsions:		A #0.0	(m2)			abt(m)		Volumo(m ³ )	
Ground floor			<b></b>	<b>a(m²)</b> 0.76	(1a) x	<b>Av. He</b> i	.11	(2a) =	<b>Volume(m³)</b> 86	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1c	l)+(1e)+(1n	I) 4	0.76	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	86	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m ³ per hour	
Number of chimneys	0	+ 0	+	0	] = [	0	x 4	40 =	0	(6a)
Number of open flues	0	+ 0	<u> </u> + [	0	ī = [	0	x 2	20 =	0	(6b)
Number of intermittent far	ns				- 	2	x ^	10 =	20	(7a)
Number of passive vents						0	x ^	10 =	0	(7b)
Number of flueless gas fi	res				Γ	0	x 4	40 =	0	(7c)
								Air ch	anges per ho	
Infilmation due to object		- (Co) (Cb) (7	a) (7b) (7	70) -	F					-
Infiltration due to chimney If a pressurisation test has be					continue fro	20 om (9) to (		÷ (5) =	0.23	(8)
Number of storeys in th						.,,,,	,		0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.						uction			0	(11)
if both types of wall are pr deducting areas of openin			the greate	er wall are	a (after					
If suspended wooden f			1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ent	ter 0.05, else ent	er 0							0	(13)
Percentage of windows	s and doors drau	ght stripped							0	(14)
Window infiltration				0.25 - [0.2		- T			0	(15)
Infiltration rate				(8) + (10)					0	(16)
Air permeability value,	· ·				•	etre of e	nvelope	area	5	(17)
If based on air permeabili						. , .	,		0.48	(18)
Air permeability value applies Number of sides sheltere		rest has been don	e or a deg	iree air pei	rmeability	is being us	sed			(19)
Shelter factor	u			(20) = 1 -	[0.075 x (1	9)] =			0.92	(19)
Infiltration rate incorporat	ing shelter factor	-		(21) = (18)	) x (20) =				0.45	_(21)
Infiltration rate modified for	-								0110	
		May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7	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	2)m ÷ 4									
	· · · · ·	1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
			-			-		-		

Adjusted infiltration rate (allowing for shelter and	d wind spe	eed) = (21a) x (	(22a)m					
0.57 0.56 0.55 0.49 0.48	-	0.42 0.41	0.45	0.48	0.5	0.52		
Calculate effective air change rate for the applic If mechanical ventilation:	cable case					Г		
If exhaust air heat pump using Appendix N, (23b) = (23a	u) x Emv (equ	ation (N5)) other	wise (23h	) = (23a)		Ľ	0	(23a)
If balanced with heat recovery: efficiency in % allowing for				(200)		l	0	(23b)
				Ob)ma L ((	20k) v [	_ (22م)	0	(23c)
a) If balanced mechanical ventilation with heat (24a)m= 0 0 0 0 0			$\frac{1}{0}$ $\frac{1}{0}$ $\frac{1}{0}$	$\frac{20}{10}$ m + (2	230) × [ 0	1 - (23C)	÷ 100]	(24a)
	-		-	-	•	0		(244)
b) If balanced mechanical ventilation without		0 0 24b	m = (22)	2) + m(d2	230)	0		(24b)
	-		-	0	0	0		(240)
c) If whole house extract ventilation or positiv if (22b)m < 0.5 × (23b), then (24c) = (23b	•			5 x (23h	)			
(24c)m = 0  0  0  0  0			0		/ 0	0		(24c)
d) If natural ventilation or whole house positiv	-	-	-		•			,
if $(22b)m = 1$ , then $(24d)m = (22b)m$ othe				0.5]				
(24d)m= 0.66 0.66 0.65 0.62 0.62	0.59	0.59 0.59	0.6	0.62	0.63	0.64		(24d)
Effective air change rate - enter (24a) or (24b	o) or (24c)	or (24d) in box	(25)	•				
(25)m= 0.66 0.66 0.65 0.62 0.62	0.59	0.59 0.59	0.6	0.62	0.63	0.64		(25)
3. Heat losses and heat loss parameter:	•					-		
ELEMENT Gross Openings	Net Area	ı U-valı		AXU		k-value	Δ	Xk
area (m ² ) m ²	A ,m ²	W/m2		(W/F	()	kJ/m²·k		J/K
Doors	2	<b>x</b> 1	=	2				(26)
Windows Type 1	0.99	x1/[1/( 1.4 )+	0.04] =	1.31				(27)
Windows Type 2	0.99	x1/[1/( 1.4 )+	0.04] =	1.31	=			(27)
Windows Type 3	1.58	x1/[1/( 1.4 )+	0.04] =	2.09	Ξ			(27)
Walls Type1 20.65 4.55	16.1	X 0.18		2.9	Ξ r			(29)
Walls Type2 2.62 2	0.62	X 0.18	≓ _	0.11	= i		╡ ├──	(29)
Walls Type3         3.08         0	3.08	x 0.18	≓ _	0.55	3			(29)
Walls Type4         21.91         0	21.91	x 0.18	<b>⊣</b> _	3.94	╡╏		$\exists$	(29)
Roof Type1         30.84         0	30.84	x 0.13		4.01	╡╏			(30)
					╡╏		$\dashv$	
	1.91	X 0.13	=	0.25				(30)
Total area of elements, m ²	81.01				r			(31)
Party wall	23.33	× 0	=	0	_		<b>」</b>	(32)
Party floor	40.76				L			(32a)
* for windows and roof windows, use effective window U-va ** include the areas on both sides of internal walls and part		d using formula 1/	[(1/U-valı	ıe)+0.04] a	s given in	paragraph	3.2	
Fabric heat loss, $W/K = S (A \times U)$	literie	(26) (30)	+ (32) =			Г	19.8	(33)
Heat capacity $Cm = S(A \times k)$			((28)	(30) + (32	) + (32a)	(32e) =	5449.13	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in	ı kJ/m²K			tive Value:			250	(35)
For design assessments where the details of the construction		nown precisely the	indicative	e values of	TMP in T	able 1f		` ′

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

12.12	(36	)

if details	s of therma	al bridging	are not kr	10wn (36) -	= 0.15 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			31.92	(37)
Ventila	ation hea	at loss ca	alculated	d monthl	у	-			(38)m	= 0.33 × (	25)m x (5)	)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	18.79	18.61	18.43	17.61	17.46	16.74	16.74	16.61	17.02	17.46	17.77	18.09		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (	38)m			
(39)m=	50.7	50.52	50.35	49.53	49.37	48.66	48.66	48.53	48.93	49.37	49.68	50.01	]	
Heat l	oss para	ameter (F	· HLP), W	/m²K	•	•				Average = = (39)m ÷		₁₂ /12=	49.53	(39)
(40)m=	1.24	1.24	1.24	1.22	1.21	1.19	1.19	1.19	1.2	1.21	1.22	1.23	]	
										Average =	Sum(40)1	12 / <b>12=</b>	1.22	(40)
Numb	er of day	ys 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	tina ene	rav reau	irement:								kWh/y	ear:	
		upancy, 9, N = 1		(1 - exp	o(-0.0003	349 x (TF		)2)] + 0.(	)013 x ( ⁻	TFA -13		.43		(42)
	A £ 13.	,												
								(25 x N) to achieve		se target o		8.08		(43)
		-		r day (all w		-	-	lo achieve	a walei ut	se largel o	1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
Hot wat				ייקרי ach month	-				Oep	000		Dec	J	
(44)m=	74.89	72.17	69.45	66.72	64	61.28	61.28	64	66.72	69.45	72.17	74.89	1	
()	14.00	/2.1/	00.40	00.72	04	01.20	01.20			Total = Su			817	(44)
Energy	content of	f hot water	used - cal	lculated me	onthly = 4.	190 x Vd,r	n x nm x D	) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) )			× /		017	
(45)m=	111.06	97.14	100.24	87.39	83.85	72.36	67.05	76.94	77.86	90.74	99.05	107.56		
		•	•	•	•	•		•		Total = Su	m(45) _{1 12} =	-	1071.22	(45)
lf instan	taneous v	vater heati	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46,	) to (61)	-	-			
(46)m=	16.66	14.57	15.04	13.11	12.58	10.85	10.06	11.54	11.68	13.61	14.86	16.13		(46)
	storage		\in alu din		olo <i>n</i> or \A		ataraga	within or		o o l			1	( 17 )
-							-	within sa	ame ves	sei		0	]	(47)
		•		ank in dw	•			. ,	ore) ont	or 'O' in (	47)			
	storage		not wate		iciuues i	nstantai		ombi boil	ers) erne		47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):					0	]	(48)
Tempe	erature f	actor fro	m Table	2b			• •					0		(49)
•				e, kWh/ye	ear		(48) x (49)	) =			0	]	(50)	
-			-	cylinder		or is not		( - / ( - )	, 			0	]	(00)
Hot wa	ater stor	age loss	factor fi	rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
	-	-	see secti	on 4.3									1	
		from Ta		. <b>0</b> h								0		(52)
			m Table									0		(53)
-			-	e, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter	(50) or	(54) in (5	oo)									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	rage, (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	nual) fro	om Table	e 3							0	Ì	(58)
	•	loss cal	,			59)m = (	(58) ÷ 36	65 × (41)	m					
(mo	dified by	factor fi	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	loss ca	lculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)	)m						
(61)m=	38.16	33.22	35.39	32.9	32.61	30.22	31.23	32.61	32.9	35.39	35.59	38.16		(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=	149.23	130.35	135.62	120.29	116.46	102.57	98.27	109.55	110.76	126.13	134.64	145.72		(62)
Solar Di	-IW input	calculated	using App	endix G o	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 \	WWHRS	applies	, see Ap	pendix (	<u>3)</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=	149.23	130.35	135.62	120.29	116.46	102.57	98.27	109.55	110.76	126.13	134.64	145.72		_
								Outp	out from w	ater heate	r (annual)₁	12	1479.61	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	[]	
(65)m=	46.47	40.6	42.18	37.28	36.03	31.61	30.1	33.74	34.11	39.02	41.83	45.3		(65)
inclu	ıde (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fi	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	ts	-			-	-	-			_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	71.33	71.33	71.33	71.33	71.33	71.33	71.33	71.33	71.33	71.33	71.33	71.33		(66)
Lightin	g gains	(calcula	ted in A	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m=	12.41	11.02	8.97	6.79	5.07	4.28	4.63	6.02	8.07	10.25	11.97	12.76		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5				
(68)m=	123.45	124.73	121.5	114.63	105.96	97.8	92.35	91.07	94.3	101.17	109.85	118		(68)
Cookir	ng gains	(calcula	ited in A	ppendix	L, equat	tion L15	or L15a)	), also se	ee Table	5				
(69)m=	30.13	30.13	30.13	30.13	30.13	30.13	30.13	30.13	30.13	30.13	30.13	30.13		(69)
Pumps	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	aporatio	n (nega	tive valu	es) (Tab	le 5)							•	
(71)m=	-57.07	-57.07	-57.07	-57.07	-57.07	-57.07	-57.07	-57.07	-57.07	-57.07	-57.07	-57.07	1	(71)
Water	heating	gains (T	able 5)	•						•	•		•	
(72)m=	62.46	60.42	56.69	51.78	48.43	43.91	40.46	45.34	47.38	52.44	58.1	60.89		(72)
Total i	nternal	gains =			•	(66)	)m + (67)m	n + (68)m -	⊦ (69)m +	(70)m + (7	1)m + (72)	)m	•	
(73)m=	245.72	243.57	234.56	220.6	206.86	193.39	184.84	189.83	197.16	211.27	227.31	239.05		(73)
6 So	lar gains	s.		•		•	•	•	•	•	•	•		

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	0.99	×	11.28	x	0.63	x	0.7	=	3.41	(75)
Northeast 0.9x	0.77	x	0.99	×	22.97	x	0.63	x	0.7	=	6.95	(75)
Northeast 0.9x	0.77	x	0.99	×	41.38	x	0.63	x	0.7	=	12.52	(75)
Northeast 0.9x	0.77	x	0.99	×	67.96	x	0.63	x	0.7	=	20.56	(75)
Northeast 0.9x	0.77	x	0.99	×	91.35	x	0.63	x	0.7	=	27.64	(75)
Northeast 0.9x	0.77	x	0.99	×	97.38	x	0.63	x	0.7	=	29.46	(75)
Northeast 0.9x	0.77	x	0.99	×	91.1	x	0.63	x	0.7	=	27.56	(75)
Northeast 0.9x	0.77	x	0.99	x	72.63	x	0.63	x	0.7	=	21.97	(75)
Northeast 0.9x	0.77	x	0.99	×	50.42	x	0.63	x	0.7	=	15.26	(75)
Northeast 0.9x	0.77	x	0.99	×	28.07	x	0.63	x	0.7	=	8.49	(75)
Northeast 0.9x	0.77	x	0.99	x	14.2	x	0.63	x	0.7	=	4.3	(75)
Northeast 0.9x	0.77	x	0.99	×	9.21	x	0.63	x	0.7	=	2.79	(75)
Southeast 0.9x	0.77	x	0.99	×	36.79	x	0.63	x	0.7	=	22.26	(77)
Southeast 0.9x	0.77	x	1.58	x	36.79	x	0.63	x	0.7	=	17.77	(77)
Southeast 0.9x	0.77	x	0.99	×	62.67	x	0.63	x	0.7	=	37.92	(77)
Southeast 0.9x	0.77	x	1.58	×	62.67	x	0.63	x	0.7	=	30.26	(77)
Southeast 0.9x	0.77	x	0.99	×	85.75	x	0.63	x	0.7	=	51.89	(77)
Southeast 0.9x	0.77	x	1.58	×	85.75	x	0.63	x	0.7	=	41.41	(77)
Southeast 0.9x	0.77	x	0.99	x	106.25	x	0.63	x	0.7	=	64.29	(77)
Southeast 0.9x	0.77	x	1.58	×	106.25	x	0.63	x	0.7	=	51.31	(77)
Southeast 0.9x	0.77	x	0.99	×	119.01	x	0.63	x	0.7	=	72.01	(77)
Southeast 0.9x	0.77	x	1.58	×	119.01	x	0.63	x	0.7	=	57.47	(77)
Southeast 0.9x	0.77	x	0.99	×	118.15	x	0.63	x	0.7	=	71.49	(77)
Southeast 0.9x	0.77	x	1.58	x	118.15	x	0.63	x	0.7	=	57.05	(77)
Southeast 0.9x	0.77	x	0.99	x	113.91	x	0.63	x	0.7	=	68.93	(77)
Southeast 0.9x	0.77	x	1.58	×	113.91	x	0.63	x	0.7	=	55	(77)
Southeast 0.9x	0.77	x	0.99	x	104.39	x	0.63	x	0.7	=	63.17	(77)
Southeast 0.9x	0.77	x	1.58	×	104.39	x	0.63	x	0.7	=	50.41	(77)
Southeast 0.9x	0.77	x	0.99	×	92.85	x	0.63	x	0.7	=	56.19	(77)
Southeast 0.9x	0.77	x	1.58	×	92.85	x	0.63	x	0.7	=	44.84	(77)
Southeast 0.9x	0.77	x	0.99	x	69.27	x	0.63	x	0.7	=	41.91	(77)
Southeast 0.9x	0.77	x	1.58	×	69.27	x	0.63	x	0.7	=	33.45	(77)
Southeast 0.9x	0.77	x	0.99	x	44.07	x	0.63	x	0.7	=	26.67	(77)
Southeast 0.9x	0.77	x	1.58	×	44.07	×	0.63	x	0.7	=	21.28	(77)
Southeast 0.9x	0.77	x	0.99	×	31.49	x	0.63	x	0.7	=	19.05	(77)
Southeast 0.9x	0.77	x	1.58	×	31.49	x	0.63	x	0.7	=	15.2	(77)

Solar g	ains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m	(82)m			
(83)m=	43.44	75.14	105.82	136.16	157.12	158.01	151.49	135.55	116.28	83.85	52.24	37.05	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	289.17	318.71	340.37	356.76	363.98	351.4	336.34	325.38	313.43	295.12	279.56	276.1	(84)

7. Me	an inter	nal temp	perature	(heating	season	)								
				` ·		,	from Tat	ole 9, Th	1 (°C)				21	(85)
		-	ains for			-			( )					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.99	0.96	0.91	0.78	0.61	0.65	0.86	0.97	0.99	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	bllow ste	ps 3 to 7	r in Tabl	e 9c)					
(87)m=	19.73	19.87	20.1	20.42	20.71	20.91	20.98	20.97	20.84	20.48	20.06	19.72		(87)
Temp	erature	durina h	neating p	eriods ir	n rest of	dwelling	I from Ta	ble 9, T	h2 (°C)					
(88)m=	19.89	19.89	19.89	19.91	19.91	19.92	19.92	19.93	19.92	19.91	19.9	19.9		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	wellina.	h2.m (se	e Table	9a)						
(89)m=	0.99	0.99	0.98	0.95	0.87	0.68	0.47	0.52	0.79	0.95	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	eps 3 to 1	7 in Tabl	le 9c)				
(90)m=	18.22	18.42	18.76	19.22	19.61	19.86	19.92	19.92	19.79	19.32	18.71	18.2		(90)
			1			1	1	1	1	fLA = Livin	ig area ÷ (4	4) =	0.62	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	llina) = f	I A × T1	+ (1 – fL	A) × T2					
(92)m=	19.15	19.32	19.59	19.96	20.29	20.51	20.57	20.57	20.44	20.04	19.54	19.14		(92)
Apply	adjustn	nent to t	he mear	interna	l temper	i ature fro	n Table	4e, whe	ere appro	opriate				
(93)m=	19.15	19.32	19.59	19.96	20.29	20.51	20.57	20.57	20.44	20.04	19.54	19.14		(93)
8. Sp	ace hea	ting requ	uirement								-			
						ned at st	ep 11 of	Table 9	b, so tha	it Ti,m=(	76)m an	d re-calc	ulate	
the ut	Jan	Feb	or gains Mar	Apr	1	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm		May	Jun	Jui	Aug	0ep			Dec		
(94)m=	0.99	0.99	0.98	0.95	0.88	0.74	0.56	0.6	0.83	0.96	0.99	0.99		(94)
Usefu	l gains,	hmGm	, W = (94	۱ 4)m x (8	ـــــــــــــــــــــــــــــــــــــ	1		1	1	1				
(95)m=	287.22	315.1	333.06	339.52	322.07	259.18	187.53	194.24	258.59	282.25	276.12	274.59		(95)
Month	nly aver	age exte	ernal 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)
		r		· · ·	i	1	<u> </u>	<u> </u>	– (96)m					(07)
(97)m=	753.08	728.4	659.04	547.77	424.05	287.56	193.27	202.2	310.27	465.85	618.12	746.91		(97)
Space (98)m=	346.6	277.74	242.52	149.94	75.87		ln = 0.02	24 X [(97	)m – (95 0	136.6	246.24	351.41		
(00)11	010.0	2	212.02	110.01	10.01	Ů	, °				r) = Sum(9		1826.92	(98)
Space	o hoatin	a roquir	ement in	k\//b/m2	Woor			1010	in por your	(10011) 9000	) Oum(0	<b>(</b> )15,912	44.82	(99)
		• •			•								44.02	(33)
			nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heatir ion of sp	-	at from s	econdar	y/supple	mentary	v system						0	(201)
Fracti	on of sp	ace 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)
			ace heat	-									93.4	(206)
	-		ry/supple	• •		g svsten	า. %					·	0	(208)
			J		,		,						Ŭ	

			<u> </u>	1		<u> </u>				-			1	
Cree	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	e neatin 346.6	g require 277.74	242.52	alculate	d above	) 0	0	0	0	136.6	246.24	351.41	1	
(211)m				100 ÷ (20		Ů		Ů		100.0	240.24	001.41	J	(211)
(211)11	371.09	297.37	259.66	160.54	81.23	0	0	0	0	146.25	263.64	376.24	]	(211)
								Tota	al (kWh/yea	I ar) =Sum(2	1 211) _{15,10. 12}	<u> </u>	1956.02	(211)
Space	e heatin	g fuel (s	econdar	ry), kWh/	month									
= {[(98	)m x (20	)1)]}x1	00 ÷ (20	)8)			•			•	-			
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	al (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
	heating	-	tor (oolo		hava)									
Output	149.23	ater nea 130.35	135.62	ulated a	116.46	102.57	98.27	109.55	110.76	126.13	134.64	145.72	]	
Efficie	ncy of w	ater hea	iter	I		I	1	I		1			80.3	(216)
(217)m=	87.1	86.91	86.5	85.61	84	80.3	80.3	80.3	80.3	85.25	86.55	87.19		(217)
		•	kWh/m											
` '	1 = (64) 171.32	m x 100 149.99	) ÷ (217 156.79	)m 140.52	138.64	127.74	122.38	136.43	137.94	147.94	155.56	167.14	1	
(213)11-	171.52	143.33	150.75	140.32	130.04	127.74	122.00		al = Sum(2		100.00	107.14	1752.4	(219)
Annua	al totals										Wh/yeaı		kWh/year	
			ed, main	system	1								1956.02	7
Water	heating	fuel use	d										1752.4	Ī
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatir	a pump	:									30	1	(230c)
		•••••	sted flue									45	]	(230e)
Total e	electricit	/ for the	above,	kWh/yea	r			sum	of (230a)	(230g) =	1	I	75	(231)
Electri	city for li	ahtina		2									219.2	(232)
	-		– Individ	lual heat	ina svste	ems incl	udina mi	cro-CHF	D					
120.				iddi fiodi	ing of ot		Ŭ							
							<b>ergy</b> /h/year			Emiss kg CO	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/yea	
Space	heating	(main s	ystem 1	)		(21	1) x			0.2	16	=	422.5	(261)
Space	heating	(secon	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(21	9) x			0.2	16	=	378.52	(264)
Space	and wa	ter heati	ng			(26	1) + (262)	+ (263) + (	(264) =				801.02	(265)
Electri	city for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	38.93	(267)
Electri	city for li	ghting				(23	2) x			0.5	19	=	113.76	(268)
Total (	- CO2, kg/	vear							sum o	of (265) (2			953.71	(272)
	, J	-											L	` ´
TER	=												23.4	(273)
													L	`



Appendix Energy Assessment 40-42 Mill Lane

LEAN Scenario

			User D	etails:						
	hris Hocknell troma FSAP 201	2		Stroma Softwa					016363 n: 1.0.4.10	
		P	roperty A	Address:	Unit 1-F	Proposed	d-Lean			
Address : U	nit 1, 40-42 Mill La	ne, Lono	don, NW	6 1NR						
1. Overall dwelling dimension	ns:									
Ground floor			Area		(1a) x	<b>Av. Hei</b>	i <b>ght(m)</b> .75	(2a) =	<b>Volume(m³)</b> 198	(3a)
Total floor area TFA = (1a)+(	1b)+(1c)+(1d)+(1e	)+(1n	)	72	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	198	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues		econdar eating 0 0	y · · · · · · · · · · · · · · · · · · ·	0 0 0	] = [ ] = [	<b>total</b> 0		40 = 20 =	m ³ per hour	(6a) (6b)
Number of intermittent fans						0	x	10 =	0	(7a)
Number of passive vents						0	x ′	10 =	0	](7b)
·								40 =	-	]
Number of flueless gas fires						0		+0 -	0	(7c)
								Air ch	anges per hou	ır
Infiltration due to chimneys, f If a pressurisation test has been a Number of storeys in the d	carried out or is intende				continue fro	0 om (9) to (		÷ (5) =	0	](8) ](9)
Additional infiltration	weining (ins)						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.25	or steel or timber f	rame or	0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are preser deducting areas of openings);	t, use the value corres _i if equal user 0.35	oonding to	the greate	er wall area	a (after					
If suspended wooden floor		ed) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, enter 0								·	0	(13)
Percentage of windows an Window infiltration	a doors draught st	ripped		0.25 - [0.2	v (14) ÷ 1	001 =		-	0	(14)
Infiltration rate				(8) + (10) ·		1	+ (15) =		0	(15)
Air permeability value, q50	expressed in cub	ic metre						area	0	(16) (17)
If based on air permeability v	•			•	•		molopo	aioa	0.35	(18)
Air permeability value applies if a						is being us	sed		0.00	
Number of sides sheltered									2	(19)
Shelter factor				(20) = 1 - [	0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporating	shelter factor			(21) = (18)	x (20) =				0.3	(21)
Infiltration rate modified for m	onthly wind speed								L	
Jan Feb Mai	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind speed	from Table 7									
(22)m= 5.1 5 4.9	4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m	÷ 4									
(22a)m= 1.27 1.25 1.23	1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltra	ation rat	e (allowi	ng for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m				_		
<b>.</b>	0.38	0.37	0.36	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.33	0.35			
	l <i>ate effec</i> echanica		-	rate for t	he appli	cable ca	se								(23a)
	naust air he			endix N. (2	(23a) = (23a	a) × Fmv (e	equation (N	N5)), othe	rwise (23b	) = (23a)				.5	(23b)
	anced with	• •	0		, ,	, ,	• •	,, .		, ()				.5 4.8	(23c)
			-	-	-					2b)m + (2	23h) x [1	1 – (23c)		1.0	
(24a)m=		0.5	0.49	0.45	0.45	0.41	0.41	0.4	0.42	0.45	0.46	0.48	]		(24a)
b) If	balance	d mecha	ı anical ve	ntilation	u without	heat rec	L Coverv (N	u MV) (24b	)m = (22	2b)m + (2	23b)		]		
(24b)m=	r	0	0	0	0	0	0	0	0	0	0	0	]		(24b)
c) If	whole h	ouse ex	tract ver	tilation of	r positiv	ve input v	ventilatio	n from c	outside			1	J		
,					•	•				5 × (23b	)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	]		(24c)
,	natural														
	if (22b)m		<u>,                                     </u>	,	ŕ	<u>`</u>		<u> </u>	, <u> </u>	<u> </u>			1		(244)
(24d)m=		0	0	0	0	0	0	0	0	0	0	0			(24d)
	ctive air		i	·	í .	<u> </u>	<u>, ,</u>	í	<u> </u>	0.45	0.40	0.40	1		(25)
(25)m=	0.51	0.5	0.49	0.45	0.45	0.41	0.41	0.4	0.42	0.45	0.46	0.48			(25)
3. He	at losse	s and he	eat loss p	paramete	er:										
ELEN	IENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-valu kJ/m²·		A X kJ/ł	
Doors			<b>、</b> ,			2	x	1.5	= [	3					(26)
Windo	ws Type	1				2.3	x1.	/[1/( 1.4 )+	0.04] =	3.05	=				(27)
Windo	ws Type	2				3.43		/[1/( 1.4 )+	0.04] =	4.55	=				(27)
Floor						72	x	0.25	= [	18	Ξ r				(28)
Walls	Type1	48.2	2	17.2	3	30.97	7 X	0.25		7.74	= i		=		(29)
Walls	Type2	14.9	96	0	=	14.96	> x	0.2		3.05	= i		=		(29)
Walls	Туре3	9.9	)	2		7.9	×	0.23		1.78	<b>-</b>				(29)
Total a	area of e	lements	, m²			145.0	6								⊐ (31)
Party	wall					40.96	3 X	0	=	0					(32)
Party	ceiling					72			'						(32b)
	ndows and de the area						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	∟ s given in	paragrapl	h 3.2		
	heat los							(26) (30)	+ (32) =				56	.42	(33)
	apacity			,					((28)	(30) + (32	!) + (32a)	(32e) =		)9.41	(34)
	al mass		. ,	• = Cm ÷	⊦ TFA) ir	n kJ/m²K			Indica	tive Value:	Medium			50	(35)
	ign assess used instea				construct	ion are not	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f			
	al bridge				using Ap	pendix ł	<						21	.76	(36)
	s of therma	•	,		• •								·		
Total f	abric he	at loss							(33) +	(36) =			78	.18	(37)
Ventila	ation hea		r	monthl	y	· · · · ·		i		= 0.33 × (2	25)m x (5)	)	1		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			

(38)m=	33.02	32.53	32.05	29.62	29.13	26.7	26.7	26.21	27.67	29.13	30.1	31.07		(38)
Heat tr	ansfer o	coefficie	nt. W/K						(39)m	= (37) + (3	1 38)m			
(39)m=	111.2	110.71	110.23	107.8	107.31	104.88	104.88	104.39	105.85	107.31	108.28	109.25		
											Sum(39)1	₁₂ /12=	107.67	(39)
1	-	· · · ·	HLP), W/	· · · · · ·				L	r	= (39)m ÷	r			
(40)m=	1.54	1.54	1.53	1.5	1.49	1.46	1.46	1.45	1.47	1.49	1.5	1.52	1.5	(40)
Numbe	er of day	s in mo	nth (Tab	le 1a)					,	Average -	Sum(40)1	12/12-	1.5	(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	iter heat	ting ene	rgy requi	irement:								kWh/ye	ar:	
if TF	A > 13.9 A £ 13.9	9, N = 1	+ 1.76 x							TFA -13.		29		(42)
Reduce	the annua	al average	ater usag hot water person per	usage by	5% if the a	lwelling is	designed			se target o		.68		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	97.54	94	90.45	86.9	83.35	79.81	79.81	83.35	86.9	90.45	94	97.54		_
Energy o	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		1064.1	(44)
(45)m=	144.65	126.51	130.55	113.82	109.21	94.24	87.33	100.21	101.41	118.18	129	140.09		
lf instant	aneous w	vater heati	ng at point	of use (no	o hot water	⁻ storage),	enter 0 in	boxes (46		Total = Su	m(45) _{1 12} =	-	1395.2	(45)
(46)m=	21.7	18.98	19.58	17.07	16.38	14.14	13.1	15.03	15.21	17.73	19.35	21.01		(46)
	storage													
-			) includir				-		ame ves	sei		0		(47)
Otherw		o stored	nd no ta hot wate		-			• •	ers) ente	er '0' in (	47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/dav):					0		(48)
			m Table			,	,					0		(49)
			· storage		ear			(48) x (49	) =			0		(50)
			eclared o	•										
		-	factor fr		le 2 (kW	h/litre/da	iy)					0		(51)
	•	from Ta		011 4.0								0		(52)
Tempe	rature f	actor fro	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)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	хH	
(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)
							. ,	65 × (41)						
	-	r	rom Tab	le H5 if t	i	i	er heati	ng and a	cylinde		<u>,                                     </u>		l	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	Iculated	for each	month (	(61)m =	(60) ÷ 36	65 × (41	)m						
(61)m=	49.71	43.26	46.09	42.86	42.48	39.36	40.67	42.48	42.86	46.09	46.35	49.71		(61)
Total h	eat 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=	194.36	169.78	176.64	156.67	151.69	133.6	128	142.69	144.26	164.27	175.36	189.8		(62)
Solar DH	IW input	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	y) (enter '0'	' if no sola	r contribut	ion to wate	er heating)		
(add ad	ditiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix G	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter				-				-	-		
(64)m=	194.36	169.78	176.64	156.67	151.69	133.6	128	142.69	144.26	164.27	175.36	189.8		
								Outp	out from wa	ater heate	r (annual)₁	12	1927.11	(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=	60.52	52.88	54.93	48.56	46.93	41.17	39.2	43.94	44.43	50.82	54.48	59.01		(65)
inclu	de (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	ernal q	ains (see	e Table 5	5 and 5a	):	-		-				-	-	
		ns (Table			,									
motabl	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68	114.68		(66)
Lightin	g gains	(calcula	ted in Ar	opendix	L. equat	ion L9 o	r L9a), a	llso see ⁻	Table 5					
(67)m=	18	15.99	13	9.84	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5		(67)
Appliar	nces da	ins (calc	ulated ir	n Append	dix L. ea	uation L	13 or L1	3a), also	see Ta	ble 5			I	
(68)m=	201.92	204.01	198.73	187.49	173.3	159.97	151.06	148.96	154.24	165.48	179.67	193.01		(68)
Cookin	a aains	(calcula	ted in A	ı ppendix	L. equat	ion L15	or L15a	), also se	e Table	5	I			
(69)m=		34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47	34.47		(69)
Pumps	and fa	ı ns gains	(Table !	1				ļ						
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
	e.a. ev	ı vaporatio	n (nega	ı tive valu	es) (Tab	le 5)								
(71)m=	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75	-91.75		(71)
		ı gains (T		ļ							ļ			
(72)m=	81.35	78.69	73.83	67.44	63.08	57.19	52.69	59.06	61.71	68.3	75.67	79.31		(72)
		gains =						n + (68)m +						
(73)m=	361.67	359.1	345.97	325.19	304.15	283.77	270.87	277.15	288.07	309.06	333.1	351.23		(73)
. ,	ar gain							20	200.07	000.00				( -)
			using sola	r flux from	Table 6a	and assoc	iated equa	ations to co	nvert to th	e applicat	ole orientat	ion.		
Orienta	ation:	Access F	actor	Area		Flu	х		g_		FF		Gains	

Onentation.	Table 6d	I	m²		Table 6a		9_ Table 6b		Table 6c		(W)	
Northeast 0.9>	0.77	x	3.43	x	11.28	×	0.57	x	0.7	] =	10.7	(75)
Northeast 0.9	0.77	x	3.43	x	22.97	×	0.57	×	0.7	] =	21.78	(75)

Northoast a s	-			1		7						
Northeast 0.9x	0.77	×	3.43	×	41.38	×	0.57		0.7	=	39.24	(75)
Northeast 0.9x		×	3.43	×	67.96	X	0.57	_  ×	0.7	=	64.45	(75)
Northeast 0.9x	•	×	3.43	×	91.35	X	0.57	_ × [	0.7	=	86.63	(75)
Northeast 0.9x	0.77	x	3.43	X	97.38	X	0.57	×	0.7	=	92.36	(75)
Northeast 0.9x	0.77	×	3.43	x	91.1	X	0.57	×	0.7	=	86.4	(75)
Northeast 0.9x	0.77	x	3.43	x	72.63	x	0.57	×	0.7	=	68.88	(75)
Northeast 0.9x	0.77	×	3.43	x	50.42	x	0.57	×	0.7	=	47.82	(75)
Northeast 0.9x	0.77	x	3.43	x	28.07	x	0.57	_ × [	0.7	=	26.62	(75)
Northeast 0.9x	0.77	x	3.43	x	14.2	x	0.57	_ x [	0.7	=	13.46	(75)
Northeast 0.9x	0.77	x	3.43	x	9.21	x	0.57	_ × [	0.7	=	8.74	(75)
Northwest 0.9x	0.77	x	2.3	x	11.28	x	0.57	×	0.7	=	43.05	(81)
Northwest 0.9x	0.77	x	2.3	x	22.97	x	0.57	_ × [	0.7	=	87.64	(81)
Northwest 0.9x	0.77	×	2.3	x	41.38	x	0.57		0.7	=	157.89	(81)
Northwest 0.9x	0.77	×	2.3	x	67.96	x	0.57		0.7	=	259.31	(81)
Northwest 0.9x	0.77	x	2.3	x	91.35	x	0.57		0.7	=	348.56	(81)
Northwest 0.9x	0.77	×	2.3	] ×	97.38	] x	0.57		0.7	=	371.6	(81)
Northwest 0.9x	0.77	×	2.3	] ×	91.1	] x	0.57	ī × Ī	0.7	=	347.62	(81)
Northwest 0.9x	0.77	×	2.3	] x	72.63	x	0.57	 × [	0.7		277.13	(81)
Northwest 0.9x	0.77	×	2.3	1 x	50.42	1 x	0.57	Ξ×Ϊ	0.7		192.4	(81)
Northwest 0.9x	0.77	×	2.3	i x	28.07	] x	0.57		0.7	=	107.1	(81)
Northwest 0.9x		×	2.3	] x	14.2	] x	0.57	k	0.7	=	54.17	(81)
Northwest 0.9x		×	2.3	i x	9.21	1 x	0.57	⊾ × [	0.7		35.16	(81)
				-	L	1		L				
Solar gains in	watts, calc	ulated	for each mon	ith		(83)m	n = Sum(74)m	(82)m				
(83)m= 53.75	1 1	97.14	323.76 435.1	-	63.96 434.03	346		133.72	67.64	43.9	]	(83)
Total gains –	internal and	l solar	(84)m = (73)r	n + (	83)m , watts	!	I		-		1	
(84)m= 415.43	468.52 5	43.11	648.94 739.3	4 7	47.73 704.9	623	.16 528.29	442.78	400.74	395.12		(84)
7 Mean inte	rnal temper	ature (	heating seas	on)			•		•		•	
					area from Tal	ble 9	. Th1 (°C)				21	(85)
-	•	• •		-	ee Table 9a)		, ( - )					` ´
Jan	<u> </u>	Mar	Apr Ma	`	Jun Jul	A	ug Sep	Oct	Nov	Dec	]	
(86)m= 1		0.99	0.97 0.9	-	0.76 0.61	0.6		0.99	1	1		(86)
Moon intorn:		uro in li	iving area T1		ow steps 3 to 7	1 7 in 7					1	
(87)m= 19.24	<u> </u>	19.71	20.17 20.5	<u> </u>	20.87 20.96	20.		20.17	19.65	19.24	1	(87)
								20.17	10.00	10.21	J	
		<u> </u>	1	_	velling from Ta	1		10.00	10.00	40.07	1	(00)
(88)m= 19.65	19.66 1	19.66	19.69 19.69	⁹	19.72 19.72	19.	73 19.71	19.69	19.68	19.67	J	(88)
	<u> </u>	i	1		,m (see Table	T Ó					1	
(89)m= 1	1 (	0.99	0.96 0.86		0.66 0.45	0.5	53 0.85	0.98	1	1	J	(89)
Mean interna	al temperatu	ure in t	he rest of dwo	elling	T2 (follow ste	eps 3	to 7 in Tabl	e 9c)				
(90)m= 17.35	17.58 1	18.03	18.72 19.29	9	19.64 19.71	19	.7 19.45	18.72	17.95	17.35		(90)
	_	_	_	_		_	f	LA = Liv	ing area ÷ (4	1) =	0.34	(91)

Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	A) × T2					
(92)m=	17.98	18.19	18.59	19.2	19.73	20.05	20.13	20.12	, 19.87	19.2	18.52	17.99		(92)
Apply	v adjustn	nent to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	17.83	18.04	18.44	19.05	19.58	19.9	19.98	19.97	19.72	19.05	18.37	17.84		(93)
8. Sp	ace hea	ting requ	uirement											
			ernal ter or gains	•		ied at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:					. <u> </u>					
(94)m=	1	0.99	0.98	0.95	0.85	0.67	0.49	0.57	0.85	0.97	0.99	1		(94)
Usefu	ul gains,	hmGm	, W = (94	4)m x (84	4)m						•			
(95)m=	413.68	465.13	533.96	615.5	631.48	503.29	344.04	353.65	449.14	430.55	397.86	393.78		(95)
Mont	hly aver	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 intern	al tempe	erature,	Lm , W =	=[(39)m x	x [(93)m	– (96)m	]				
(97)m=	1505.06	1454.34	1316.4	1094.58	845.6	556	354.27	372.19	594.43	907.15	1220.49	1489.7		(97)
Spac	e heatin	g require	ement fo	r each n	nonth, k۱	Nh/mont	h = 0.02:	24 x [(97]	)m – (95	)m] x (4	1)m			
(98)m=	811.99	664.75	582.14	344.94	159.3	0	0	0	0	354.6	592.29	815.36		
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	4325.37	(98)
Spac	e heatin	a require	ement in	kWh/m ²	/vear								60.07	(99)
					•	ystems i	ocluding	micro (	יחחי			l		
	e heatir	•		Nuual II	eating s	ysterns n	nciuuing	micro-c	, ir )					
•		-	at from s	econdar	v/supple	mentary	svstem						0	(201)
	-		at from m			<b>)</b>	•	(202) = 1 -	- (201) =				1	(202)
	-			-	. ,				02) × [1 – (	(203)] =				
			ng from	-				(204) - (20	02) ~ [1 - 1	(200)] –			1	(204)
	-		ace heat										90.3	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Spac	e heatin	g require	ement (c	alculate	d above	)								
	811.99	664.75	582.14	344.94	159.3	0	0	0	0	354.6	592.29	815.36		
(211)n	n = {[(98	)m x (20	4)] } x 1	00 ÷ (20	)6)									(211)
	899.21	736.16	644.67	381.99	176.42	0	0	0	0	392.69	655.91	902.95		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	4790	(211)
Spac	e heatin	a fuel (s	econdar	v), kWh/	month									
•			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)
Water	heating	1												
	-		ter (calc	ulated a	bove)	-								
	194.36	169.78	176.64	156.67	151.69	133.6	128	142.69	144.26	164.27	175.36	189.8		
Efficie	ncy of w	ater hea	iter								-		81	(216)
(217)m=	88.34	88.24	87.95	87.17	85.51	81	81	81	81	87.13	87.99	88.38		(217)
Fuel fo	or water	heating,	kWh/m	onth										
. ,			) ÷ (217)											
(219)m=	220.01	192.41	200.85	179.73	177.39	164.94	158.02	176.16	178.1	188.53	199.29	214.74		_
								Tota	I = Sum(21	19a). " =			2250.15	(219)

Annual totals			kWh/year		kWh/year	
Space heating fuel used, main system 1					4790	
Water heating fuel used				[	2250.15	]
Electricity for pumps, fans and electric keep-hot						
mechanical ventilation - balanced, extract or posit	tive input from ou	Itside		181.17		(230a)
central heating pump:				30		(230c)
Total electricity for the above, kWh/year		sum of (230a)	(230g) =	[	211.17	(231)
Electricity for lighting				[	317.91	(232)
12a. CO2 emissions – Individual heating systems	including micro-	CHP				
	<b>Energy</b> kWh/year		Emission fac kg CO2/kWh	tor	<b>Emissions</b> kg CO2/yea	r
Space heating (main system 1)	(211) x		0.216	=	1034.64	(261)
Space heating (secondary)	(215) x		0.519	= [	0	(263)
Water heating	(219) x		0.216	= [	486.03	(264)
Space and water heating	(261) + (262) + (26	3) + (264) =		[	1520.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	= [	109.6	(267)
Electricity for lighting	(232) x		0.519	= [	164.99	(268)
Total CO2, kg/year		sum o	f (265) (271) =	[	1795.26	(272)
Dwelling CO2 Emission Rate		(272)	÷ (4) =	[	24.93	(273)
El rating (section 14)				[	79	(274)

Assessor Name:       Chris Hocknell       Stroma Number:       STR0016363         Software Name:       Stroma FSAP 2012       Software Version:       Version: 1.0.4.10         Property Address:       Unit 2, 40-42 Mill Lane, London, NWØ 1NR         Address :       Unit 2, 40-42 Mill Lane, London, NWØ 1NR         Incomposition of the state of				User D	etails:						
Address :       Unit 2, 40-42 Mill Lane, London, NW6 1NR         I. Overall dwelling dimensions:       Area(m²)       Av. Height(m)       Volume(m³)         Ground floor $38.56$ (ia) x $2.75$ (2a) = $106.04$ (3a)         Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) $38.56$ (4) $2.75$ (2a) = $106.04$ (3a)         Owelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$ $106.04$ (5)         Vertilation rate:       main heating       secondary       other       total       m³ per hour         Number of chimneys $0$ $+$ $0$ $=$ $0$ $x40 =$ $0$ (6a)         Number of passive vents $0$ $x10 =$ $0$ (7e)         Number of flueless gas fires $0$ $x10 =$ $0$ (7c)         Number of storeys in the dwelling (ns)       Additional infiltration $(0)+1p(0.1 =$ $0$ $(0)$ $(0)$ $(0)$ $(0)$ $(0)$ $(0)$ $(0)$ $(0)$ $(0)$ $(1)$ $(0)$ $(0)$ $(1)$ $(0)$ $(1)$ $(0)$ $(1)$ $(0)$ $(1)$ $(1)$			12								
Area(m ² )       Av. Height(m)       Volume(m ³ )         Ground floor       38.56       (1a)       x       2.75       (2a)       =       106.04       (3a)         Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)       38.56       (1a)       x       2.75       (2a)       =       106.04       (3a)         Dwelling volume       (3a)+(3b)+(3c)+(3d)+(3c)+(3d)+(3e)+(3n)       =       106.04       (5) <b>2. Ventilation rate:</b> main       secondary       other       total       m ³ per hour         Number of chimneys       0       +       0       =       0       x40 =       0       (6a)         Number of popen flues       0       +       0       =       0       x40 =       0       (7a)         Number of intermittent fans       x10 =       0       (7a)       x40 =       0       (7b)       (7c)         Number of flueless gas fires       0       x40 =       0       (6a)       (7c)       (7c)       (7c)       (7c)         Number of storeys flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =       0       x40 =       0       (7c)       (7c)       (7c)       (7c)       (7c)       (7c)       (7c)			Pro	operty A	Address:	Unit 2-F	Proposed	d-Lean			
Area(m²) (38.56)Av. Height(m) (2.75)Volume(m²) (2a) =Ground floor $38.56$ $(1a) \times 2.75$ $(2a) = 106.04$ $(3a)$ Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ $38.56$ $(4)$ $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 106.04$ $(5)$ Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 106.04$ $(5)$ $(5)$ 2. Ventilation rate: $aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa$	Address :	Unit 2, 40-42 Mill L	ane, Lond	on, NW	6 1NR						
Ground floor $38.56$ $(1a) \times 2.75$ $(2a) =$ $106.04$ $(3a)$ Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ $38.56$ $(4)$ Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$ $106.04$ $(5)$ <b>2. Ventilation rate:</b> main heating $besting$ $other$ $total$ $m^3$ per hourNumber of chimneys $0$ $+$ $0$ $=$ $0$ $x40 =$ $0$ $(6a)$ Number of open flues $0$ $+$ $0$ $=$ $0$ $x20 =$ $0$ $(6b)$ Number of intermittent fans $0$ $x10 =$ $0$ $(7a)$ Number of flueless gas fires $0$ $x10 =$ $0$ $(7c)$ Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ $+$ $+$ $0$ $+$ Infiltration $(9)$ $(40)$ $0$ $(7c)$ $(9)$ $(10)$ Structural infiltration: $0.25$ for steel or timber frame or $0.35$ for masonry construction $(9)-(1)x.1 =$ $0$ $(11)$ If both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user $0.35$ $0$ $(12)$ $0$ $(12)$ If suspended wooden floor, enter $0.2$ (unsealed) or $0.1$ (sealed), else enter $0$ $0$ $(12)$ $0$ $(13)$	1. Overall dwelling dimer	nsions:									
Dwelling volume(3a)+(3c)+(3d)+(3e)+(3n) = 106.04 (5)2. Ventilation rate:Number of chimneys $\bigcirc$ $\bigcirc$ $\bigcirc$ $o$ $f$ $total$ $m^3$ per hourNumber of chimneys $\bigcirc$ $\bigcirc$ $+$ $\bigcirc$ $=$ $\bigcirc$ $x40 =$ $\bigcirc$ (6a)Number of open flues $\bigcirc$ $+$ $\bigcirc$ $=$ $\bigcirc$ $x40 =$ $\bigcirc$ (6b)Number of intermittent fans $\bigcirc$ $x10 =$ $\bigcirc$ (7a)Number of passive vents $\bigcirc$ $x10 =$ $\bigcirc$ (7b)Number of flueless gas fires $\bigcirc$ $\bigcirc$ $\bigcirc$ $\bullet$ $\bigcirc$ $\bigcirc$ $\bigcirc$ $(-)$ $\bigcirc$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $(-)$ $($	Ground floor			-	· ·	(1a) x	-	,	(2a) =		-
2. Ventilation rate:       main heating       secondary heating       other       total       m³ per hour         Number of chimneys $0$ $+$ $0$ $+$ $0$ $=$ $0$ $x40 =$ $0$ (6a)         Number of open flues $0$ $+$ $0$ $=$ $0$ $x40 =$ $0$ (6a)         Number of open flues $0$ $+$ $0$ $=$ $0$ $x20 =$ $0$ (6b)         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)         Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7c) = $0$ $+$ $(6)$ $(7c)$ Number of storeys in the dwelling (ns)       Additional infiltration $(9)$ $(9)$ $(10)$ $(9)$ $(10)$ $(11)$ $0$ $(11)$ $0$ $(11)$ $0$ $(11)$ $0$ $(11)$ $0$ $(12)$ $0$ $(12)$ $0$ $(12)$ $0$ $(12)$ <	Total floor area TFA = (1a	)+(1b)+(1c)+(1d)+(1	e)+(1n)	) 38	8.56	(4)					
main heatingsecondary heatingothertotalm³ per hourNumber of chimneys $0$ $+$ $0$ $=$ $0$ $x40 =$ $0$ (6a)Number of open flues $0$ $+$ $0$ $=$ $0$ $x20 =$ $0$ (6b)Number of intermittent fans $0$ $+$ $0$ $=$ $0$ $x10 =$ $0$ (7a)Number of passive vents $0$ $x10 =$ $0$ (7b)Number of flueless gas fires $0$ $x40 =$ $0$ (7c)Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ $0$ $+$ $0$ $(7c)$ Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ $0$ $+$ $0$ $(7c)$ Number of storeys in the dwelling (ns) $Additional infiltration$ $(9)$ $(9)$ $(9)$ Additional infiltration: $0.25$ for steel or timber frame or $0.35$ for masonry construction $0$ $(11)$ $if both types of wall are present, use the value corresponding to the greater wall area (afterdeducting areas of openings); if equal user 0.350(12)If no draught lobby, enter 0.2 (unsealed) or 0.1 (sealed), else enter 00(12)If no draught lobby, enter 0.5, else enter 00(13)$	Dwelling volume					(3a)+(3b)	+(3c)+(3d	)+(3e)+	.(3n) =	106.04	(5)
heatingheatingheatingNumber of chimneys $0$ $+$ $0$ $+$ $0$ $=$ $0$ $x40 =$ $0$ $(6a)$ Number of open flues $0$ $+$ $0$ $=$ $0$ $x20 =$ $0$ $(6b)$ Number of intermittent fans $0$ $x10 =$ $0$ $(7a)$ Number of passive vents $0$ $x10 =$ $0$ $(7a)$ Number of flueless gas fires $0$ $x40 =$ $0$ $(7c)$ Number of flueless gas fires $0$ $x40 =$ $0$ $(7c)$ Number of storeys, flues and fans = $(6a)+(6b)+(7a)+(7c) =$ $0$ $+$ $(5) =$ $0$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) $(9)$ $(9)$ Additional infiltration $(9)-1]x0.1 =$ $0$ $(9)$ Structural infiltration: $0.25$ for steel or timber frame or $0.35$ for masonry construction $(9)-1]x0.1 =$ $0$ if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user $0.35$ $0$ $(12)$ If no draught lobby, enter $0.05$ , else enter $0$ $0$ $(13)$ Description function function for the diverse of	2. Ventilation rate:		-								
Number of passive vents $0$ $x 10 =$ $0$ $(14)$ Number of flueless gas fires $0$ $x 40 =$ $0$ $(7b)$ Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ $0$ $x 40 =$ $0$ $(7c)$ Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ $0$ $+ (5) =$ $0$ $(8)$ If a pressurisation test has been carried out or is intended, proceed to $(17)$ , otherwise continue from $(9)$ to $(16)$ $0$ $(9)$ Number of storeys in the dwelling (ns) $0$ $(9)$ $(9)-1]x0.1 =$ $0$ Additional infiltration $(9)-1]x0.1 =$ $0$ $(11)$ Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction $0$ $(11)$ if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 $0$ $(12)$ If no draught lobby, enter 0.05, else enter 0 $0$ $(12)$ $0$ $(13)$	2	heating 0 + [	heating 0	, <u> </u>	0	ļĽ	0			0	(6a)
Number of passive vents $0$ $x 10 =$ $0$ $(7b)$ Number of flueless gas fires $0$ $x 40 =$ $0$ $(7c)$ Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ $0$ $+(5) =$ $0$ $(8)$ If a pressurisation test has been carried out or is intended, proceed to $(17)$ , otherwise continue from $(9)$ to $(16)$ $0$ $(9)$ Number of storeys in the dwelling (ns) $0$ $(9)$ $(9)-1]x0.1 =$ $0$ Additional infiltration $(9)-1]x0.1 =$ $0$ $(11)$ Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction $0$ $(11)$ if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 $0$ $(12)$ If no draught lobby, enter 0.05, else enter 0 $0$ $(12)$ Democrators of openings of both types of wall area (after deducting areas of openings); if equal user 0.35 $0$ $(13)$	Number of intermittent far	IS L					0	x 1	10 =	0	] (7a)
Number of flueless gas fires $0$ $x 40 =$ $0$ $(7c)$ Air changes per hourInfiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c) =$ $0$ $+ (5) =$ $0$ $(8)$ If a pressurisation test has been carried out or is intended, proceed to $(17)$ , otherwise continue from $(9)$ to $(16)$ Number of storeys in the dwelling (ns) $0$ $(9)$ Additional infiltration $[(9)-1]x0.1 =$ $0$ $(10)$ Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction $0$ $(11)$ <i>it both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35$0$$(12)$If no draught lobby, enter 0.05, else enter 0$0$$(13)$</i>	Number of passive vents							x 1	10 =		
Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Descentation of the descentation of the second of the greater wall area (after of the second of the greater of the second of the second of the greater of the second											-
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c) = 0$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration [(9)-1]x0.1 = 0 (10) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Dementation of the present	Number of flueless gas fir	es					0		+0 -	0	(7c)
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c) = 0$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration [(9)-1]x0.1 = 0 (10) Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 If no draught lobby, enter 0.05, else enter 0 Dementation of the present									Air ch	anges per ho	ur
Additional infiltration       [(9)-1]x0.1 =       0       (10)         Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction       0       (11)         if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35       0       (12)         If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0       0       (13)         Dementance of fuein dump and dumpt to the private dements of the private dumpt to the	If a pressurisation test has be	en carried out or is intend				continue fro	•		÷ (5) =		_ _
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction       0       (11)         if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35       0       (12)         If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0       0       (12)         If no draught lobby, enter 0.05, else enter 0       0       (13)	•	e dwelling (HS)						[(9)-	-11x0 1 =		-
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0 0 (13) Demonstrates of fusic device and device the trianged		25 for steel or timber	r frame or (	0 35 for	masonr	v constri	uction	[(0)	170.1		=
If no draught lobby, enter 0.05, else enter 0	if both types of wall are pre deducting areas of opening	esent, use the value corre gs); if equal user 0.35	esponding to t	the greate	er wall area	a (after				0	
	-		aled) or 0.1	l (seale	d), else	enter 0				0	(12)
Dereenters of windows and doors draught stripped										0	=
	<b>U</b>	and doors draught	stripped		0.05 10.0		001 -		-	0	(14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0(15)Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$ 0(16)							1	(15) -			=
		EQ overcood in ou	bio motroo						oroo		
V(1) = V(1) +	• •			•				ivelope	alea		4
If based on air permeability value, then $(18) = [(17) + 20]+(8)$ , otherwise $(18) = (10)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used (18)	•						is being us	sed		0.35	
Number of sides sheltered 3 (19)				Ū	,	,	U			3	(19)
Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ (20)	Shelter factor			(	(20) = 1 - [	0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.27$ (21)	Infiltration rate incorporation	ng shelter factor		(	(21) = (18)	x (20) =				0.27	(21)
Infiltration rate modified for monthly wind speed	Infiltration rate modified for	r monthly wind spee	ed								_
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb I	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind speed from Table 7	Monthly average wind spe	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	(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 $\div$ 4	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	(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 (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
	0.35	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32		
			-	rate for t	he appli	cable ca	se	-		-	-		-	
		al ventila		andix NL (2	(2b) = (22c)	$(a) \times Em(a)$	austion (I	N5)) , othei	wine (22h	) = (22a)			0.5	(23a)
		• •	0 11		, ,	, ,		,, -	,	) – (23a)			0.5	(23b)
			-	-	-			n Table 4h		<b>N N N N</b>		4 (00)	74.8	(23c)
		i	i	<b></b>		i	<u> </u>	<u> </u>	, ,	· · · ·		1 - (23c)	) ÷ 100] 1	(24a)
(24a)m=		0.47	0.46	0.42	0.42	0.38	0.38	0.38	0.4	0.42	0.43	0.44	J	(24a)
	r		· · · · · ·			· · · · · ·	· · · ·	MV) (24b	, ,	, <u>,</u>	· · · · · · · · · · · · · · · · · · ·		1	
(24b)m=		0	0	0	0	0	0	0	0	0	0	0		(24b)
,					•	•		on from c c) = (22b		5 × (23b	))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,					•	•		on from l 0.5 + [(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 (24	c) or (24	d) in boy	(25)					
(25)m=	0.47	0.47	0.46	0.42	0.42	0.38	0.38	0.38	0.4	0.42	0.43	0.44	]	(25)
3 He	at losse	s and he	at loss i	paramete	≏r.								-	
ELEN		Gros		Openin		Net Ar	ea	U-valı	IE	AXU		k-value	<u>α</u> Δ	Xk
		area		m		A ,r		W/m2		(W/I	<)	kJ/m²·		I/K
Windo	ws					3.43	x1	/[1/( 1.4 )+	0.04] =	4.55				(27)
Floor						38.56	3 X	0.25	] = [	9.64				(28)
Walls	Type1	16.5	51	3.43	;	13.08	3 X	0.25	 	3.27	i F		$\exists$	(29)
Walls ⁻	Type2	3.9	5	0		3.95	×	0.23		0.89	= i		$\dashv$	(29)
Total a	area of e	lements	, m²	L		59.02	2	L	เ		I			(31)
Party v						57.49		0	= [	0				(32)
Party of						38.56			[		I		$\dashv$	(32b)
	Ū	roof wind	ows, use e	effective wi	ndow U-va	L		n formula 1	/[(1/U-valu	ie)+0.041 a	l Is aiven in	paragraph	 132	
				nternal wal				,			ie gireir in	paragrapi		
Fabric	heat los	s, W/K	= S (A x	U)				(26) (30)	+ (32) =				18.35	(33)
Heat c	apacity	Cm = S	(Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	8086.62	(34)
Therm	al mass	parame	ter (TMF	⊃ = Cm ÷	- TFA) ir	n kJ/m²K	•		Indica	tive Value	Medium		250	(35)
	-		ere the de tailed calc		construct	ion are noi	t known pi	recisely the	indicative	values of	TMP in T	able 1f		_
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix l	<						8.85	(36)
			are not kn	own (36) =	= 0.15 x (3	1)								_
Total fa	abric he	at loss							(33) +	(36) =			27.2	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y			i	(38)m	= 0.33 × (	25)m x (5	)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ł	
(38)m=	16.51	16.27	16.04	14.85	14.61	13.43	13.43	13.19	13.9	14.61	15.09	15.56	J	(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	43.71	43.48	43.24	42.05	41.81	40.63	40.63	40.39	41.1	41.81	42.29	42.76		
										Average =	Sum(39)	12 /12=	41.99	(39)

Heat lo	oss para	imeter (I	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.13	1.13	1.12	1.09	1.08	1.05	1.05	1.05	1.07	1.08	1.1	1.11		
Numbe	er of day	/s in mo	nth (Tab	le 1a)	•			•	,	Average =	Sum(40)1	₁₂ /12=	1.09	(40)
- turnot	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	iter hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
if TF				(1 - exp	0(-0.0003	349 x (TF	FA -13.9	9)2)] + 0.(	0013 x ( ⁻	TFA -13		37		(42)
Reduce	the annua	al average	hot water	usage by		lwelling is	designed	(25 x N) to achieve		se target o		6.7		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	73.37	70.71	68.04	65.37	62.7	60.03	60.03	62.7	65.37	68.04	70.71	73.37		
<b>-</b>						100 V.d.					m(44) _{1 12} =		800.45	(44)
			. <u> </u>	. <u> </u>	· ·			DTm / 3600		-			I	
(45)m=	108.81	95.17	98.21	85.62	82.15	70.89	65.69	75.38	76.28	88.9	97.04	105.38	10.10 -0	
lf instan	taneous w	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46		Total = Su	m(45) _{1 12} =		1049.52	(45)
(46)m=	16.32	14.28	14.73	12.84	12.32	10.63	9.85	11.31	11.44	13.33	14.56	15.81		(46)
· · ·	storage	loss:				I	I	1		I				
Storag	e volum	e (litres)	) includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
Otherv Water	vise if no storage	o stored loss:	hot wate	er (this ir		nstantar	neous co	n (47) ombi boil	ers) ente	er '0' in (	47)			
,					or is kno	wn (kWł	n/day):					0		(48)
•		actor fro										0		(49)
			-	e, kWh/ye cylinder	ear loss fact	or is not	known:	(48) x (49)	) =			0		(50)
,					le 2 (kW							0		(51)
		neating s		on 4.3										
		from Ta		0								0		(52)
		actor fro							(50) (	50)		0		(53)
		om water (54) in (8	-	e, kWh/y	ear			(47) x (51)	) X (52) X (	53) =		0		(54) (55)
	. ,	. , .	,	for each	month			((56)m = (	55) × (41)	m		0		(00)
(56)m=						0	0		0	0	0	0		(56)
	-	÷	-	-	-		-	50), else (5	-	-		-	ix H	(00)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
								I -						(58)
	-	•	,	om Table for each		59)m = 4	(58) ÷ 34	65 × (41)	m			0		(00)
								ng and a		r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
		-	-		-		-	-	-	-			•	

Combi	loss ca	lculated	for eac	h m	onth (	61)m =	(60	) ÷ 36	65 × (41)	)m									
(61)m=	37.39	32.54	34.67	3	2.24	31.95	2	9.61	30.59	31.9	5	32.24	34.67	7 (	34.87	37.	39		(61)
Total h	eat req	uired for	water	heat	ing ca	lculated	l fo	r each	n month	(62)n	n =	0.85 × (	(45)m	+ (40	6)m +	(57)	m +	(59)m + (61)m	
(62)m=	146.2	127.71	132.88	3 1'	17.86	114.1	1	00.5	96.28	107.3	33	108.52	123.5	7 1	31.91	142	.77		(62)
Solar DH	IW input	calculated	using Ap	pend	lix G or	Appendix	:Н(	negativ	/e quantity	) (ente	er '0'	if no sola	r contrib	oution	to wate	er hea	ting)		
(add ad	dditiona	al lines if	FGHR	S an	d/or V	VWHRS	ap	plies,	see Ap	pendi	хG	G)							
(63)m=	0	0	0		0	0		0	0	0		0	0		0	0	)		(63)
Output	from w	ater hea	ter													-			
(64)m=	146.2	127.71	132.88	3 1'	17.86	114.1	1	00.5	96.28	107.3	33	108.52	123.5	7 1	31.91	142	.77		
										C	Dutp	out from wa	ater hea	iter (a	nnual)1	12		1449.64	(64)
Heat g	ains fro	m water	heating	g, kV	Vh/mo	onth 0.2	5 ´	[0.85	× (45)m	+ (61	l)m	] + 0.8 x	(46)r	m +	(57)m	+ (5	9)m	1	
(65)m=	45.53	39.78	41.32		6.53	35.3	<u> </u>	- 0.97	29.49	33.0	÷ i	33.42	38.23	_	40.98	44.	,	-	(65)
inclu	de (57)	)m in calo	ulatior	n of (	65)m	onlv if c	vlir	nder is	s in the c	dwelli	na (	or hot w	ater is	fron	n com	muni	itv h	eating	
	. ,	ains (see			. ,	-	,				0						,	5	
					ia daj	/•													
Melab	Jan	ns (Table Feb	Mar		Apr	May		Jun	Jul	Au	a	Sep	Oct	-	Nov	П	ес		
(66)m=	68.43	68.43	68.43		8.43	68.43		8.43	68.43	68.4	<u> </u>	68.43	68.43		58.43	68.			(66)
i i		(calcula																	()
(67)m=	12.14	10.78	8.77	<u> </u>	6.64	_, equat 4.96	<u> </u>	1.19	4.53	5.88	- 1	7.9	10.03		11.7	12.	48	l	(67)
`´														<u> </u>	11.7	12.	40		(0.)
· · ·		ains (calc			· ·		r			,	- T		· · · · ·		04.04	440	70	I	(69)
(68)m=	117.93		116.07		09.5	101.22		3.43	88.23	87		90.09	96.65		04.94	112	.73		(68)
		s (calcula		<u> </u>			<u> </u>				-							I	(00)
(69)m=	29.84	29.84	29.84	2	9.84	29.84	2	9.84	29.84	29.8	4	29.84	29.84		29.84	29.	84		(69)
Pumps	and fa	ns gains	(Table	5a)												<del></del>			
(70)m=	3	3	3		3	3		3	3	3		3	3		3	3	8		(70)
Losses	e.g. e	vaporatio	n (neg	ative	e value	es) (Tab	le	5)					-						
(71)m=	-54.74	-54.74	-54.74	-5	54.74	-54.74	-5	54.74	-54.74	-54.7	74	-54.74	-54.74	4 -	54.74	-54	.74		(71)
Water	heating	gains (T	able 5	)															
(72)m=	61.19	59.2	55.54	5	0.73	47.45	4	3.02	39.64	44.4	3	46.42	51.38	3 !	56.92	59.	66		(72)
Total i	nterna	l gains =					_	(66)	m + (67)m	+ (68)	m +	· (69)m + (	(70)m +	(71)n	n + (72)	)m			
(73)m=	237.79	235.66	226.91	2	13.4	200.16	18	37.16	178.92	183.8	34	190.93	204.5	9 2	20.09	231	.39		(73)
6. Sol	ar gain	s:																	
Solar g	ains are	calculated	using so	lar flu	IX from	Table 6a	and	associ	ated equa	tions to	o coi	nvert to th	e applic	able	orientat	tion.			
Orienta		Access F			Area			Flu			-	g_		<b>T</b> - I.	FF			Gains	
	-	Table 6d			m²			Tac	ole 6a		li	able 6b			le 6c			(W)	_
Northea	ist <mark>0.9x</mark>	0.77		×	3.4	3	x	1	1.28	x		0.57	x		0.7		=	10.7	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	3.4	3	x	2	2.97	x		0.57	x		0.7		=	21.78	(75)
Northea	ist <mark>0.9x</mark>	0.77		×	3.4	3	x	4	1.38	x		0.57	×		0.7		=	39.24	(75)
Northea	ist <mark>0.9x</mark>	0.77		×	3.4	3	x	6	7.96	x		0.57	x		0.7		=	64.45	(75)
Northea	ist <mark>0.9x</mark>	0.77		×Ē	3.4	3	x	9	1.35	x		0.57	x		0.7		=	86.63	(75)

	_													
Northea	ist <mark>0.9x</mark>	0.77	×	3.4	3	<b>x</b>	97.38	×	0.57	x	0.7	=	92.36	(75)
Northea	ist <mark>0.9x</mark>	0.77	×	3.4	.3	x	91.1	x	0.57	x	0.7	=	86.4	(75)
Northea	ist <mark>0.9x</mark>	0.77	×	3.4	3	x	72.63	x	0.57	x	0.7	=	68.88	(75)
Northea	ist <mark>0.9x</mark>	0.77	x	3.4	-3	x	50.42	x 🗌	0.57	x	0.7	=	47.82	(75)
Northea	ist <mark>0.9x</mark>	0.77	x	3.4	.3	x	28.07	x	0.57	x	0.7	=	26.62	(75)
Northea	ist <mark>0.9x</mark>	0.77	x	3.4	3	x	14.2	x	0.57	x	0.7	=	13.46	(75)
Northea	ist <mark>0.9x</mark>	0.77	x	3.4	.3	x	9.21	x	0.57	x	0.7	=	8.74	(75)
	_													
Solar g	ains in	watts, ca	alculated	for eac	n month	-		(83)m =	Sum(74)m	(82)m				
(83)m=	10.7	21.78	39.24	64.45	86.63	92.36	86.4	68.88	47.82	26.62	13.46	8.74		(83)
Total g	ains – i	nternal a	ind solar	(84)m =	= (73)m ·	+ (83)m	, watts		_	i		·		
(84)m=	248.49	257.44	266.15	277.85	286.79	279.53	265.32	252.72	238.75	231.21	233.56	240.13		(84)
7. Me	an inter	nal temp	erature	(heating	season	)								
Temp	erature	during h	leating p	eriods ir	n the livi	ng area	from Tal	ble 9, T	h1 (°C)				21	(85)
Utilisa	ition fac	tor for g	ains for I	iving are	ea, h1,m	(see Ta	able 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.98	0.94	0.81	0.65	0.69	0.91	0.98	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	Dlow ste	eps 3 to 7	7 in Tal	le 9c)					
(87)m=	19.82	19.92	20.11	20.42	20.7	20.92	20.98	20.97	20.83	20.49	20.13	19.82		(87)
Tomp	oroturo	durina h		oriodo ir	root of	dwolling	I from To				<b></b>			
(88)m=	19.97	19.98	19.98	20.01	20.01	20.04	g from Ta 20.04	20.04	20.03	20.01	20	19.99		(88)
								1	20.00	20.01	20	10.00		()
r		<u> </u>				r È	ee Table	T Ó						(00)
(89)m=	1	0.99	0.99	0.97	0.91	0.73	0.52	0.57	0.85	0.97	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (1	follow ste	eps 3 to	7 in Tab	le 9c)		-	L	
(90)m=	18.41	18.55	18.84	19.3	19.7	19.98	20.03	20.03	19.88	19.41	18.87	18.43		(90)
									1	fLA = Livir	ig area ÷ (	4) =	0.69	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 –	fLA) × T2					
(92)m=	19.38	19.49	19.72	20.07	20.39	20.63	20.69	20.68	20.54	20.15	19.74	19.39		(92)
Apply	adjustr	nent to t	he mean	internal	temper	ature fro	om Table	e 4e, wł	nere appro	opriate				
(93)m=	19.23	19.34	19.57	19.92	20.24	20.48	20.54	20.53	20.39	20	19.59	19.24		(93)
8. Spa	ace hea	ting requ	uirement											
				•		ied at st	ep 11 of	Table	9b, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the ut	-		or gains						0	0.1	New	Du	l	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	1	0.99	ains, hm 0.99	0.97	0.92	0.77	0.59	0.63	0.87	0.97	0.99	1		(94)
			W = (94			0.11	0.00	0.00	0.07	0.07	0.00	'		(0.)
(95)m=	247.35	255.83	263.16	269.92	263.01	215.3	155.6	160.42	208.6	225.18	231.7	239.21		(95)
			rnal tem							L	L		l	. /
(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)
							=[(39)m	x [(93)i	<u> </u>	ı 1	I	I	I	
(97)m=	652.74	627.8	564.95	463.41	357.19	, 238.72	159.91	166.83		393.13	528.05	643.18		(97)
Space	e heatin	g require	ement fo	r each n	honth, k	Nh/mon	th = 0.02	24 x [(9	7)m – (95	j)m] x (4	1)m	<u>.</u>	I	
(98)m=	301.61	249.96	224.53	139.31	70.07	0	0	0	0	124.95	213.37	300.55		
L		•					•	•	•	-	•	•	•	

								Tota	l per year	(kWh/yea	r) = Sum(9	8)15,912 =	1624.35	(98)
Space	e heatin	g require	ement in	ı kWh/m²	²/year								42.13	(99)
9a. En	ergy red	quiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	HP)					
-	e heatii	-												
				econdar		ementary	-	(202) = 4	(201) -				0	(201)
				nain syst	. ,			(202) = 1 -		(000)]			1	(202)
			-	main sys				(204) = (20	02) × [1 –	(203)] =			1	(204)
		•		ing syste									90.3	(206)
Efficie	ency of :	seconda	ry/suppl	ementar	y heating	g systen	1, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin 301.61	<u> </u>	·`		i	í	0	0	0	124.95	212 27	200 55	l	
(0.4.4)		249.96	224.53	139.31	70.07	0	0	0	0	124.95	213.37	300.55		
(211)m	1 = {[(98 334.01	)m x (20 276.81	4)]}X1 248.65	100 ÷ (20	77.6	0	0	0	0	138.37	236.29	332.84		(211)
	334.01	270.01	240.03	134.27	77.0	0	0		-		230.29 211) _{15,10.12}		1798.84	(211)
Snac	- heatin	a fuel (s	econdar	y), kWh/	month					, (	/15,10. 12	2	1700.04	](=)
•		)1)]}x1		•	montan									
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
				-				Tota	l (kWh/yea	ar) =Sum(:	215) _{15,10. 12}	2	0	(215)
	heating	-												
Output	from w	ater hea 127.71	ter (calc 132.88	ulated a	bove) 114.1	100.5	96.28	107.33	108.52	123.57	131.91	142.77		
Efficier	_	ater hea		117.00	114.1	100.5	30.20	107.55	100.52	123.37	101.91	142.11	81	(216)
(217)m=	-	86.93	86.6	85.79	84.3	81	81	81	81	85.42	86.51	87.08		(217)
		L heating,	kWh/m	onth										
(219)m	n = (64)	<u>m x 100</u>	) ÷ (217)	)m	1	1	1		1	1		1	I	
(219)m=	167.98	146.92	153.43	137.38	135.35	124.07	118.87	132.51	133.97	144.66	152.49	163.95		٦
<b>A n n u o</b>	l totals							TOLA	I = Sum(2		White		1711.59	(219)
			ed. main	system	1					ĸ	Wh/yeaı	ſ	<b>kWh/year</b> 1798.84	1
•		fuel use		,									1711.59	ן ר
				electric	kaan ha	+							1111.00	]
													I	
				iced, ext	ract or p	ositive ii	nput fron	n outside	9			97.03		(230a)
centra	al heatir	ig pump										30		(230c)
Total e	lectricit	y for the	above,	kWh/yea	r			sum	of (230a)	(230g) =			127.03	(231)
Electri	city for I	ighting											214.37	(232)
12a. (	CO2 err	issions -	– Individ	ual heati	ing syste	ems inclu	uding mi	cro-CHP	)					
						Fn	ergy			Emiss	ion fac	tor	Emissions	
							/h/year			kg CO			kg CO2/yea	ır
Space	heating	(main s	ystem 1	)		(21	1) x			0.2	16	=	388.55	(261)

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	369.7	(264)
Space and water heating	(261) + (262) + (263) + (264)	=		758.25	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	65.93	(267)
Electricity for lighting	(232) x	0.519	=	111.26	(268)
Total CO2, kg/year	S	um of (265) (271) =		935.44	(272)
Dwelling CO2 Emission Rate	(.	272) ÷ (4) =		24.26	(273)
El rating (section 14)				85	(274)

			User D	etails:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 20	12		Stroma Softwa					016363 n: 1.0.4.10	
		P	roperty A	Address:	Unit 3-F	ropose	d-Lean			
Address :	Unit 3, 40-42 Mill L	ane, Lon	don, NW	/6 1NR						
1. Overall dwelling dimen	sions:									
Ground floor				<b>a(m²)</b> 6.45	(1a) x	<b>Av. He</b>	i <b>ght(m)</b> .75	(2a) =	Volume(m ³ ) 155.24	(3a)
Total floor area TFA = (1a)	+(1b)+(1c)+(1d)+(1	e)+(1r	ו) <u>5</u>	6.45	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	155.24	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues		econdar heating 0 0	ſ <b>y</b> ] + [_ ] + [_	0 0	] = [ ] = [	<b>total</b> 0 0		40 = 20 =	m ³ per hour	(6a) (6b)
Number of intermittent fans	; <u>_</u>				- _	0	x ′	10 =	0	(7a)
Number of passive vents						0	x ^	10 =	0	_ (7b)
Number of flueless gas fire	s					0	×4	40 =	0	](7c)
						0			0	
								Air ch	anges per ho	ur
Infiltration due to chimneys If a pressurisation test has been	en carried out or is intend				continue fro	0 om (9) to (		÷ (5) =	0	(8)
Number of storeys in the Additional infiltration	aweiiing (ns)						[(0)]	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.2	5 for steel or timber	frame or	0.35 for	masonr	v constr	uction	[(3)	-1]x0.1 -	0	(10) (11)
if both types of wall are pre- deducting areas of opening.	sent, use the value corre s); if equal user 0.35	sponding to	o the greate	er wall area	a (after				0	_ _()
If suspended wooden flo		led) or 0	.1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente								·	0	(13)
Percentage of windows a Window infiltration	and doors draught s	tripped		0.25 - [0.2	$\mathbf{v}(14) \div 1$	001 -			0	(14)
Infiltration rate				(8) + (10)		1	+ (15) =		0	(15)
Air permeability value, q	50 expressed in cu	hic metre						area	0 7	(16) (17)
If based on air permeability	•				•		nvelope	ulcu	0.35	(17)
Air permeability value applies						is being us	sed		0.00	
Number of sides sheltered									2	(19)
Shelter factor				(20) = 1 - [	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporation	g shelter factor			(21) = (18)	) x (20) =				0.3	(21)
Infiltration rate modified for	monthly wind spee	d								
Jan Feb M	lar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	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 1.1	23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltr	ation rat	e (allow	ing for sl	nelter an	d wind s	peed) =	: (21a) x	(22a)m					
	0.38	0.37	0.36	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.33	0.35		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se							(23a)
				endix N, (2	(23a) = (23a	a) × Fmv (e	equation (	N5)) . othe	rwise (23b	) = (23a)			0.5	(23a)
				ciency in %						, ( ,			0.5 75.65	
			-	-	-					2h)m + (	23h) x [ [,]	1 – (23c)		(200)
(24a)m=	0.5	0.49	0.49	0.45	0.44	0.4	0.4	0.4	0.42	0.44	0.46	0.47	]	(24a)
	balance	ed mech	i anical ve	I entilation	u without	heat rec	L coverv (l	1 MV) (24t	(22))m = (22)	1 2b)m + ()	1 23b)		I	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
	whole h	i Iouse ex	ract ver	ntilation of	r positiv	e input v	ı ventilatio	n from o	utside	<u> </u>			1	
,				then (24	•	•				.5 × (23b	))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,				nole hous )m = (22		•				0.5]				
(24d)m=	· ,	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	ctive air	change	rate - ei	nter (24a	ı) or (24t	o) or (240	c) or (24	ld) in bo	x (25)				1	
(25)m=	0.5	0.49	0.49	0.45	0.44	0.4	0.4	0.4	0.42	0.44	0.46	0.47		(25)
3 40	at losse	e and he	at loss	paramet	or:									
ELEN		Gros		Openir		Net Ar	62	U-val		AXU		k-value	2	AXk
		area		n		A ,n		W/m2		(W/I	K)	kJ/m ² ·l		kJ/K
Doors						2	x	1.5	=	3				(26)
Window	ws Type	e 1				3.43	x1	/[1/( 1.4 )+	0.04] =	4.55				(27)
Window	ws Type	e 2				2.38	x1	/[1/( 1.4 )+	0.04] =	3.16				(27)
Window	ws Type	e 3				5		/[1/( 1.4 )+	0.04] =	6.63				(27)
Window	ws Type	e 4				1.35		/[1/( 1.4 )+	0.04] =	1.79				(27)
Window	ws Type	e 5				1.35		/[1/( 1.4 )+	0.04] =	1.79				(27)
Window	ws Type	e 6				0.32		/[1/( 1.4 )+	0.04] =	0.42				(27)
Floor						56.45	5 X	0.25		14.112	 ₅			(28)
Walls 1	Гуре1	67.7	72	15.1	8	52.54	x x	0.25	= =	13.14	<b>-</b>		$\exists$	(29)
Walls 1	Гуре2	16.8		2		14.86	<b>x</b>	0.23	=	3.35	5		$\dashv$	(29)
Roof		27.1		0		27.19		0.18	=	4.89	= 1		$\dashv$	(30)
	rea of e	elements				168.2					J L			(31)
Party v			,			37.33		0		0				(32)
Party c						29.26				•	L 		$\dashv$	(32b)
* for wind	dows and			effective wi nternal wal		alue calcula		g formula 1	/[(1/U-valı	ıe)+0.04] â	L as given in	paragraph	L 1 <i>3.2</i>	(02.5)
		ss, W/K			.e una pun			(26) (30	) + (32) =				58.62	(33)
		Cm = S(		,					((28)	(30) + (32	2) + (32a)	(32e) =	8891.4	

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 l	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						25.23	(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) =			83.85	(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=	25.67	25.29	24.91	23	22.62	20.72	20.72	20.33	21.48	22.62	23.38	24.14		(38)
Heat t	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (	38)m			
(39)m=	109.52	109.14	108.76	106.86	106.47	104.57	104.57	104.19	105.33	106.47	107.24	108		
Heat lo	oss para	ameter (H	HLP), W/	/m²K				•		Average = = (39)m ÷	- Sum(39)₁ - (4)	₁₂ /12=	106.76	(39)
(40)m=	1.94	1.93	1.93	1.89	1.89	1.85	1.85	1.85	1.87	1.89	1.9	1.91		
										I Average =	Sum(40)1	12 / <b>12=</b>	1.89	(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 requi	irement:								kWh/ye	ear:	
												,		
if TF		upancy,   9, N = 1		[1 - exp	(-0.0003	849 x (TF	-A -13.9	)2)] + 0.(	0013 x ( ⁻	TFA -13		88		(42)
		e hot wa	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		78	.84		(43)
		al average				-	-	to achieve	a water us	se target o	of			
not mor	e that 125	litres per	person per	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	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)		-				
(44)m=	86.73	83.57	80.42	77.27	74.11	70.96	70.96	74.11	77.27	80.42	83.57	86.73		
Enerav	content of	^t hot water	used - cal	culated m	onthly = 4	190 x Vd r	n x nm x D	)Tm / 3600			m <mark>(44)</mark> 1 12 = ables 1b, 1		946.11	(44)
(45)m=	128.61	112.49	116.08	101.2	97.1	83.79	77.65	89.1	90.16	105.08	114.7	124.56		
(40)11-	120.01	112.43	110.00	101.2	57.1	05.79	11.00	03.1			m(45) _{1 12} =		1240.51	(45)
lf instan	taneous v	vater heati	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46					1210.01	
(46)m=	19.29	16.87	17.41	15.18	14.57	12.57	11.65	13.36	13.52	15.76	17.2	18.68		(46)
	storage													
-		ne (litres)					-		ame ves	sel		0		(47)
	•	neating a			-			. ,	<b>`</b>	(0) :				
		o stored	not wate	er (this ir	iciudes i	nstantar	ieous co	iiod idmo	ers) ente	er 'O' in (	(47)			
	storage	turer's de	eclared l	oss facto	or is kno	wn (kWł	n/dav).					0		(48)
		actor fro					"day).							
•					ar			$(40) \times (40)$				0		(49)
		om water turer's de	-	-		or is not		(48) x (49)	) =			0		(50)
,		age loss										0		(51)
	•	neating s		on 4.3										
		from Ta										0		(52)
Гетре	erature f	actor fro	m Table	2b								0		(53)

		om water (54) in (§	storage	, kWh/ye	ear			(47) x (51	) x (52) x (	53) =		0		(54) (55)
	. ,	. , .	culated t	for each	month			((56)m = (	(55) × (41)	m		0		(00)
(56)m=						0	0	0	0	0	0	0	l	(56)
	-	-	-	-	-	-	H11)] ÷ (5	-	-	-	-	-		(00)
-	0	0	0	0	0			0	0	0	0	0	i	(57)
(57)m=						0	0	0	0	0				
	•	•	nnual) fro			<b>FO</b> )		· · · · / / / ·				0		(58)
	•					,	(58) ÷ 36 ter heatii	• •		r thermo	stat)			
(59)m=											0	0		(59)
		l Ioulatad	l	month	(61)m =	(60) · 20		l	I		l			
(61)m=	44.2	38.47	40.98	38.1	37.77	(60) ÷ 30 34.99	65 × (41) 36.16	37.77	38.1	40.98	41.21	44.2		(61)
														(01)
(62)m=	172.81	150.95	157.06	139.3	134.87	118.78	113.8	(02)III - 126.87	128.27	45)III + 146.06	(40)11 +	(57)11 +	(59)m + (61)m	(62)
· · ·							ve quantity							(02)
							, see Ap					er neaung)		
(63)m=									0	0	0	0		(63)
		ater hea												. ,
(64)m=	172.81	150.95	157.06	139.3	134.87	118.78	113.8	126.87	128.27	146.06	155.91	168.75	l	
(- )									Dut from wa				1713.43	(64)
Heat o	ains fro	m water	heating	kWh/m	onth 0.2	5 ´ [0 85	× (45)m						ı	
(65)m=	53.81	47.02	48.84	43.17	41.73	36.61	34.86	39.07	39.51	45.18	48.44	52.46	-	(65)
inclu	L Ide (57)	n in cal	L Culation	L of (65)m	I only if c	l vlinder i	s in the o	l dwellina	or hot w	l ater is fr	om com	I munitv h	l leating	
	. ,		e Table 5	. ,	-	,	•						Joanny	
					<i>)</i> •									
Melab	Jan	Feb	<u>5), Wat</u> Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=		93.99	93.99	93.99	93.99	93.99	93.99	93.99	93.99	93.99	93.99	93.99		(66)
					1		r L9a), a							
(67)m=	14.61	12.98	10.56	7.99	5.97	5.04	5.45	7.08	9.51	12.07	14.09	15.02		(67)
	nces da	ins (calc	ulated ir	I Append	u dix L. ea	L uation L	13 or L1	i 3a), also	see Ta	ble 5				
(68)m=	163.91	165.61	161.33	152.2	140.68	129.86	122.63	120.93	125.21	134.34	145.86	156.68		(68)
					L equat		i or L15a)		i ee Table					
(69)m=	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4		(69)
			I (Table {			I								
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
			n (nega		L es) (Tab	L								
(71)m=	-75.19	-75.19	-75.19	-75.19	-75.19	-75.19	-75.19	-75.19	-75.19	-75.19	-75.19	-75.19		(71)
		gains (1		I	L	I		ļ					l	
(72)m=	72.33	69.97	65.65	59.96	56.09	50.85	46.85	52.51	54.87	60.73	67.28	70.52		(72)
		gains =					)m + (67)m						l	
(73)m=	305.05	302.76	291.73	274.35	256.94	239.94	229.12	234.71	243.78	261.33	281.42	296.41		(73)
	lar gains	I	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 F Table 6d	actor	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	x	3.43	x	11.28	<b>x</b>	0.57	x	0.7	=	10.7	(75)
Northeast 0.9x 0.77	x	1.35	x	11.28	x	0.57	x	0.7	=	4.21	(75)
Northeast 0.9x 0.77	x	3.43	x	22.97	x	0.57	x	0.7	] =	21.78	(75)
Northeast 0.9x 0.77	x	1.35	x	22.97	x	0.57	x	0.7	=	8.57	(75)
Northeast 0.9x 0.77	x	3.43	x	41.38	x	0.57	x	0.7	=	39.24	(75)
Northeast 0.9x 0.77	x	1.35	x	41.38	x	0.57	x	0.7	] =	15.45	(75)
Northeast 0.9x 0.77	x	3.43	x	67.96	x	0.57	x	0.7	] =	64.45	(75)
Northeast 0.9x 0.77	x	1.35	x	67.96	x	0.57	x	0.7	=	25.37	(75)
Northeast 0.9x 0.77	x	3.43	x	91.35	<b>x</b>	0.57	x	0.7	] =	86.63	(75)
Northeast 0.9x 0.77	x	1.35	x	91.35	x	0.57	x	0.7	] =	34.1	(75)
Northeast 0.9x 0.77	x	3.43	x	97.38	x	0.57	x	0.7	=	92.36	(75)
Northeast 0.9x 0.77	x	1.35	x	97.38	x	0.57	x	0.7	] =	36.35	(75)
Northeast 0.9x 0.77	x	3.43	x	91.1	x	0.57	x	0.7	=	86.4	(75)
Northeast 0.9x 0.77	x	1.35	x	91.1	x	0.57	x	0.7	=	34.01	(75)
Northeast 0.9x 0.77	x	3.43	x	72.63	x	0.57	x	0.7	] =	68.88	(75)
Northeast 0.9x 0.77	x	1.35	x	72.63	x	0.57	x	0.7	=	27.11	(75)
Northeast 0.9x 0.77	x	3.43	x	50.42	x	0.57	x	0.7	=	47.82	(75)
Northeast 0.9x 0.77	x	1.35	x	50.42	x	0.57	x	0.7	] =	18.82	(75)
Northeast 0.9x 0.77	x	3.43	x	28.07	x	0.57	x	0.7	=	26.62	(75)
Northeast 0.9x 0.77	x	1.35	x	28.07	x	0.57	x	0.7	] =	10.48	(75)
Northeast 0.9x 0.77	x	3.43	x	14.2	x	0.57	x	0.7	] =	13.46	(75)
Northeast 0.9x 0.77	x	1.35	x	14.2	x	0.57	x	0.7	=	5.3	(75)
Northeast 0.9x 0.77	x	3.43	x	9.21	x	0.57	x	0.7	=	8.74	(75)
Northeast 0.9x 0.77	x	1.35	x	9.21	x	0.57	x	0.7	=	3.44	(75)
Southeast 0.9x 0.77	x	2.38	x	36.79	x	0.57	x	0.7	=	24.21	(77)
Southeast 0.9x 0.77	x	5	x	36.79	x	0.57	x	0.7	=	50.87	(77)
Southeast 0.9x 0.77	x	1.35	x	36.79	x	0.57	x	0.7	=	27.47	(77)
Southeast 0.9x 0.77	x	2.38	x	62.67	x	0.57	x	0.7	=	41.24	(77)
Southeast 0.9x 0.77	x	5	x	62.67	x	0.57	x	0.7	] =	86.65	(77)
Southeast 0.9x 0.77	x	1.35	x	62.67	x	0.57	x	0.7	=	46.79	(77)
Southeast 0.9x 0.77	x	2.38	x	85.75	x	0.57	x	0.7	=	56.43	(77)
Southeast 0.9x 0.77	x	5	x	85.75	x	0.57	x	0.7	] =	118.56	(77)
Southeast 0.9x 0.77	x	1.35	x	85.75	x	0.57	x	0.7	=	64.02	(77)
Southeast 0.9x 0.77	x	2.38	x	106.25	x	0.57	x	0.7	=	69.92	(77)
Southeast 0.9x 0.77	x	5	x	106.25	x	0.57	x	0.7	=	146.9	(77)
Southeast 0.9x 0.77	x	1.35	x	106.25	×	0.57	×	0.7	=	79.32	(77)
Southeast 0.9x 0.77	x	2.38	x	119.01	×	0.57	×	0.7	=	78.32	(77)
Southeast 0.9x 0.77	x	5	x	119.01	x	0.57	×	0.7	=	164.54	(77)
Southeast 0.9x 0.77	x	1.35	<b>x</b>	119.01	×	0.57	x	0.7	=	88.85	(77)

		-				-		,				_
Southeast 0.9x	0.77	×	2.38	×	118.15	×	0.57	_ × [	0.7	=	77.75	(77)
Southeast 0.9x	0.77	x	5	x	118.15	x	0.57	×	0.7	=	163.35	(77)
Southeast 0.9x	0.77	x	1.35	X	118.15	x	0.57	×	0.7	=	88.21	(77)
Southeast 0.9x	0.77	x	2.38	x	113.91	x	0.57	×	0.7	=	74.96	(77)
Southeast 0.9x	0.77	x	5	x	113.91	x	0.57	x	0.7	=	157.48	(77)
Southeast 0.9x	0.77	x	1.35	x	113.91	x	0.57	x	0.7	=	85.04	(77)
Southeast 0.9x	0.77	x	2.38	x	104.39	x	0.57	x	0.7	=	68.7	(77)
Southeast 0.9x	0.77	x	5	x	104.39	x	0.57	×	0.7	=	144.32	(77)
Southeast 0.9x	0.77	x	1.35	x	104.39	x	0.57	<b>x</b>	0.7	=	77.93	(77)
Southeast 0.9x	0.77	x	2.38	x	92.85	x	0.57	_ × [	0.7	=	61.1	(77)
Southeast 0.9x	0.77	x	5	x	92.85	x	0.57	x	0.7	=	128.37	(77)
Southeast 0.9x	0.77	x	1.35	x	92.85	x	0.57	×	0.7	=	69.32	(77)
Southeast 0.9x	0.77	x	2.38	x	69.27	x	0.57	×	0.7	=	45.58	(77)
Southeast 0.9x	0.77	x	5	x	69.27	x	0.57	×	0.7	=	95.76	(77)
Southeast 0.9x	0.77	x	1.35	x	69.27	x	0.57	x	0.7	=	51.71	(77)
Southeast 0.9x	0.77	x	2.38	x	44.07	<b>x</b>	0.57	_ × [	0.7	=	29	(77)
Southeast 0.9x	0.77	x	5	x	44.07	x	0.57	<b>x</b>	0.7	=	60.93	(77)
Southeast 0.9x	0.77	x	1.35	x	44.07	x	0.57	× [	0.7	=	32.9	(77)
Southeast 0.9x	0.77	x	2.38	x	31.49	<b>x</b>	0.57	_ × [	0.7	=	20.72	(77)
Southeast 0.9x	0.77	x	5	x	31.49	x	0.57	_ × [	0.7	=	43.53	(77)
Southeast 0.9x	0.77	x	1.35	x	31.49	x	0.57	_ × [	0.7	=	23.51	(77)
Southwest0.9x	0.77	x	0.32	x	36.79	Ī	0.57	_ × [	0.7	=	3.26	(79)
Southwest _{0.9x}	0.77	x	0.32	x	62.67	Ī	0.57	_ × [	0.7	=	5.55	(79)
Southwest _{0.9x}	0.77	x	0.32	x	85.75	1	0.57	_ × [	0.7	=	7.59	(79)
Southwest0.9x	0.77	x	0.32	x	106.25	Ī	0.57	_ x [	0.7	=	9.4	(79)
Southwest _{0.9x}	0.77	x	0.32	x	119.01	Ī	0.57	_ × [	0.7	=	10.53	(79)
Southwest _{0.9x}	0.77	x	0.32	x	118.15	Ī	0.57		0.7	=	10.45	(79)
Southwest _{0.9x}	0.77	x	0.32	x	113.91	Ī	0.57		0.7	=	10.08	(79)
Southwest _{0.9x}	0.77	x	0.32	x	104.39	1	0.57		0.7	=	9.24	(79)
Southwest0.9x	0.77	x	0.32	x	92.85	Ī	0.57		0.7	=	8.22	(79)
Southwest _{0.9x}	0.77	x	0.32	x	69.27	i	0.57		0.7	=	6.13	(79)
Southwest _{0.9x}	0.77	x	0.32	x	44.07	Ī	0.57	 × [	0.7	=	3.9	(79)
Southwest0.9x	0.77	x	0.32	x	31.49	Ī	0.57		0.7	= =	2.79	(79)
L		_				-						
Solar gains in	Solar gains in watts, calculated for each month (83)m = Sum(74)m (82)m											
(83)m= 120.72	210.58 30	1.29	395.36 462.9	7	468.47 447.97	396	.18 333.65	236.29	145.5	102.73		(83)
Total gains – i	nternal and s	solar	(84)m = (73)n	1 +	(83)m , watts							
(84)m= 425.77	513.34 593	3.01	669.72 719.9	1	708.42 677.1	630	).9 577.44	497.62	426.92	399.14		(84)
7. Mean inter	nal temper <u>a</u>	ture (	heating seaso	on)								

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

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

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

21

(85)

(86)m=	0.99	0.99	0.98	0.95	0.88	0.76	0.61	0.66	0.86	0.96	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	7 in Table	e 9c)					
(87)m=	18.96	19.18	19.55	20.03	20.48	20.8	20.93	20.91	20.66	20.08	19.44	18.93		(87)
Temp	erature	during h	eating p	periods ir	n rest of	dwelling	from Ta	able 9, Tl	h2 (°C)					
(88)m=	19.37	19.38	19.38	19.41	19.41	19.43	19.43	19.44	19.42	19.41	19.4	19.39		(88)
Utilisa	ation 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	0.82	0.63	0.42	0.48	0.77	0.94	0.99	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	16.76	17.09	17.62	18.32	18.92	19.31	19.41	19.41	19.17	18.4	17.48	16.73		(90)
				-	-				f	fLA = Livin	g area ÷ (4	4) =	0.42	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	A) × T2			-		
(92)m=	17.68	17.96	18.42	19.04	19.57	19.93	20.05	20.03	19.79	19.1	18.3	17.65		(92)
Apply	adjustr	nent to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	17.53	17.81	18.27	18.89	19.42	19.78	19.9	19.88	19.64	18.95	18.15	17.5		(93)
		ting requ												
				mperatui using Ta		ied at st	ep 11 of	Table 9	b, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
ine ui	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa		tor for g		<u> </u>	Iviay	Jun		Aug		000	1100	Dee		
(94)m=	0.99	0.98	0.96	0.91	0.82	0.66	0.48	0.54	0.78	0.94	0.98	0.99		(94)
Usefu	L Il gains,	hmGm	, W = (94	۱ 4)m x (84	ـــــــــــــــــــــــــــــــــــــ									
(95)m=	420.99	502.62	569.01	612.45	, 593.17	470.81	328.1	338.87	450.97	465.75	418.64	395.51		(95)
Month	nly avera	age exte	rnal tem	perature	e from Ta	able 8				I				
(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	x [(93)m	– (96)m	]				
(97)m=	1448.57	1409.26	1280.53	1067.47	822.1	542.1	344.87	363.05	583.65	889.55	1184.47	1436.4		(97)
Space	e heatin	g require	ement fo	or each n	nonth, k	Wh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
(98)m=	764.52	609.26	529.37	327.61	170.32	0	0	0	0	315.31	551.39	774.42		
								Tota	l per year	(kWh/year	[.] ) = Sum(9	8)15,912 =	4042.21	(98)
Space	e heatin	g require	ement in	ı kWh/m²	²/year								71.61	(99)
9a. En	erav rec	uiremer	nts – Ind	ividual h	eating s	vstems i	ncluding	micro-C	CHP)			<u>I</u>		
	e heatir													
-		-	at from s	econdar	y/supple	mentary	[,] system						0	(201)
Fracti	ion of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =			İ	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								90.3	(206)
	•			ementar		a system	1. %						0	(208)
Linoit	-				-	1	<b></b>	A.u.a.	Son	Oct	Nov	Dee	-	
Snac	Jan a heatin	Feb	Mar	Apr alculate	May d above	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	al
opaci	764.52	609.26	529.37	327.61	170.32	) 0	0	0	0	315.31	551.39	774.42		
(211)~						L		Ĺ	Ľ					(211)
(211)[]	846.64	)III X (20 674.71	4)] } X   586.23	100 ÷ (20 362.81	188.62	0	0	0	0	349.18	610.63	857.61		(211)
	0.07		000.20		1.00.02	l Č	l Č		-		211) _{15,10. 12}		4476.42	(211)
										· · · · ·	* 15,10. 12		1710.72	<u> </u>

Space heating fuel (secondary), kWh/month

= {[(98	)m x (20	01)]}x 1	00 ÷ (20	8)										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	ll (kWh/yea	ar) =Sum(2	215) _{15,10. 1} 2	2=	0	(215)
	heating													
Output	172.81	ater nea 150.95	ter (calc 157.06	139.3	134.87	118.78	113.8	126.87	128.27	146.06	155.91	168.75		
Efficie	ncy of w	ater hea	iter	<u> </u>	<u> </u>		I	I	I	I			81	(216)
(217)m=	88.43	88.29	87.99	87.31	85.94	81	81	81	81	87.13	88.07	88.48		(217)
		•	kWh/mo ) ÷ (217)								-	-		
• •	195.42	170.98	178.5	159.55	156.93	146.65	140.5	156.62	158.35	167.63	177.03	190.72		_
								Tota	I = Sum(2	19a) ₁₁₂ =			1998.88	(219)
	al totals		d main	ovetom	1					k	Wh/yea	r	kWh/year	7
	-		ed, main	System	1								4476.42	ļ
	-	fuel use											1998.88	]
Electri	city for p	oumps, fa	ans and	electric	keep-ho	t								
mech	anical v	entilatio	n - balan	iced, ext	ract or p	ositive i	nput fror	n outside	Э			125.47		(230a)
centra	al heatin	ig pump	:									30		(230c)
Total e	electricity	for the	above, l	(Wh/yea	r			sum	of (230a)	(230g) =			155.47	(231)
Electri	city for li	ghting											258.07	(232)
12a.	CO2 em	issions -	– Individ	ual heat	ing syste	ems inclu	uding mi	icro-CHF	)					
							e <b>rgy</b> /h/year			<b>Emiss</b> kg CO	<b>ion fac</b> 2/kWh	tor	<b>Emissions</b> kg CO2/yea	ır
Space	heating	(main s	ystem 1	)		(21	1) x			0.2	16	=	966.91	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.2	16	=	431.76	(264)
Space	and wa	ter heati	ng			(26	1) + (262)	+ (263) + (	(264) =				1398.67	(265)
Electri	city for p	oumps, fa	ans and	electric	keep-ho	t (23 ⁻	1) x			0.5	19	=	80.69	(267)
Electri	city for li	ghting				(232	2) x			0.5	19	=	133.94	(268)
Total (	CO2, kg/	year							sum c	of (265) (2	271) =		1613.29	(272)
Dwelli	ng CO2	Emissi	on Rate	!					(272)	÷ (4) =			28.58	(273)
El ratir	ng (secti	on 14)											79	(274)

			User D	etails:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 20	12		Stroma Softwa					016363 n: 1.0.4.10	
		Р	roperty /	Address:	Unit 4-F	⊃ropose	d-Lean			
Address :	Unit 4, 40-42 Mill L	ane, Lon	don, NW	/6 1NR						
1. Overall dwelling dimens	sions:									
Ground floor			-	<b>a(m²)</b> 3.27	(1a) x	<b>Av. He</b> i	i <b>ght(m)</b> 6	(2a) =	Volume(m ³ ) 190.5	(3a)
Total floor area TFA = (1a)	+(1b)+(1c)+(1d)+(1	e)+(1r	ד (ו	3.27	(4)					
Dwelling volume			L		(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	190.5	(5)
2. Ventilation rate:									- · ·	
Number of chimneys Number of open flues	main         s           heating         •           0         +           0         +	secondar heating 0 0	″¥ □ + [ □ + [	0 0 0	] = [ ] = [	<b>total</b> 0 0		40 = 20 =	m ³ per hour	(6a) (6b)
Number of intermittent fans	L L					0	x ^	10 =	0	_ ](7a)
Number of passive vents							× ·	10 =		]( ⁷ b)
						0			0	
Number of flueless gas fire	S					0	X 2	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimneys If a pressurisation test has been	n carried out or is intend				continue fro	0 om (9) to (		÷ (5) =	0	(8)
Number of storeys in the Additional infiltration	dwelling (IIS)						[(9).	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.2	5 for steel or timber	frame or	0.35 for	masonr	v constr	uction	[(0)	-1]x0.1 -	0	(10) (11)
if both types of wall are pres deducting areas of opening	sent, use the value corre s); if equal user 0.35	sponding to	the greate	er wall area	a (after					]()
If suspended wooden flo		aled) or 0	.1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente									0	(13)
Percentage of windows a	and doors draught s	stripped		0.25 - [0.2	v (14) + 1	001 -			0	(14)
Window infiltration				(8) + (10)		- 1	(15) -		0	(15)
Infiltration rate Air permeability value, q	50 ovprossed in cu	hic motro						aroa	0	(16)
If based on air permeability	•		•		•		inelope	aica	7	(17) (18)
Air permeability value applies						is being us	sed		0.35	
Number of sides sheltered			U		,	Ū			2	(19)
Shelter factor				(20) = 1 - [	[0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporatin	g shelter factor			(21) = (18)	) x (20) =				0.3	(21)
Infiltration rate modified for	monthly wind spee	d	-							
Jan Feb M	lar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spec	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	1.12	1.18		

Adjuste	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.38	0.37	0.36	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.33	0.35		
		<i>ctive air</i> al ventila	<i>change i</i>	rate for t	he applic	cable ca	se						0.5	(23a)
			using Appe	endix N (2	3b) = (23a	) × Fmv (e	equation (N	N5)) othe	rwise (23b	) = (23a)			0.5	
			overy: effici							) (200)			0.5	(23b)
			anical ve	-	-					(h) = (h)	02h) v [/	1 (220)	73.1	(23c)
(24a)m=	r	0.51		0.46	0.45	0.42	0.42	0.41	0.43	0.45	0.47	0.48	] ]	(24a)
			anical ve								-	0.40	J	()
(24b)m=				0				0		0	0	0	1	(24b)
	-		tract ven		_	-	-		-	Ů			J	(=)
,			(23b), tl		•	•				5 × (23b	))			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
d) lf	natural	ventilatio	on or wh	ole hous	e positiv	ve input v	ventilatio	n from l	oft				1	
			en (24d)							0.5]			_	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - en	iter (24a	) or (24b	) or (24	c) or (24	d) in box	k (25)			-	_	
(25)m=	0.51	0.51	0.5	0.46	0.45	0.42	0.42	0.41	0.43	0.45	0.47	0.48		(25)
3. He	at losse	s and he	eat loss p	paramete	er:									
ELEN		Gros		Openin		Net Ar	ea	U-valı	ue	AXU		k-value	9	AXk
		area	(m²)	. m		A ,n	n²	W/m2	K	(W/ł	<b>&lt;</b> )	kJ/m²∙	K	kJ/K
Doors						2	x	1.5	=	3				(26)
Window	ws Type	e 1				1.35	x1.	/[1/( 1.4 )+	0.04] =	1.79				(27)
Window	ws Type	2				1.35	x1.	/[1/( 1.4 )+	0.04] =	1.79				(27)
Walls 7	Гуре1	45.5	57	6.75		38.82	<u>x</u>	0.25	=	9.7				(29)
Walls 7	Гуре2	11.7	73	2		9.73	x	0.23	=	2.21				(29)
Walls 7	Гуре3	12.8	38	0		12.88	s x	0.2	=	2.63				(29)
Roof		15.0	)7	0		15.07	' x	0.18	= =	2.71			7	(30)
Total a	rea of e	lements	, m²			85.25	5							(31)
Party v	vall					37.7	x	0	=	0				(32)
Party fl	loor					73.27	, ]						$\dashv$	(32a)
Party c	eiling					58.2					Γ		$\dashv$	(32b)
			ows, use e sides of in				ated using	formula 1	/[(1/U-valu	ie)+0.04] a	∟ s given in	paragraph	n 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26) (30)	) + (32) =				29.2	1 (33)
Heat c	apacity	Cm = S(	(Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	13327.	.59 (34)
Therma	al mass	parame	eter (TMF	e Cm ÷	- TFA) in	⊨kJ/m²K			Indica	tive Value:	Medium		250	(35)
	-		ere the dei tailed calcu		constructi	on are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therma	al bridge	es : S (L	x Y) calo	culated u	using Ap	pendix k	<						12.79	9 (36)
			are not kn	own (36) =	= 0.15 x (3	1)								
Fotal fa	abric he	at loss							(33) +	(36) =			41.99	9 (37)

Ventilation heat loss calculated monthly								-						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	32.3	31.83	31.37	29.03	28.56	26.22	26.22	25.76	27.16	28.56	29.5	30.43		(38)
Heat transfer coefficient, W/K (39)m = (37) + (38)m														
(39)m=	74.3	73.83	73.36	71.02	70.55	68.22	68.22	67.75	69.15	70.55	71.49	72.42		
								•		-	Sum(39)1	₁₂ /12=	70.91	(39)
	<u> </u>	meter (H	<u>,</u>	1						= (39)m ÷	<u> </u>			
(40)m=	1.01	1.01	1	0.97	0.96	0.93	0.93	0.92	0.94	0.96	0.98	0.99	0.97	
Average = Sum(40)1 12 /12=       Number of days in month (Table 1a)														(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				<u> </u>		1				
4. Wa	ater hea	tina ene	rav reau	irement:								kWh/ye	ear:	
		Ŭ	0, 1									,		
		ו,µancy א N = 1		([1 - exp		849 x (TF	- Δ -13 9	)2)] + 0.(	)013 x ( ⁻	TFA -13		32		(42)
	A £ 13.		. 1.707		(-0.0000	, , , , , , , , , , , , , , , , , , ,	A-10.0	<i>)</i> ∠)] · 0.(		11 A - 10	.0)			
								(25 x N)				.37		(43)
		-		' usage by r day (all w		-	-	to achieve	a water us	se target o	)Ť			
				1	i	Ι.	·	<u> </u>	San	Oct	Nov	Dee		
Hot wat	Jan er usage i	Feb n litres per	Mar day for e	Apr ach month	May Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	98.3	, 94.73	91.15	87.58	84.01	80.43	80.43	84.01	87.58	91.15	94.73	98.3		
(++)   -	00.0	04.70	01.10	07.00	04.01	00.40	00.40	04.01			m(44) _{1 12} =		1072.41	(44)
Energy	content of	hot water	used - ca	lculated m	onthly = 4.	190 x Vd,r	n x nm x D	DTm / 3600			· · · ·		1072.41	
(45)m=	145.78	127.5	131.57	114.71	110.06	94.98	88.01	100.99	102.2	119.1	130.01	141.18		
				1						Total = Su	m(45) _{1 12} =	-	1406.09	(45)
lf instan	taneous w	ater heati	ng at poin	t of use (no	o hot water	r storage),	enter 0 in	boxes (46	) to (61)					
(46)m=		19.13	19.74	17.21	16.51	14.25	13.2	15.15	15.33	17.87	19.5	21.18		(46)
	storage		) includir		olar or M		etorado	within sa		col		0		(47)
-		. ,		ank in dw			-			501		0		(47)
	-	-			-			ombi boil	ers) ente	er '0' in (	(47)			
	storage			- (										
a) If n	nanufact	urer's de	eclared	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										
		age loss leating s		rom Tab	ie 2 (kvv	n/litre/da	iy)					0		(51)
	•	from Ta		011 4.5								0		(52)
		actor fro		e 2b								0		(53)
Energ	y lost fro	m water	storage	e, kWh/y	ear			(47) x (51	) x (52) x (	53) =		0		(54)
-		(54) in (5	-	. ,							(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)
	L			1		1	1			1				

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H														
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)	
Primary cir	cuit loss (ar	nual) fro	om Table	e 3					-		0		(58)	
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m														
· ·	d by factor f	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)		1		
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)	
Combi loss	calculated	for each	month (	61)m =	(60) ÷ 36	65 × (41	)m				-			
(61)m= 50.	09 43.6	46.45	43.19	42.81	39.66	40.99	42.81	43.19	46.45	46.72	50.09		(61)	
Total heat	required for	water he	eating ca	alculated	l for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m		
(62)m= 195	.88 171.1	178.02	157.9	152.87	134.64	129	143.8	145.39	165.55	176.73	191.28		(62)	
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)														
(add additi	onal lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix C	G)				L		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)	
Output fror	n water hea	iter												
<mark>(64)</mark> m= 195	.88 171.1	178.02	157.9	152.87	134.64	129	143.8	145.39	165.55	176.73	191.28		-	
							Outp	out from w	ater heate	r (annual)₁	12	1942.15	(64)	
Heat gains	from water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	]		
(65)m= 6	1 53.29	55.36	48.94	47.3	41.5	39.51	44.28	44.78	51.21	54.91	59.47		(65)	
include (	57)m in cal	culation	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating		
5. Interna	l gains (see	e Table 5	5 and 5a	):										
Metabolic g	naine (Table		4											
	Janis (Table	<u>e 5), vval</u>	ts											
		Mar	ts Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	an Feb			May 116.14	Jun 116.14	Jul 116.14	Aug 116.14	Sep 116.14	Oct 116.14	Nov 116.14	Dec 116.14		(66)	
(66)m= 116	an Feb	Mar 116.14	Apr 116.14	116.14	116.14	116.14	116.14	116.14					(66)	
(66)m= 116	an Feb .14 116.14 ins (calcula	Mar 116.14	Apr 116.14	116.14	116.14	116.14	116.14	116.14					(66) (67)	
(66)m= Ja (66)m= 116 Lighting ga (67)m= 20. Appliances	An         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula	Mar 116.14 ted in Ap 15.11 culated in	Apr 116.14 ppendix 11.44	116.14 L, equat 8.55 lix L, eq	116.14 ion L9 oi 7.22 uation L ⁻	116.14 r L9a), a 7.8 13 or L1	116.14 Iso see 10.14 3a), also	116.14 Table 5 13.61 see Ta	116.14 17.28	116.14	116.14			
(66)m= Ja (66)m= 116 Lighting ga (67)m= 20. Appliances	an Feb .14 116.14 ins (calcula 92 18.58	Mar 116.14 ted in Ap 15.11 culated in	Apr 116.14 ppendix 11.44	116.14 L, equat 8.55 lix L, eq	116.14 ion L9 oi 7.22 uation L ⁻	116.14 r L9a), a 7.8 13 or L1	116.14 Iso see 10.14 3a), also	116.14 Table 5 13.61 see Ta	116.14 17.28	116.14	116.14			
Ja           (66)m=           Lighting ga           (67)m=           20.           Appliances           (68)m=           204	An         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula	Mar 116.14 ted in Ap 15.11 culated in 201.58	Apr 116.14 opendix 11.44 Append 190.17	116.14 L, equat 8.55 lix L, eq 175.78	116.14 ion L9 or 7.22 uation L 162.26	116.14 r L9a), a 7.8 13 or L1 153.22	116.14 Iso see 10.14 3a), also 151.09	116.14 Table 5 13.61 see Ta 156.45	116.14 17.28 ble 5 167.85	116.14 20.17	116.14 21.51		(67)	
Ja           (66)m=           Lighting ga           (67)m=           20.           Appliances           (68)m=           204	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           .81         206.93           ains (calcula	Mar 116.14 ted in Ap 15.11 culated in 201.58	Apr 116.14 opendix 11.44 Append 190.17	116.14 L, equat 8.55 lix L, eq 175.78	116.14 ion L9 or 7.22 uation L 162.26	116.14 r L9a), a 7.8 13 or L1 153.22	116.14 Iso see 10.14 3a), also 151.09	116.14 Table 5 13.61 see Ta 156.45	116.14 17.28 ble 5 167.85	116.14 20.17	116.14 21.51		(67)	
Ja           (66)m=           116           Lighting ga           (67)m=           20.           Appliances           (68)m=           204           Cooking ga           (69)m=           34.	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           .81         206.93           ains (calcula	Mar 116.14 ted in Ap 15.11 culated in 201.58 ated in A 34.61	Apr 116.14 ppendix 11.44 Append 190.17 ppendix 34.61	116.14 L, equat 8.55 Jix L, eq 175.78 L, equat	116.14 ion L9 or 7.22 uation L 162.26 tion L15	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a)	116.14 Iso see 10.14 3a), also 151.09 ), also se	116.14 Table 5 13.61 see Ta 156.45 ee Table	116.14 17.28 ble 5 167.85 5	116.14 20.17 182.24	116.14 21.51 195.77		(67) (68)	
Ja           (66)m=           116           Lighting ga           (67)m=           20.           Appliances           (68)m=           204           Cooking ga           (69)m=           34.	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           .81         206.93           ains (calcula           61         34.61           J fans gains	Mar 116.14 ted in Ap 15.11 culated in 201.58 ated in A 34.61	Apr 116.14 ppendix 11.44 Append 190.17 ppendix 34.61	116.14 L, equat 8.55 Jix L, eq 175.78 L, equat	116.14 ion L9 or 7.22 uation L 162.26 tion L15	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a)	116.14 Iso see 10.14 3a), also 151.09 ), also se	116.14 Table 5 13.61 see Ta 156.45 ee Table	116.14 17.28 ble 5 167.85 5	116.14 20.17 182.24	116.14 21.51 195.77		(67) (68)	
$\begin{bmatrix} Ja \\ (66)m = & 116 \\ Lighting ga \\ (67)m = & 20. \\ Appliances \\ (68)m = & 204 \\ Cooking ga \\ (69)m = & 34. \\ Pumps and \\ (70)m = & 3 \end{bmatrix}$	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           .81         206.93           ains (calcula           61         34.61           J fans gains	Mar           116.14           ted in Ap           15.11           culated in           201.58           ated in A           34.61           6 (Table §	Apr 116.14 ppendix 11.44 Appendix 190.17 ppendix 34.61 5a) 3	116.14 L, equat 8.55 dix L, eq 175.78 L, equat 34.61	116.14 ion L9 or 7.22 uation L 162.26 tion L15 34.61	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a) 34.61	116.14 Iso see 10.14 3a), also 151.09 ), also se 34.61	116.14 Table 5 13.61 see Ta 156.45 ee Table 34.61	116.14 17.28 ble 5 167.85 5 34.61	116.14 20.17 182.24 34.61	116.14 21.51 195.77 34.61		(67) (68) (69)	
$\begin{bmatrix} Ja \\ (66)m = & 116 \\ Lighting ga \\ (67)m = & 20. \\ Appliances \\ (68)m = & 204 \\ Cooking ga \\ (69)m = & 34. \\ Pumps and \\ (70)m = & 3 \end{bmatrix}$	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           .81         206.93           ains (calcula           61         34.61           d fans gains           3         3           . evaporation	Mar           116.14           ted in Ap           15.11           culated in           201.58           ated in A           34.61           6 (Table §	Apr 116.14 ppendix 11.44 Appendix 190.17 ppendix 34.61 5a) 3	116.14 L, equat 8.55 dix L, eq 175.78 L, equat 34.61	116.14 ion L9 or 7.22 uation L 162.26 tion L15 34.61	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a) 34.61	116.14 Iso see 10.14 3a), also 151.09 ), also se 34.61	116.14 Table 5 13.61 see Ta 156.45 ee Table 34.61	116.14 17.28 ble 5 167.85 5 34.61	116.14 20.17 182.24 34.61	116.14 21.51 195.77 34.61		(67) (68) (69)	
$\begin{bmatrix} Ja \\ (66)m = & 116 \\ Lighting ga \\ (67)m = & 20. \\ Appliances \\ (68)m = & 204 \\ Cooking ga \\ (69)m = & 34. \\ Pumps and \\ (70)m = & 3 \\ Losses e.g \\ (71)m = & -92 \end{bmatrix}$	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           .81         206.93           ains (calcula           61         34.61           d fans gains           3         3           . evaporation	Mar 116.14 ted in Ap 15.11 culated in A 201.58 ated in A 34.61 (Table § 3 on (negation) -92.91	Apr 116.14 ppendix 11.44 Appendix 190.17 ppendix 34.61 5a) 3 tive valu	116.14 _, equat 8.55 dix L, eq 175.78 L, equat 34.61 3 es) (Tab	116.14 ion L9 or 7.22 uation L 162.26 tion L15 34.61 3 ule 5)	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a) 34.61 3	116.14 Iso see ⁻ 10.14 3a), also 151.09 ), also se 34.61 3	116.14 Table 5 13.61 see Ta 156.45 ee Table 34.61 3	116.14 17.28 ble 5 167.85 5 34.61 3	116.14 20.17 182.24 34.61 3	116.14 21.51 195.77 34.61 3		(67) (68) (69) (70)	
$\begin{bmatrix} Ja \\ (66)m = & 116 \\ Lighting ga \\ (67)m = & 20. \\ Appliances \\ (68)m = & 204 \\ Cooking ga \\ (69)m = & 34. \\ Pumps and \\ (70)m = & 3 \\ Losses e.g \\ (71)m = & -92 \end{bmatrix}$	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           92         18.58           gains (calcula           61         34.61           d fans gains           6         3           .         evaporation           .91         -92.91           ing gains (7)	Mar 116.14 ted in Ap 15.11 culated in A 201.58 ated in A 34.61 (Table § 3 on (negation) -92.91	Apr 116.14 ppendix 11.44 Appendix 190.17 ppendix 34.61 5a) 3 tive valu	116.14 _, equat 8.55 dix L, eq 175.78 L, equat 34.61 3 es) (Tab	116.14 ion L9 or 7.22 uation L 162.26 tion L15 34.61 3 ule 5)	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a) 34.61 3	116.14 Iso see ⁻ 10.14 3a), also 151.09 ), also se 34.61 3	116.14 Table 5 13.61 see Ta 156.45 ee Table 34.61 3	116.14 17.28 ble 5 167.85 5 34.61 3	116.14 20.17 182.24 34.61 3	116.14 21.51 195.77 34.61 3		(67) (68) (69) (70)	
Ja         (66)m=       116         Lighting ga       (67)m=       20.         Appliances       (68)m=       204         Cooking ga       (69)m=       34.         Pumps and       (70)m=       3         Losses e.g       (71)m=       -92         Water heat       (72)m=       81.	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           92         18.58           gains (calcula           61         34.61           d fans gains           6         3           .         evaporation           .91         -92.91           ing gains (7)	Mar           116.14           ted in Ap           15.11           culated in           201.58           ated in Ap           34.61           (Table 5)           -92.91           Fable 5)	Apr 116.14 ppendix 11.44 Appendix 190.17 ppendix 34.61 5a) 3 tive valu -92.91	116.14 _, equat 8.55 dix L, eq 175.78 L, equat 34.61 3 es) (Tab -92.91	116.14 ion L9 or 7.22 uation L 162.26 tion L15 34.61 3 le 5) -92.91 57.63	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a) 34.61 3 -92.91 53.1	116.14 Iso see 10.14 3a), also 151.09 ), also se 34.61 3 -92.91 59.52	116.14 Table 5 13.61 5 see Ta 156.45 2 Table 34.61 3 -92.91 62.19	116.14 17.28 ble 5 167.85 5 34.61 3 -92.91	116.14 20.17 182.24 34.61 3 -92.91 76.26	116.14 21.51 195.77 34.61 3 -92.91 79.93		<ul> <li>(67)</li> <li>(68)</li> <li>(69)</li> <li>(70)</li> <li>(71)</li> </ul>	
Ja         (66)m=       116         Lighting ga       (67)m=       20.         Appliances       (68)m=       204         Cooking ga       (69)m=       34.         Pumps and       (70)m=       3         Losses e.g       (71)m=       -92         Water heat       (72)m=       81.	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           92         18.58           gains (calcula           61         34.61           d fans gains           3         3           evaporation           91         -92.91           ing gains (7           98         79.31           nal gains =	Mar           116.14           ted in Ap           15.11           culated in           201.58           ated in Ap           34.61           (Table 5)           -92.91           Fable 5)	Apr 116.14 ppendix 11.44 Appendix 190.17 ppendix 34.61 5a) 3 tive valu -92.91	116.14 _, equat 8.55 dix L, eq 175.78 L, equat 34.61 3 es) (Tab -92.91	116.14 ion L9 or 7.22 uation L 162.26 tion L15 34.61 3 le 5) -92.91 57.63	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a) 34.61 3 -92.91 53.1	116.14 Iso see 10.14 3a), also 151.09 ), also se 34.61 3 -92.91 59.52	116.14 Table 5 13.61 5 see Ta 156.45 2 Table 34.61 3 -92.91 62.19	116.14 17.28 ble 5 167.85 5 34.61 3 -92.91 68.84	116.14 20.17 182.24 34.61 3 -92.91 76.26	116.14 21.51 195.77 34.61 3 -92.91 79.93		<ul> <li>(67)</li> <li>(68)</li> <li>(69)</li> <li>(70)</li> <li>(71)</li> </ul>	
$\begin{bmatrix} Ja \\ (66)m = & 116 \\ Lighting ga \\ (67)m = & 20. \\ Appliances \\ (68)m = & 204 \\ Cooking ga \\ (69)m = & 34. \\ Pumps and \\ (70)m = & 3 \\ Losses e.g \\ (71)m = & -92 \\ Water heat \\ (72)m = & 81. \\ Total inter$	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           92         18.58           gains (calcula           61         34.61           d fans gains           61         34.61           d fans gains           91         -92.91           ing gains (7           98         79.31           nal gains =           .56         365.67	Mar           116.14           ted in Ap           15.11           culated in           201.58           ated in A           34.61           6 (Table 5)           -92.91           Table 5)           74.41	Apr 116.14 ppendix 11.44 Appendix 190.17 ppendix 34.61 5a) 3 tive valu -92.91 67.97	116.14 _, equat 8.55 dix L, eq 175.78 L, equat 34.61 3 -92.91 63.57	116.14 ion L9 or 7.22 uation L 162.26 tion L15 34.61 3 .92.91 57.63 (66)	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a) 34.61 3 -92.91 53.1 m + (67)m	116.14 Iso see - 10.14 3a), also 151.09 ), also se 34.61 -92.91 59.52 + (68)m +	116.14 Table 5 13.61 5 see Ta 156.45 2e Table 34.61 3 -92.91 62.19 + (69)m +	116.14 17.28 ble 5 167.85 5 34.61 3 -92.91 68.84 (70)m + (7	116.14 20.17 182.24 34.61 3 -92.91 76.26 1)m + (72)	116.14 21.51 195.77 34.61 3 -92.91 79.93		<ul> <li>(67)</li> <li>(68)</li> <li>(69)</li> <li>(70)</li> <li>(71)</li> <li>(72)</li> </ul>	
Ja         (66)m=       116         Lighting ga       (67)m=       20.         Appliances       (68)m=       204         Cooking ga       (69)m=       34.         Pumps and       (70)m=       3         Losses e.g       (71)m=       -92         Water heat       (72)m=       81.         Total inter       (73)m=       368         6. Solar g       36.       36.	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           92         18.58           gains (calcula           61         34.61           d fans gains           61         34.61           d fans gains           91         -92.91           ing gains (7           98         79.31           nal gains =           .56         365.67	Mar           116.14           ted in Ap           15.11           culated in           201.58           ated in A           34.61           c (Table 5)           -92.91           Table 5)           74.41           351.94	Apr 116.14 ppendix 11.44 Appendix 190.17 ppendix 34.61 5a) 3 tive valu -92.91 67.97 330.43	116.14 _, equat 8.55 dix L, eq 175.78 L, equat 34.61 3 es) (Tab -92.91 63.57 308.75	116.14 ion L9 or 7.22 uation L 162.26 tion L15 34.61 3 .92.91 57.63 (66) 287.95	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a) 34.61 3 -92.91 53.1 m + (67)m 274.97	116.14 Iso see - 10.14 3a), also 151.09 ), also se 34.61 -92.91 59.52 + (68)m + 281.6	116.14 Table 5 13.61 5 see Ta 156.45 2e Table 34.61 3 -92.91 62.19 + (69)m + 293.1	116.14 17.28 ble 5 167.85 5 34.61 3 -92.91 68.84 (70)m + (7 314.81	116.14 20.17 182.24 34.61 3 -92.91 76.26 1)m + (72) 339.52	116.14 21.51 195.77 34.61 3 -92.91 79.93 m 358.05		<ul> <li>(67)</li> <li>(68)</li> <li>(69)</li> <li>(70)</li> <li>(71)</li> <li>(72)</li> </ul>	
$\begin{bmatrix} Ja\\ (66)m = & 116\\ 116\\ 116\\ 116\\ 16\\ 16\\ 16\\ 16\\ 16\\$	an         Feb           .14         116.14           ins (calcula           92         18.58           gains (calcula           92         18.58           gains (calcula           61         34.61           d fans gains           3         3           . evaporation           91         -92.91           ing gains (7           98         79.31           nal gains =           .56         365.67           ains:	Mar           116.14           ted in Ap           15.11           culated in           201.58           ated in Ap           34.61           6 (Table 5)           -92.91           Fable 5)           74.41           351.94           using sola           -actor	Apr 116.14 ppendix 11.44 Appendix 190.17 ppendix 34.61 5a) 3 tive valu -92.91 67.97 330.43	116.14 _, equat 8.55 dix L, eq 175.78 L, equat 34.61 3 es) (Tab -92.91 63.57 308.75	116.14 ion L9 or 7.22 uation L 162.26 tion L15 34.61 3 	116.14 r L9a), a 7.8 13 or L1 153.22 or L15a) 34.61 3 -92.91 53.1 m + (67)m 274.97	116.14 Iso see 1 10.14 3a), also 151.09 ), also se 34.61 3 -92.91 59.52 + (68)m + 281.6 tions to co	116.14 Table 5 13.61 5 see Ta 156.45 2e Table 34.61 3 -92.91 62.19 + (69)m + 293.1	116.14 17.28 ble 5 167.85 5 34.61 3 -92.91 68.84 (70)m + (7 314.81 he applications of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second	116.14 20.17 182.24 34.61 3 -92.91 76.26 1)m + (72) 339.52	116.14 21.51 195.77 34.61 3 -92.91 79.93 m 358.05	Gains	<ul> <li>(67)</li> <li>(68)</li> <li>(69)</li> <li>(70)</li> <li>(71)</li> <li>(72)</li> </ul>	

-									_			_			_		_
Northeast 0.9x	0.77		x	1.3	5	×	1	1.28	x		0.57	×	0.7	=	Ľ	4.21	(75)
Northeast 0.9x	0.77		x	1.3	1.35		2	2.97	x		0.57	x	0.7	=	-	8.57	(75)
Northeast 0.9x	0.77		x	1.3	1.35		4	1.38	x		0.57	x	0.7	=	• [	15.45	(75)
Northeast 0.9x	0.77		x	1.35		x	6	7.96	x		0.57	×	0.7	=	- [	25.37	(75)
Northeast 0.9x	0.77		x	1.35		x	g	1.35	x		0.57	×	0.7	=	- [	34.1	(75)
Northeast 0.9x	0.77		x	1.3	5	x	g	7.38	x		0.57	x	0.7	=	- [	36.35	(75)
Northeast 0.9x	0.77		x	1.3	1.35			91.1	x		0.57	x	0.7	=	- [	34.01	(75)
Northeast 0.9x	0.77		x	1.3	1.35		7	2.63	x		0.57	×	0.7	-	۰Ē	27.11	(75)
Northeast 0.9x	0.77		x	1.3	1.35		5	0.42	x		0.57	×	0.7	-	٠Ē	18.82	(75)
Northeast 0.9x	0.77		x	1.35		x	2	8.07	x		0.57	×	0.7	=	• [	10.48	(75)
Northeast 0.9x	0.77		x	1.35		x	· ·	14.2	X		0.57	×	0.7		٠Ē	5.3	(75)
Northeast 0.9x	0.77		x	1.35		x		9.21	Ī×		0.57	×	0.7		۰Ē	3.44	(75)
Northwest 0.9x	0.77		x	1.3	5	x	1	1.28	] ×		0.57	×	0.7	=	٠Ē	16.85	(81)
Northwest 0.9x	0.77		x	1.3	5	x	2	2.97	x		0.57	×	0.7	=	٠Ē	34.29	(81)
Northwest 0.9x	0.77		x	1.3	5	x	4	1.38	] ×		0.57	×	0.7		٠Ē	61.78	(81)
Northwest 0.9x	0.77		x	1.35		x	6	7.96	] ×		0.57	×	0.7		Ē	101.47	(81)
Northwest 0.9x	0.77		x	1.35		x	g	1.35	] ×		0.57	×	0.7		Γ	136.39	(81)
Northwest 0.9x	0.77		x	1.35		x	g	7.38	] ×		0.57	×	0.7		۰Ē	145.41	(81)
Northwest 0.9x	0.77		x	1.35		x		91.1	Ī x		0.57	×	0.7		Ē	136.03	(81)
Northwest 0.9x	0.77		x	1.35		x	7	2.63	Īx		0.57	×	0.7		Ē	108.44	(81)
Northwest 0.9x	0.77		x	1.35		x	5	0.42	] ×		0.57	×	0.7		· Ē	75.29	(81)
Northwest 0.9x	0.77		x	1.3	1.35		2	8.07	İ x		0.57	۲ × آ	0.7		- F	41.91	(81)
Northwest 0.9x 0.77			x	1.3	5	x		14.2	] x		0.57	× ٦	0.7		- F	21.2	(81)
Northwest 0.9x	0.77		x	1.3	5	x		9.21	] ×		0.57	×	0.7		· Ē	13.76	(81)
L									-								
Solar gains in	watts. ca	alculat	ed	for eacl	n mont	h			(83)n	n = Su	um(74)m	(82)m					
(83)m= 21.06	42.87	77.23	<b>T</b>	126.83	170.49		81.76	170.03	135	5.55	94.11	52.39	1	17.2			(83)
Total gains – i	internal a	and so	lar	(84)m =	= (73)m	1+(	83)m	, watts									
(84)m= 389.62	408.53	429.1	7	457.26	479.24	4	69.71	445	417	7.15	387.2	367.2	2 366.02	375.24	1		(84)
7. Mean inter	rnal tem	beratu	re (	(heating	seaso	n)							•	•			
Temperature							area	from Tal	ble 9	, Th1	1 (°C)				Г	21	(85)
Utilisation fac	-					-				,	( )				L		
Jan	Feb	Ма	-	Apr	May	Ť	Jun	Jul	A	ug	Sep	Oc	t Nov	Dec	;		
(86)m= 1	1	1	1	0.99	0.95	_	0.82	0.65	0.	<u> </u>	0.93	0.99	_	1			(86)
Mean interna		ature	in li	iving ar		follo	w eto	ne 3 to ⁻		L Cable	9 (C)		1	I			
(87)m= 19.88	19.97	20.16	-	20.46	20.73	-	20.93	20.99	1	.98	20.84	20.5 [,]	20.17	19.89			(87)
											. /						
Temperature during heating periods in rest o						-	velling 20.14	20.14	1	1	12 (°C) 20.13	20.1	20.1	20.00			(88)
										(00)							
Utilisation fac	T	r	-			-			<del>1 (</del>					Γ.	-		(00)
(89)m= 1	1	0.99		0.98	0.93		0.75	0.54	0.	.6	0.88	0.99	1	1			(89)
Moon interne	l tompor	oturo	in t	ho root	of dwo	llina	T2 /f	allow at	one a	) to 7	in Tabl	o 0o)					

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

(90)m=	18.56	18.7	18.98	19.44	19.82	20.09	20.14	20.14	19.99	19.51	19.01	18.59		(90)
				•	•		•		1	fLA = Livin	g area ÷ (4	4) =	0.34	(91)
Moon	intorna	Itompor	atura (fa	r tho wh	olo dwo	lling) – f	I A ~ T1	+ (1 – fL	A) ~ T2			I		_
(92)m=	19.02	19.14	19.39	19.79	20.14	20.38	20.43	20.43	20.28	19.86	19.41	19.04		(92)
		_			-			4e, whe			10.41	10.04		(02)
(93)m=	18.87	18.99	19.24	19.64	19.99	20.23	20.28	20.28	20.13	19.71	19.26	18.89		(93)
		ting requ												
					re ohtair	ed at st	en 11 of	Table 9	h so tha	t Ti m=('	76)m an	d re-calc	ulate	
				using Ta					0, 30 tha	ι <b>ι</b> 11,111-(	<i>i o jin an</i>		ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1 <u></u> 1:										
(94)m=	1	1	0.99	0.98	0.92	0.76	0.56	0.61	0.88	0.98	1	1		(94)
Usefu	I gains,	hmGm	W = (94	4)m x (8	4)m		•							
(95)m=	388.77	407.2	426.24	447.41	442.52	356.16	247.24	256.3	342.62	360.95	364.54	374.59		(95)
Month	nly aver	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 mea	an interr	al temp	erature,	Lm,W:	=[(39)m	x [(93)m	– (96)m	]	-			
(97)m=	1082.23	1040.14	934.46	762.57	584.66	384.06	250.88	262.57	416.97	642.41	869.08	1063.68		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Nh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
(98)m=	515.93	425.34	378.12	226.91	105.75	0	0	0	0	209.41	363.27	512.68		
								Tota	l per year	(kWh/year	[.] ) = Sum(9	8)15,912 =	2737.41	(98)
Space	e heatin	g require	ement in	kWh/m ²	²/year								37.36	(99)
9a, En	erav rea	uiremer	nts – Ind	ividual h	eating s	vstems i	ncludino	micro-C	CHP)			L. L. L. L. L. L. L. L. L. L. L. L. L. L		
	e heatir	•			<u> </u>	)								
-		-	it from s	econdar	y/supple	mentary	y system						0	(201)
Fracti	ion of sp	ace hea	it from m	nain syst	em(s)			(202) = 1 -	- (201) =			Ì	1	(202)
	•			main sys	( )			(204) = (2	02) × [1 –	(203)] =			1	(204)
			0	ing syste					<i>,</i> .			l	90.3	(206)
	•	-		•••			- 0/							4
ETTICIE	ency of s	seconda	ry/suppi	ementar	y neating	g systen	1, %		r	r	r		0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	r	<u> </u>	· · ·	alculate	i		1							
	515.93	425.34	378.12	226.91	105.75	0	0	0	0	209.41	363.27	512.68		
(211)m	ı = {[(98	)m x (20	4)] } x 1	00 ÷ (20	06)	-			-	-	-			(211)
	571.35	471.03	418.74	251.29	117.11	0	0	0	0	231.9	402.29	567.75		
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	3031.46	(211)
Space	e heatin	g fuel (s	econdar	y), kWh/	month							-		_
= {[(98	)m x (20	)1)]}x1	00 ÷ (20	8)			-	-						
(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)
Water	heating	J										•		
Output				ulated a	1	r			r					
	195.88	171.1	178.02	157.9	152.87	134.64	129	143.8	145.39	165.55	176.73	191.28		_
Efficier	ncy of w	ater hea	ter										81	(216)

(217)m= 87.53	87.42	87.1	86.24	84.56	81	81	81	81	85.94	87.03	87.57		(217)
Fuel for water h													
(219)m = (64)r (219)m= 223.77	<u>m x 100</u> 195.72	÷ (217) 204.39	m 183.1	180.78	166.22	159.25	177.53	179.49	192.63	203.06	218.43		
LI		I	I				Tota	I = Sum(2	19a) ₁₁₂ =	1		2284.39	(219)
Annual totals									k	Wh/year		kWh/year	_
Space heating	fuel use	d, main	system ?	1								3031.46	
Water heating	fuel used	d										2284.39	]
Electricity for p	umps, fa	ans and	electric k	keep-ho	t								
mechanical ve	entilation	ı - balan	ced, extr	ract or p	ositive ir	nput from	n outside	e			206.27		(230a)
central heating	g pump:										30		(230c)
Total electricity	for the a	above, k	Wh/yea	r			sum	of (230a)	(230g) =			236.27	(231)
	ahtina											369.53	(232)
Electricity for lig	99												
12a. CO2 emi		- Individu	ual heati	ng syste	ems inclu	uding mi	cro-CHF	)					
-		- Individu	ual heatii	ng syste	En	uding mi <b>ergy</b> /h/year	cro-CHF	)	<b>Emiss</b> kg CO	<b>ion fac</b> 2/kWh	tor	<b>Emissions</b> kg CO2/yea	
-	issions –			ng syste	<b>En</b> kW	ergy	cro-CHF	)		2/kWh	tor =		
12a. CO2 emi	issions – (main sy	/stem 1)		ng syste	<b>En</b> kW (211	<b>ergy</b> /h/year	cro-CHF		kg CO	2/kWh	-	kg CO2/yea	ar
12a. CO2 emi	issions – (main sy	/stem 1)		ng syste	<b>En</b> kW (21 ⁻ (215	<b>ergy</b> /h/year	cro-CHF	)	kg CO	2/kWh 16 19	=	kg CO2/yea 654.8	ar ](261)
12a. CO2 emi Space heating Space heating	issions – (main sy (second	/stem 1) ary)		ng syste	En kW (211 (215	ergy /h/year ) x 5) x 9) x	cro-CHF + (263) + (		kg CO	2/kWh 16 19	=	kg CO2/yea 654.8 0	ar ](261) ](263)
12a. CO2 emi Space heating Space heating Water heating	(main sy (second	/stem 1) ary) ng			En kW (212 (215 (215) (262	ergy /h/year ) x 5) x 9) x			kg CO	2/kWh 16 19 16	=	kg CO2/yea 654.8 0 493.43	ar ](261) ](263) ](264)
12a. CO2 emi Space heating Space heating Water heating Space and wat	(main sy (second ter heatir umps, fa	/stem 1) ary) ng			En kW (21* (21) (21) (21) (26* t (23*	ergy /h/year ) x 5) x 9) x 1) + (262)			kg CO	2/kWh 16 19 16	= =	kg CO2/yea 654.8 0 493.43 1148.22	ar (261) (263) (264) (265)
12a. CO2 emi Space heating Space heating Water heating Space and wat Electricity for p	(main sy (second ter heatir umps, fa ghting	/stem 1) ary) ng			En kW (21* (21) (21) (21) (26* t (23*	ergy /h/year ) x 5) x 2) x 1) + (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262		264) =	kg CO. 0.2 0.5 0.2	2/kWh 16 19 16 19 19	= = =	kg CO2/yea 654.8 0 493.43 1148.22 122.62	ar (261) (263) (264) (265) (265) (267)
12a. CO2 emi Space heating Space heating Water heating Space and wat Electricity for p Electricity for lig	(main sy (second ter heatir umps, fa ghting year	/stem 1) ary) ng ans and i	electric k		En kW (21* (21) (21) (21) (26* t (23*	ergy /h/year ) x 5) x 2) x 1) + (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262) (262		264) = sum o	kg CO 0.2 0.5 0.2 0.5	2/kWh 16 19 16 19 19	= = =	kg CO2/yea 654.8 0 493.43 1148.22 122.62 191.79	ar (261) (263) (264) (265) (265) (267) (268)

		User D	etails:						
	Hocknell na FSAP 2012		Stroma Softwa					016363 on: 1.0.4.10	
		Property.	Address:	Unit 5-F	Propose	d-Lean			
	5, 40-42 Mill Lane, Lo	ndon, NV	/6 1NR						
1. Overall dwelling dimensions:									
Ground floor			<b>a(m²)</b> 8.31	(1a) x	<b>Av. He</b> i	<b>ght(m)</b> .6	(2a) =	Volume(m ³ ) 177.61	(3a)
Total floor area TFA = (1a)+(1b)-	+(1c)+(1d)+(1e)+(	1n) 6	8.31	(4)					
Dwelling volume				(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	177.61	(5)
2. Ventilation rate:									
	ain     second $ating$ heating       0     +       0     +       0     +		0 0	] = [	<b>total</b> 0 0		40 = 20 =	m ³ per hour	(6a) (6b)
Number of intermittent fans		L	-		0	x ·	10 =	0	(7a)
							10 =		
Number of passive vents				Ļ	0			0	(7b)
Number of flueless gas fires					0	X 4	40 =	0	(7c)
							Air ch	anges per ho	ur
Infiltration due to chimneys, flues If a pressurisation test has been carrie				continue fro	0 om (9) to (		÷ (5) =	0	(8)
Number of storeys in the dwell	ing (ns)							0	(9)
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for s if both types of wall are present, us deducting areas of openings); if equ	e the value corresponding ual user 0.35	to the great	er wall area	a (after	uction			0	(11)
If suspended wooden floor, en		0.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, enter 0.05								0	(13)
Percentage of windows and do	oors draught stripped		0.25 - [0.2	$v(14) \pm 1$	001 -			0	(14)
Window infiltration Infiltration rate			(8) + (10)		1	- (15) =		0	(15)
Air permeability value, q50, ex	pressed in cubic met	res ner hr					area	0	(16) (17)
If based on air permeability value	•			•		nvelope	arca	7 0.35	(17)
Air permeability value applies if a pres					is being us	sed		0.00	
Number of sides sheltered								2	(19)
Shelter factor			(20) = 1 - [	0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporating she	ter factor		(21) = (18)	x (20) =				0.3	(21)
Infiltration rate modified for mont	hly wind speed								
Jan Feb Mar	Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind speed from	n Table 7								
(22)m= 5.1 5 4.9	4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4									
(22a)m= 1.27 1.25 1.23	1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m	-		-	_	
	0.38	0.37	0.36	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.33	0.35		
		<i>ctive air</i> al ventila	•	rate for t	he appli	cable ca	se						0.5	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (1	N5)), othe	rwise (23b	) = (23a)			0.5	(23a) (23b)
			• • • •	iency in %	, ,	, .				/ ( /			73.1	(23c)
			-	-	-					2b)m + (2	23h) x [	1 – (23c)		(200)
(24a)m=		0.51	0.5	0.46	0.45	0.42	0.42	0.41	0.43	0.45	0.47	0.48	]	(24a)
		d mech	L anical ve	I entilation	without	heat rec	L Coverv (N	I MV) (24b	) )m = (22	1 2b)m + (2	23b)		]	
(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	ve input v	ventilatio	n from o	outside				1	
,					•	•				5 × (23b	)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
,				ole hous	•	•								
	· ,	r	r , ,	)m = (22l	, 	· · ·	<u> </u>	1	r	<u> </u>			1	(244)
(24d)m=		0	0	0	0	0	0	0	0	0	0	0		(24d)
		<u> </u>	1	nter (24a	, <u>,</u>	<u> </u>	r i	í –	<u> </u>	0.45	0.47	0.40	1	(25)
(25)m=	0.51	0.51	0.5	0.46	0.45	0.42	0.42	0.41	0.43	0.45	0.47	0.48	]	(25)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	IENT	Gros area		Openin rr		Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-valu kJ/m²·		A X k kJ/K
Doors						2	x	1.5	=	3				(26)
Windov	ws Type	e 1				1.35	x1	/[1/( 1.4 )+	0.04] =	1.79				(27)
Windov	ws Type	e 2				1.35	x1	/[1/( 1.4 )+	0.04] =	1.79				(27)
Windov	ws Type	e 3				1.35	x1	/[1/( 1.4 )+	0.04] =	1.79				(27)
Windov	ws Type	94				2.66	x1	/[1/( 1.4 )+	0.04] =	3.53				(27)
Walls 7	Гуре1	60.4	11	8.06	;	52.35	5 X	0.25	=	13.09				(29)
Walls 7	Гуре2	5.6	5	2		3.65	x	0.23	=	0.83				(29)
Roof		22.6	35	0		22.65	5 X	0.18	=	4.08				(30)
Total a	rea of e	lements	, m²			88.71	1							(31)
Party v	vall					30.66	3 X	0	=	0				(32)
Party f	loor					68.31	1				[			(32a)
Party c	eiling					45.66	3				[			(32b)
				effective wi nternal wal			ated using	g formula 1	/[(1/U-valu	ie)+0.04] a	s given in	paragrapl	h 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26) (30)	) + (32) =				31.68	3 (33)
Heat c	apacity	Cm = S	(A x k )						((28)	(30) + (32	2) + (32a)	(32e) =	11384	.7 (34)
Therm	al mass	parame	ter (TMF	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35)
	-		nere the de tailed calc		construct	ion are not	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						13.31	(36)
if details	of therma	al bridging	are not kr	nown (36) =	= 0.15 x (3	1)								

Total fa	abric he	at loss							(33) +	(36) =			44.99	(37)
Ventila	tion hea	at loss ca	alculated	l monthly	/	-	-		(38)m	= 0.33 × (	25)m x (5)		_	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	30.11	29.68	29.24	27.06	26.63	24.45	24.45	24.01	25.32	26.63	27.5	28.37		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	75.1	74.66	74.23	72.05	71.61	69.43	69.43	69	70.31	71.61	72.49	73.36		
						•	•				Sum(39)1	₁₂ /12=	71.94	(39)
		meter (H	<i>,</i> .		1.05	4.00	1.00	4.04	. ,	= (39)m ÷	. ,	4.07	1	
(40)m=	1.1	1.09	1.09	1.05	1.05	1.02	1.02	1.01	1.03	1.05	1.06 Sum(40) ₁	1.07	1.05	(40)
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average –	Sum(40)1	12/12-	1.05	(+0)
	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)
I													•	
4. Wa	ter heat	ting ener	gy requi	rement:								kWh/y	ear:	
A			. 1										1	
		ıpancy, l 9. N = 1		[1 - exp	(-0.0003	849 x (TF	- A -13.9	)2)] + 0.0	)013 x ( ⁻	TFA -13.		.2	J	(42)
	A £ 13.9			L	(			/_/]			-)			
					•		•	(25 x N)		a taraat a		.55	]	(43)
		-				hot and co	-	to achieve	a water us	se target o	Γ			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
Hot wate					,	ctor from 1		Ŭ Ŭ	Seb		NOV	Dec	J	
(44)m=	95.21	91.75	88.29	84.82	81.36	77.9	77.9	81.36	84.82	88.29	91.75	95.21	1	
(,											m(44) _{1 12} =		1038.66	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x D	OTm / 3600						
(45)m=	141.19	123.49	127.43	111.1	106.6	91.99	85.24	97.81	98.98	115.35	125.92	136.74		
										Total = Su	m(45) _{1 12} =		1361.84	(45)
lf instant		ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46)	) to (61)	r	r	-	1	
(46)m=	21.18	18.52	19.11	16.66	15.99	13.8	12.79	14.67	14.85	17.3	18.89	20.51		(46)
	storage e volum		includir	na anv so	olar or M	/WHRS	storage	within sa	me ves	مما		0	1	(47)
		, ,		• •		nter 110				501		0	J	(47)
	•	•			•			ombi boil	ers) ente	er '0' in (	47)			
	storage			<b>v</b>					,	,	,			
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0	]	(48)
Tempe	rature f	actor fro	m Table	2b								0	]	(49)
			-	, kWh/ye				(48) x (49)	=			0	]	(50)
,				-		or is not							1	
		leating s			e 2 (KVV	h/litre/da	iy)					0	J	(51)
	•	from Ta										0	]	(52)
Tempe	rature f	actor fro	m Table	2b								0	1	(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (	53) =		0	j	(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 cylind	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	v circuit	loss (ar	nual) fro	om Table	e 3	•	•	•		1		0	Ì	(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 heati	ng and a	a cylinde	r thermo	ostat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	J	(59)
Combi	loss ca	Iculated	for each	month	(61)m =	(60) ÷ 36	65 × (41	)m						
(61)m=	48.52	42.23	44.99	41.83	41.46	38.42	39.7	41.46	41.83	44.99	45.25	48.52		(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=	189.71	165.72	172.42	152.93	148.06	130.4	124.94	139.27	140.81	160.34	171.16	185.26		(62)
										r contribut	tion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (	G)	i	i	i		
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	J	(63)
Output	t from w	ater hea	iter						-		-			
(64)m=	189.71	165.72	172.42	152.93	148.06	130.4	124.94	139.27	140.81	160.34	171.16	185.26		-
								Out	out from w	ater heate	r (annual)₁	12	1881.03	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	i + (61)n	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	·]	
(65)m=	59.08	51.62	53.62	47.4	45.81	40.19	38.27	42.89	43.37	49.6	53.18	57.6	J	(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 f	rom com	munity h	leating	
5. In	ternal ga	ains (see	e Table 5	5 and 5a	):									
Metab	olic gair	ns (Table	<u>e 5), Wat</u>	ts									1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22	110.22	J	(66)
-		<u>`</u>	· · · ·	· · · · · · · · · · · · · · · · · · ·	· · · ·	ion L9 o	· · · ·	· · · · · · · · · · · · · · · · · · ·			,		1	
(67)m=	18.71	16.62	13.51	10.23	7.65	6.46	6.98	9.07	12.17	15.45	18.04	19.23	J	(67)
Applia		ins (calc	ulated in	· · ·	· · ·	uation L	13 or L1	3a), also	see Ta	ble 5	i	i	•	
(68)m=	193.32	195.33	190.27	179.51	165.92	153.16	144.63	142.62	147.68	158.44	172.02	184.79	J	(68)
Cookir	ng gains	(calcula	ated in A	ppendix	L, equat	tion L15	or L15a	), also se	ee Table	e 5				
(69)m=	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02	34.02	J	(69)
Pumps	and fa	ns gains	(Table !	5a)										
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losse	s e.g. ev	aporatio	on (nega	tive valu	es) (Tab	le 5)	-	-	-	-	-	-	_	
(71)m=	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18	-88.18		(71)
Water	heating	gains (1	Table 5)											
(72)m=	79.4	76.81	72.07	65.83	61.57	55.82	51.43	57.65	60.24	66.67	73.86	77.41		(72)
Total i	nternal	gains =				(66)	)m + (67)m	n + (68)m ·	+ (69)m +	(70)m + (7	(1)m + (72)	)m	_	
(73)m=	350.5	347.82	334.92	314.64	294.21	274.5	262.1	268.4	279.15	299.63	322.98	340.5		(73)
6 50	lar gains	2.												

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 0.9	0.77	x	1.35	×	11.28	×	0.57	×	0.7	=	4.21	(75)
Northeast 0.9	0.77	x	1.35	x	22.97	×	0.57	x	0.7	=	8.57	(75)
Northeast 0.9	0.77	x	1.35	x	41.38	×	0.57	x	0.7	] =	15.45	(75)
Northeast 0.9	0.77	x	1.35	x	67.96	×	0.57	×	0.7	=	25.37	(75)
Northeast 0.9	0.77	x	1.35	x	91.35	x	0.57	x	0.7	=	34.1	(75)
Northeast 0.9	0.77	x	1.35	x	97.38	×	0.57	x	0.7	] =	36.35	(75)
Northeast 0.9	0.77	x	1.35	x	91.1	×	0.57	x	0.7	=	34.01	(75)
Northeast 0.9	0.77	x	1.35	x	72.63	×	0.57	x	0.7	=	27.11	(75)
Northeast 0.9	0.77	x	1.35	x	50.42	×	0.57	x	0.7	] =	18.82	(75)
Northeast 0.9	0.77	x	1.35	x	28.07	×	0.57	x	0.7	=	10.48	(75)
Northeast 0.9	0.77	x	1.35	x	14.2	×	0.57	x	0.7	=	5.3	(75)
Northeast 0.9	0.77	x	1.35	×	9.21	×	0.57	x	0.7	=	3.44	(75)
Southeast 0.9	0.77	x	1.35	x	36.79	×	0.57	x	0.7	=	13.73	(77)
Southeast 0.9	0.77	x	1.35	×	36.79	×	0.57	×	0.7	=	27.47	(77)
Southeast 0.9	0.77	x	2.66	x	36.79	×	0.57	x	0.7	=	27.06	(77)
Southeast 0.9	0.77	x	1.35	x	62.67	×	0.57	x	0.7	=	23.4	(77)
Southeast 0.9	0.77	x	1.35	×	62.67	×	0.57	×	0.7	=	46.79	(77)
Southeast 0.9	0.77	x	2.66	x	62.67	×	0.57	x	0.7	=	46.1	(77)
Southeast 0.9	0.77	x	1.35	x	85.75	×	0.57	x	0.7	=	32.01	(77)
Southeast 0.9	0.77	x	1.35	×	85.75	×	0.57	x	0.7	=	64.02	(77)
Southeast 0.9	0.77	x	2.66	x	85.75	×	0.57	x	0.7	=	63.07	(77)
Southeast 0.9	0.77	x	1.35	x	106.25	×	0.57	x	0.7	=	39.66	(77)
Southeast 0.9	0.77	x	1.35	x	106.25	×	0.57	x	0.7	=	79.32	(77)
Southeast 0.9	0.77	x	2.66	x	106.25	×	0.57	x	0.7	=	78.15	(77)
Southeast 0.9	0.77	x	1.35	x	119.01	×	0.57	x	0.7	=	44.42	(77)
Southeast 0.9	0.77	x	1.35	x	119.01	×	0.57	x	0.7	=	88.85	(77)
Southeast 0.9	0.77	x	2.66	x	119.01	×	0.57	x	0.7	=	87.53	(77)
Southeast 0.9	0.77	x	1.35	×	118.15	×	0.57	x	0.7	=	44.1	(77)
Southeast 0.9>	0.77	x	1.35	×	118.15	×	0.57	x	0.7	=	88.21	(77)
Southeast 0.9	0.77	x	2.66	x	118.15	x	0.57	x	0.7	=	86.9	(77)
Southeast 0.9		x	1.35	×	113.91	×	0.57	x	0.7	=	42.52	(77)
Southeast 0.9	0.77	x	1.35	×	113.91	×	0.57	x	0.7	=	85.04	(77)
Southeast 0.9	-	x	2.66	x	113.91	x	0.57	x	0.7	=	83.78	(77)
Southeast 0.9		x	1.35	×	104.39	×	0.57	x	0.7	=	38.97	(77)
Southeast 0.9		x	1.35	×	104.39	×	0.57	x	0.7	] =	77.93	(77)
Southeast 0.9		x	2.66	×	104.39	×	0.57	×	0.7	=	76.78	(77)
Southeast 0.9		x	1.35	×	92.85	×	0.57	×	0.7	=	34.66	(77)
Southeast 0.9		x	1.35	×	92.85	×	0.57	×	0.7	=	69.32	(77)
Southeast 0.9	0.77	x	2.66	x	92.85	×	0.57	×	0.7	] =	68.29	(77)

					_		_			_				
Southeast 0.9x	0.77	×	1.3	35	x	69.27	×	0.57		x	0.7	=	25.86	(77)
Southeast 0.9x	0.77	x	1.3	35	x	69.27	x	0.57		x	0.7	=	51.71	(77)
Southeast 0.9x	0.77	x	2.6	66	x	69.27	x	0.57		x	0.7	=	50.95	(77)
Southeast 0.9x	0.77	x	1.3	35	x	44.07	x	0.57		x	0.7	=	16.45	(77)
Southeast 0.9x	0.77	x	1.3	35	x	44.07	×	0.57		x	0.7	=	32.9	(77)
Southeast 0.9x	0.77	x	2.6	6	x	44.07	×	0.57		x	0.7	=	32.41	(77)
Southeast 0.9x	0.77	x	1.3	35	x	31.49	×	0.57		x	0.7	=	11.75	(77)
Southeast 0.9x	0.77	x	1.3	35	×	31.49	×	0.57		×	0.7	=	23.51	(77)
Southeast 0.9x	0.77	x	2.6	66	x	31.49	×	0.57		×	0.7	=	23.16	(77)
Solar gains in	watts, ca	alculated	l for eac	h month			(83)n	n = Sum(74	)m (82	2)m				
(83)m= 72.48	124.86	174.55	222.5	254.91	255	.56 245.35	220	.79 191	.1 13	38.99	87.07	61.86		(83)
Total gains –	internal a	and solar	(84)m =	= (73)m	+ (83	B)m , watts	-	<b>I</b>						
(84)m= 422.98	472.68	509.47	537.14	549.12	530	.06 507.45	489	.19 470.	24 43	88.62	410.05	402.36		(84)
7. Mean inte	rnal tom	oratura	(boating				-		-			<u> </u>		
			, , , , , , , , , , , , , , , , , , ,		<i>.</i>				• •				<b></b>	
Temperature	•	• •			-			, Ini (°C	)				21	(85)
Utilisation fa	T			1	r`					<u> </u>			l	
Jan	Feb	Mar	Apr	May		un Jul		ug Se	<u> </u>	Oct	Nov	Dec		(00)
(86)m= 1	1	0.99	0.97	0.91	0.7	76 0.59	0.6	63 0.8	6 0	.98	1	1		(86)
Mean interna	al temper	ature in	living ar	ea T1 (fe	ollow	steps 3 to	7 in 1	able 9c)			-	-		
(87)m= 19.85	19.98	20.2	20.51	20.77	20.	94 20.99	20.	99 20.8	39 20	0.56	20.16	19.84		(87)
Temperature	e during h	neating p	eriods ir	n rest of	dwe	lling from T	able	9, Th2 (°(	C)					
(88)m= 20	20.01	20.01	20.04	20.04	20.		20	<u> </u>	<u> </u>	0.04	20.03	20.02		(88)
Utilisation fa	tor for a	oine for l		wolling	h2 m			<b>I</b>			1			
(89)m= 1	0.99	0.99	0.96	0.88	0.6	<u>`</u>	e 9a)	51 0.7	a   n	.96	0.99	1		(89)
											0.00			(00)
Mean interna	<u> </u>	1		i	<u> </u>	<u> </u>					r	i	I	
(90)m= 18.46	18.67	18.99	19.45	19.81	20.	03 20.07	20.	07 19.9		9.52	18.95	18.47		(90)
									fLA =	= Livir	ng area ÷ (4	4) =	0.33	(91)
Mean interna	al temper	ature (fo	r the wh	ole dwe	lling)	$= fLA \times T^{-1}$	1 + (1	– fLA) ×	T2					
(92)m= 18.92	19.1	19.39	19.8	20.12	20.		20.			9.86	19.35	18.92		(92)
Apply adjust	ment to t	he mear	interna	l temper	ature	e from Tabl	e 4e.	where an	opropri	ate	1			
(93)m= 18.77	18.95	19.24	19.65	19.97	20.		20	<u> </u>	<u> </u>	9.71	19.2	18.77		(93)
8. Space hea	ating regi	uirement												
Set Ti to the				re obtair	ned a	at step 11 c	f Tab	le 9h so	that Ti	(	76)m an	d re-calc	ulate	
the utilisation			•		.00.0		1 1 4 5			, (	, c)n an			
Jan	Feb	Mar	Apr	May	Ju	un Jul	A	ug Se	ep (	Oct	Nov	Dec		
Utilisation fa	tor for g	ains, hm	:			I	-	<u> </u>	· •					
(94)m= 1	0.99	0.98	0.95	0.87	0.6	69 0.49	0.9	53 0.8	3 0	.96	0.99	1		(94)
Useful gains	, hmGm	, W = (94	4)m x (8 [,]	<b>4</b> )m			-	!			<u>I</u>		I	
(95)m= 421.08	· ·	500.2	511.77	480.12	366	.54 248.74	259	.67 375.	32 42	20.49	406.32	400.96		(95)
Monthly ave	rage exte	ernal tem	perature	e from T	able	8	1	I	I		1		I	
(96)m= 4.3	4.9	6.5	8.9	11.7	14	- 1	16	.4 14.	1 1	0.6	7.1	4.2		(96)
Heat loss rat	e for me	an intern	al temp	erature.	Lm.	W =[(39)m	n x [(9	<b>i</b> 3)m– (96	)m ]		<u>I</u>	1	I	
(97)m= 1086.5	1	945.74	774.39	592.47	387			<u> </u>	ŕ	52.64	876.89	1069.02		(97)
		1			I		_							

							<b>ergy</b> /h/year			Emiss kg CO2	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/ye	
12a. C	CO2 em	issions -	– Individ	lual heat	ing syste	ems inclu	uding mi	cro-CHF						
	ity for li												330.37	(232)
			above, l	kWh/yea	ır			sum	of (230a)	(230g) =			222.3	(231)
		g pump:										30		(230c)
				nced, ext	ract or p	ositive ii	nput fron	n outside	Э			192.3		(230a)
				electric	•									
	Ũ	fuel use										L	2215.87	
	-			System	I							L		
	I totals	fuel แระ	niem he	system	1					k	Wh/yea	r Г	<b>kWh/yea</b> 2766.19	, -
								Tota	II = Sum(2				2215.87	(219)
(219)m=		189.8	198.44	178.05	176	160.99	154.24	171.94	173.84	187.38	196.85	211.55		_
		heating, m x 100												
(217)m=		87.31	86.89	85.89	84.13	81	81	81	81	85.57	86.95	87.57		(217)
		ater hea	ter	-									81	(216)
. [	189.71	165.72	172.42	152.93	148.06	130.4	124.94	139.27	140.81	160.34	171.16	185.26		_
	heating		ter (calc	ulated a	bove)			Tota	il (kWh/yea	ar) =Sum(2	215) _{15,10. 1}	2=	0	(215)
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		-
= {[(98)	m x (20	1)] } x 1	00 ÷ (20	T .	1			I	ll (kWh/yea			L 1	2766.19	(211)
[	548.26	431.96	367.09	209.4	92.57	0	0	0	0	191.28	375.21	550.43		_
_ (211)m	= {[(98]	)m x (20	4)] } x 1	100 ÷ (20	06)	•		•						(211)
[	495.08	390.06	331.49	189.09	83.59	0	0	0	0	172.72	338.81	497.04		
L Space				calculate		I		,					ye	
]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	
	•			ementar		g systen	ı, %					Ĺ	0	(208)
			0	ting syste					-			L T	90.3	(206)
				main sys				(204) = (2	02) × [1 –	(203)] =		L T	1	(204)
	•			nain syst		, nontary		(202) = 1 -	- (201) =			Ĺ	1	(202)
Space	e heatin	ıg:		econdar		-			, , , , , , , , , , , , , , , , , , ,			Г	0	(201)
-				ividual h	-	vstems i	ncluding	umicro-C	HP)			L	00.01	
Space	e heating	a reauire	ement in	ı kWh/m²	²/vear			1014	in por your	(itter jour	) 0011(0	, , , , , , , , , , , , , , , , , , ,	36.57	(99)
(90)11-	495.00	390.00	551.49	109.09	03.39	0	0	-	l per year			I	2497.87	(98)
Space (98)m=	495.08	390.06	331.49	189.09	83.59		11 - 0.02		)m – (95 0	172.72	338.81	497.04		

Space heating (main system 1)	(211) x	0.216	=	597.5	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	478.63	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1076.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	115.38	(267)
Electricity for lighting	(232) x	0.519	=	171.46	(268)
Total CO2, kg/year	sum	of (265) (271) =		1362.96	(272)
Dwelling CO2 Emission Rate	(272)	) ÷ (4) =		19.95	(273)
El rating (section 14)				84	(274)

		User D	etails:						
Assessor Name:Chris HSoftware Name:Stroma	ocknell FSAP 2012		Stroma Softwa					016363 on: 1.0.4.10	
		Property /		Unit 6-F	Propose	d-Lean			
	0-42 Mill Lane, Lor	don, NW	/6 1NR						
1. Overall dwelling dimensions:		_	<i>(</i> )						
Ground floor			<b>a(m²)</b> 4.36	(1a) x	<b>Av. He</b>	<b>ight(m)</b> .16	(2a) =	Volume(m ³ ) 139.02	(3a)
Total floor area TFA = (1a)+(1b)+(1b)	c)+(1d)+(1e)+(1	n) 6	4.36	(4)					
Dwelling volume				(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	139.02	(5)
2. Ventilation rate:	-							<u> </u>	
main heatinNumber of chimneys0Number of open flues0	ng heating + 0	ry + +	0 0 0	] = [ ] = [	<b>total</b> 0 0		40 = 20 =	m ³ per hour	(6a) (6b)
Number of intermittent fans				 -	0	x ^	10 =	0	 ](7a)
Number of passive vents					0	x ^	10 =	0	 _(7b)
Number of flueless gas fires					0	x4	40 =	0	](7c)
					0			0	
							Air ch	anges per ho	ur
Infiltration due to chimneys, flues ar If a pressurisation test has been carried o	ut or is intended, procee			continue fro	0 om (9) to (		÷ (5) =	0	(8)
Number of storeys in the dwelling Additional infiltration	(ns)					[(0)	-1]x0.1 =	0	(9)
Structural infiltration: 0.25 for stee	l or timber frame o	r 0 35 for	masonr	v constr	uction	[(9)-	- 1jx0. i –	0	(10) (11)
if both types of wall are present, use th deducting areas of openings); if equal (	e value corresponding t iser 0.35	o the great	er wall area	a (after	uction			0	_ _(,,)
If suspended wooden floor, enter		.1 (seale	d), else	enter 0				0	(12)
If no draught lobby, enter 0.05, el								0	(13)
Percentage of windows and doors	draught stripped		0.25 - [0.2	$\mathbf{v}(14) \pm 1$	001 -			0	(14)
Window infiltration Infiltration rate			(8) + (10)			+ (15) =		0	(15)
Air permeability value, q50, expre	esed in cubic metr						area	0	(16) (17)
If based on air permeability value, th				•		nvelope	arca	3 0.15	(17)
Air permeability value applies if a pressuri					is being us	sed		0.10	
Number of sides sheltered								1	(19)
Shelter factor			(20) = 1 - [	[0.075 x (1	9)] =			0.92	(20)
Infiltration rate incorporating shelter	factor		(21) = (18)	) x (20) =				0.14	(21)
Infiltration rate modified for monthly	wind speed								
Jan Feb Mar Ar	or May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind speed from T	able 7								
(22)m= 5.1 5 4.9 4.4	4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)m ÷ 4									
(22a)m= 1.27 1.25 1.23 1.1	1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltra	tion rate	e (allowir	ng for sh	elter an	d wind s	peed) =	(21a) x (	(22a)m					
	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16		
	ate effect chanical		-	ate for ti	he appli	cable ca	se					г Г		
	aust air hea			ndix N (2	3h) = (23a	) x Fmv (e	equation (N	(5)) other	wise (23h	) = (23a)		ľ	0.5	(23a)
	inced with									) - (200)		ľ	0.5	(23b)
							,	,		Dh)m ⊥ //	226) v [	1 (22a)	74.8	(23c)
(24a)m=	i	0.3		0.28	0.28	0.26	0.26	0.25	)III – (22 0.26	0.28	23D) × [ 0.28	1 – (23c) 0.29	÷ 100]	(24a)
Ľ												0.29		(244)
(24b)m=	balanced							0	m = (22)	$\frac{1}{2} \frac{1}{2} \frac{1}$	230)	0		(24b)
	-	-	,	÷	-		-		•	0	0	Ū		(210)
,	whole ho f (22b)m				•	•				5 × (23b	)			
(24c)m=	0	0.0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If i	natural v	entilatio	n or who	le hous	e positiv	le input v	ventilatic	n from l	oft					
	f (22b)m									0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	ctive air c	hange r	ate - en	ter (24a	) or (24b	o) or (240	c) or (24	d) in box	(25)			-		
(25)m=	0.3	0.3	0.3	0.28	0.28	0.26	0.26	0.25	0.26	0.28	0.28	0.29		(25)
3 Hes	at losses	and he	at lose n	aramete	ar.									
ELEM		Gross		Openin		Net Ar	ea	U-valu	e	AXU		k-value	. Α	Xk
		area (	(m²)	m	2	A ,n	∩²	W/m2	к <u></u>	(W/ł	<)	kJ/m²∙k	(k	J/K
Doors						2	X	1.5	=	3				(26)
Window	ws Type	1				0.99	x1/	[1/( 1.4 )+	0.04] =	1.31				(27)
Window	ws Type	2				0.99	x1/	[1/( 1.4 )+	0.04] =	1.31				(27)
Walls T	Type1	30.12	2	4.95		25.17	×	0.15	=	3.78				(29)
Walls T	ype2	4.78		2		2.78	x	0.14	=	0.39				(29)
Walls T	уре3	3.85		0		3.85	x	0.15	= [	0.58	ו ר		7	(29)
Walls T	ype4	21.55	5	0			= ;						= ==	(29)
Walls T				0		21.55	X	0.15	= [	3.23				
	уре5	8.89		0		21.55 8.89	x x	0.15 0.13	= [ = [	3.23 1.17				(29)
Roof T		Г					× [		╡╏					(29)
Roof T Roof T	ype1	8.89		0		8.89	× [	0.13		1.17				
Roof T	ype1 ype2	8.89 53.89 2.6	)	0		8.89 53.89 2.6		0.13 0.1		1.17 5.39				(30) (30)
Roof T Total a	⊽pe1 ⊽pe2 rea of ele	8.89 53.89 2.6	)	0		8.89 53.89 2.6 125.66		0.13 0.1 0.1		1.17 5.39 0.26				(30) (30) (31)
Roof T Total a Party w	⊽pe1 ⊽pe2 rea of ele vall	8.89 53.89 2.6	)	0		8.89 53.89 2.6 125.64 22.68		0.13 0.1		1.17 5.39				(30) (30) (31) (32)
Roof T Total a Party w Party fl	ype1 ype2 rea of ele vall oor dows and r	8.89 53.89 2.6 ements,	m²	0 0 0		8.89 53.89 2.6 125.68 22.68 64.36 64.36		0.13 0.1 0.1 0		1.17 5.39 0.26 0	[ [ [ [ [ [ [ [ [ [	paragraph		(30) (30) (31)
Roof T Total at Party w Party fl * for wind ** include	ype1 ype2 rea of ele vall oor dows and r e the areas	8.89 53.89 2.6 ements,	m ² ws, use ef	0 0 0		8.89 53.89 2.6 125.68 22.68 64.36 64.36	x   x   x   x   x   x   x   x   x   x	0.13 0.1 0.1 0 formula 1/	= [ = [ = [ = [ = [	1.17 5.39 0.26 0	s given in	paragraph		(30) (30) (31) (32) (32a)
Roof T Total a Party w Party fl * for wind ** include Fabric	ype1 ype2 rea of ele vall oor dows and r e the areas heat loss	8.89 53.89 2.6 ements, coof window s on both s s, W/K =	m ² m ² sides of int S (A x U	0 0 0		8.89 53.89 2.6 125.68 22.68 64.36 64.36	x   x   x   x   x   x   x   x   x   x	0.13 0.1 0.1 0	= [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [] = [	1.17 5.39 0.26 0	-	[	24.36	(30) (30) (31) (32) (32a) (32a)
Roof T Total a Party w Party fl * for wind ** include Fabric Heat ca	ype1 ype2 rea of ele vall oor dows and r e the areas heat loss apacity C	8.89 $53.89$ $2.6$ ements, ements, s on both s $S, W/K = Cm = S(A$	m ² m ² S (A x t A x k )	0 0 0	s and part	8.89 53.89 2.6 125.64 22.68 64.36 alue calcula itions	x   x   x   x   x   x   x   x   x   x	0.13 0.1 0.1 0 formula 1/	$ \begin{bmatrix} - & - & - \\ - & - & - \\ - & - & - \\ - & - &$	$   \begin{array}{r}     1.17 \\     \overline{5.39} \\     0.26 \\     \hline     0 \\     0 \\     ue)+0.04] a \\     (30) + (32) \\   \end{array} $	?) + (32a)	[	24.36 8288.27	(30) (30) (31) (32) (32a) (32a) (33) (34)
Roof T Total a Party w Party fl * for wind ** include Fabric Heat ca Therma	ype1 ype2 rea of ele vall oor dows and r e the areas heat loss	8.89 53.89 2.6 ements, coof windows on both ss, W/K =Cm = S(Aparameter	m ² m ² S (A x I A x k ) er (TMP	0 0 0 ffective win ternal wall J) = Cm ÷	's and part · TFA) in	8.89 53.89 2.6 125.64 22.68 64.36 64.36 alue calcula itions	x   x   x   x   x   x   x   x   x   x	0.13 0.1 0.1 0 formula 1/ (26) (30)	=     =      =	1.17 5.39 0.26 0 <i>(a) + 0.04] a</i> (30) + (32) tive Value:	?) + (32a) Medium	(32e) = [	24.36	(30) (30) (31) (32) (32a) (32a)

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

24.31	(36)
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if details	of therm	al bridging	are not kr	10wn (36) :	= 0.15 x (3	11)								_
Total f	abric he	at loss							(33) +	(36) =			48.68	(37)
Ventila	ation he	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=	13.9	13.74	13.58	12.78	12.62	11.83	11.83	11.67	12.15	12.62	12.94	13.26		(38)
Heat t	ransfer	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	62.57	62.41	62.25	61.46	61.3	60.5	60.5	60.35	60.82	61.3	61.62	61.94		
			•	•		•			,	Average =	Sum(39)1	12 <b>/12=</b>	61.42	(39)
	· · ·	ameter (H	<u>,</u>	1			· · · · ·	,		= (39)m ÷	· · ·		1	
(40)m=	0.97	0.97	0.97	0.95	0.95	0.94	0.94	0.94	0.95	0.95	0.96	0.96		<b>-</b>
Numb	er of da	ys in mo	nth (Tab	le 1a)			-			Average =	Sum(40)1	12 <b>/12=</b>	0.95	(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 ene	rgy requ	irement:								kWh/y	ear:	
A			N 1										1	
		upancy, 9. N = 1		(1 - exp	)(-0.0003	349 x (TF	- A -13.9	)2)] + 0.(	)013 x ( ⁻	TFA -13.		.1	J	(42)
	A £ 13.				( 0.0000			/_/] 010			,			
								(25 x N)				.12	]	(43)
		-		usage by r day (all w		-	-	to achieve	a water us	se target o	T			
			1	1		r		<b>A</b> 110	Son	Oct	Nov	Dee	1	
Hot wat	Jan er usage i	Feb	Mar dav for e	Apr ach month	May	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	92.53	, 89.17	85.8	82.44	79.07	75.71	75.71	79.07	82.44	85.8	89.17	92.53	1	
(++)11-	02.00	00.17	00.0	02.44	10.07	10.11	10.11	10.01			m(44) _{1 12} =		1009.43	(44)
Energy	content of	f hot water	used - ca	lculated m	onthly = 4.	190 x Vd,r	n x nm x L	) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) )					1000.40	
(45)m=	137.22	120.01	123.84	107.97	103.6	89.4	82.84	95.06	96.2	112.11	122.37	132.89	]	
						1	1	1		Total = Su	m(45)1 12 =	•	1323.52	(45)
lf instar	taneous v	vater heati	ng at poin	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46	) to (61)					
(46)m=	20.58	18	18.58	16.2	15.54	13.41	12.43	14.26	14.43	16.82	18.36	19.93		(46)
	storage												1	
-							-	within sa	ame ves	sel		0		(47)
	•	•		ank in dw	•			• •	oro) ont	or (0' in (	47)			
	storage		not wate		iciudes i	nsianiai	ieous cu	ombi boil	ers) ente		47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):					0	]	(48)
		actor fro										0	]	(49)
•				e, kWh/ye	ear			(48) x (49)	) =			0	]	(50)
-			-	cylinder		or is not		( - / ( - )				0	]	(00)
		-		rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
	•	neating s		on 4.3									1	
		from Ta		. 2h								0		(52)
		actor fro							(50)	50)		0	]	(53)
-		m water (54) in (5	-	e, kWh/ye	ear			(47) x (51)	) x (52) x (	ರನ) =		0		(54)
	(50)0	(0-) 11 (3										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	rage, (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	e 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 heati	ng and a	cylinde	r thermo	ostat)		
(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) ÷ 36	65 × (41	)m					
(61)m=	47.15	41.04	43.72	40.65	40.29	37.33	38.58	40.29	40.65	43.72	43.97	47.15	(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=	184.37	161.05	167.57	148.62	143.89	126.73	121.42	135.36	136.85	155.83	166.35	180.04	(62)
Solar Dł	-IW input	calculated	using App	endix G o	Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	tion to wate	er heating)	-
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (	G)	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=	184.37	161.05	167.57	148.62	143.89	126.73	121.42	135.36	136.85	155.83	166.35	180.04	
								Outp	out from w	ater heate	<mark>r (annual)</mark> ₁	12	1828.09 (64)
Heat g	ains fro	m water	heating,	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	]
(65)m=	57.41	50.16	52.11	46.06	44.52	39.06	37.19	41.68	42.15	48.21	51.68	55.97	(65)
inclu	Ido (57)	m in cal											
incit	iue ( <i>31</i> )		culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fi	rom com	munity h	neating
	. ,		e Table 5	. ,	-	ylinder i	s in the o	dwelling	or hot w	ater is fi	rom com	munity h	neating
5. Int	ternal ga	ains (see		5 and 5a	-	ylinder i	s in the o	dwelling	or hot w	ater is fi	rom com	munity h	neating
5. Int	ternal ga	ains (see	e Table 5	5 and 5a	-	ylinder is Jun	s in the o	dwelling Aug	or hot w Sep	ater is fi Oct	rom com	munity h	neating
5. Int	ternal ga olic gain	ains (see as (Table	e Table 5 e 5), Wat	5 and 5a	):	- I	I	i		I	1		neating (66)
5. Int Metabo (66)m=	ternal ga olic gain Jan 105.09	ains (see ns (Table Feb 105.09	e Table 5 5), Wat Mar 105.09	5 and 5a ts Apr 105.09	): May 105.09	Jun 105.09	Jul 105.09	Aug	Sep 105.09	Oct	Nov	Dec	
5. Inf Metabo (66)m= Lightin	ternal ga olic gain Jan 105.09 g gains	ains (see ns (Table Feb 105.09 (calcula	e Table 5 5), Wat Mar 105.09	5 and 5a tts Apr 105.09 opendix	): May 105.09 L, equat	Jun 105.09	Jul 105.09	Aug 105.09	Sep 105.09	Oct	Nov	Dec	
5. Int Metabo (66)m= Lightin (67)m=	ternal ga olic gain Jan 105.09 g gains 19.92	ains (see ns (Table Feb 105.09 (calcula 17.69	2 Table 5), Wat Mar 105.09 ted in Ap 14.39	5 and 5a ts Apr 105.09 opendix 10.89	): 105.09 L, equat 8.14	Jun 105.09 ion L9 o 6.88	Jul 105.09 r L9a), a 7.43	Aug 105.09 Iso see	Sep 105.09 Table 5 12.96	Oct 105.09 16.46	Nov 105.09	Dec 105.09	(66)
5. Int Metabo (66)m= Lightin (67)m=	ernal ga olic gain Jan 105.09 g gains 19.92 nces ga	ains (see ns (Table Feb 105.09 (calcula 17.69	2 Table 5), Wat Mar 105.09 ted in Ap 14.39	5 and 5a ts Apr 105.09 opendix 10.89	): 105.09 L, equat 8.14	Jun 105.09 ion L9 o 6.88	Jul 105.09 r L9a), a 7.43	Aug 105.09 Iso see 9.66	Sep 105.09 Table 5 12.96	Oct 105.09 16.46	Nov 105.09	Dec 105.09	(66)
5. Int Metabo (66)m= Lightin (67)m= Appliau (68)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79	ains (see reb 105.09 (calcula 17.69 ins (calc 185.7	e Table 5 5), Wat Mar 105.09 ted in Ap 14.39 sulated in 180.9	5 and 5a tts 105.09 opendix 10.89 n Append 170.66	): 105.09 L, equat 8.14 dix L, eq 157.75	Jun 105.09 ion L9 of 6.88 uation L 145.61	Jul 105.09 r L9a), a 7.43 13 or L1 137.5	Aug 105.09 Iso see 9.66 3a), also	Sep 105.09 Table 5 12.96 see Ta 140.4	Oct 105.09 16.46 ble 5 150.63	Nov 105.09 19.21	Dec 105.09 20.48	(66)
5. Int Metabo (66)m= Lightin (67)m= Appliau (68)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79	ains (see reb 105.09 (calcula 17.69 ins (calc 185.7	e Table 5 5), Wat Mar 105.09 ted in Ap 14.39 sulated in 180.9	5 and 5a tts 105.09 opendix 10.89 n Append 170.66	): 105.09 L, equat 8.14 dix L, eq 157.75	Jun 105.09 ion L9 of 6.88 uation L 145.61	Jul 105.09 r L9a), a 7.43 13 or L1 137.5	Aug 105.09 Iso see 9.66 3a), also 135.59	Sep 105.09 Table 5 12.96 see Ta 140.4	Oct 105.09 16.46 ble 5 150.63	Nov 105.09 19.21	Dec 105.09 20.48	(66)
5. Int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m=	ernal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51	ains (see Feb 105.09 (calcula 17.69 ins (calc 185.7 (calcula 33.51	E Table 5 5), Wat Mar 105.09 ted in Ap 14.39 culated in 180.9 ated in A	5 and 5a ts Apr 105.09 opendix 10.89 Append 170.66 ppendix 33.51	): 105.09 L, equat 8.14 dix L, eq 157.75 L, equat	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table	Oct 105.09 16.46 ble 5 150.63 5	Nov 105.09 19.21 163.55	Dec 105.09 20.48 175.68	(66) (67) (68)
5. Int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m=	ernal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51	ains (see Feb 105.09 (calcula 17.69 ins (calc 185.7 (calcula 33.51	2 Table 5 3 5), Wat Mar 105.09 ted in Ap 14.39 culated in 180.9 ated in A 33.51	5 and 5a ts Apr 105.09 opendix 10.89 Append 170.66 ppendix 33.51	): 105.09 L, equat 8.14 dix L, eq 157.75 L, equat	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table	Oct 105.09 16.46 ble 5 150.63 5	Nov 105.09 19.21 163.55	Dec 105.09 20.48 175.68	(66) (67) (68)
5. Int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3	ains (see reb 105.09 (calcula 17.69 ins (calcula 185.7 (calcula 33.51 ns gains 3	Table 5 5), Wat Mar 105.09 ted in Ap 14.39 sulated in 180.9 ated in A 33.51 (Table 5	5 and 5a ts Apr 105.09 5 apendix 10.89 10.89 10.89 170.66 ppendix 33.51 5 a) 3	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51	Sep 105.09 Table 5 12.96 see Ta 140.4 ee Table 33.51	Oct 105.09 16.46 ble 5 150.63 5 33.51	Nov 105.09 19.21 163.55 33.51	Dec 105.09 20.48 175.68 33.51	(66) (67) (68) (69)
5. Int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3	ains (see reb 105.09 (calcula 17.69 ins (calcula 185.7 (calcula 33.51 ns gains 3	<ul> <li>Table 5</li> <li>5), Wat</li> <li>Mar</li> <li>105.09</li> <li>ted in Ap</li> <li>14.39</li> <li>sulated in A</li> <li>180.9</li> <li>ated in A</li> <li>33.51</li> <li>(Table 5</li> <li>3</li> </ul>	5 and 5a ts Apr 105.09 500 10.89 10.89 10.89 170.66 ppendix 33.51 5a) 3	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51	Sep 105.09 Table 5 12.96 see Ta 140.4 ee Table 33.51	Oct 105.09 16.46 ble 5 150.63 5 33.51	Nov 105.09 19.21 163.55 33.51	Dec 105.09 20.48 175.68 33.51	(66) (67) (68) (69)
5. Int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3 s e.g. ev -84.07	ains (see Feb 105.09 (calcula 17.69 ins (calcula 185.7 (calcula 33.51 ns gains 3 vaporatic	E Table 5 Mar 105.09 ted in Ag 14.39 sulated in 180.9 ated in A 33.51 (Table 5 3 on (nega -84.07	5 and 5a tts Apr 105.09 opendix 10.89 n Append 170.66 ppendix 33.51 5a) 3 tive valu	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3 es) (Tab	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51 3 .1e 5)	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table 33.51	Oct 105.09 16.46 ble 5 150.63 5 33.51 3	Nov 105.09 19.21 163.55 33.51 3	Dec 105.09 20.48 175.68 33.51 3	(66) (67) (68) (69) (70)
5. Int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3 s e.g. ev -84.07	ains (see reb 105.09 (calcula 17.69 ins (calc 185.7 (calcula 33.51 ns gains 3 vaporatic -84.07	E Table 5 Mar 105.09 ted in Ag 14.39 sulated in 180.9 ated in A 33.51 (Table 5 3 on (nega -84.07	5 and 5a tts Apr 105.09 opendix 10.89 n Append 170.66 ppendix 33.51 5a) 3 tive valu	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3 es) (Tab	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51 3 .1e 5)	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table 33.51	Oct 105.09 16.46 ble 5 150.63 5 33.51 3	Nov 105.09 19.21 163.55 33.51 3	Dec 105.09 20.48 175.68 33.51 3	(66) (67) (68) (69) (70)
5. Int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3 s e.g. ev -84.07 heating 77.17	ains (see Feb 105.09 (calcula 17.69 ins (calcula 185.7 (calcula 33.51 ns gains 3 /aporatic -84.07 gains (T	Table 5 5), Wat Mar 105.09 ted in Ap 14.39 tulated in 180.9 ated in A 33.51 (Table 5 3 on (nega -84.07 Table 5) 70.04	5 and 5a ts Apr 105.09 opendix 10.89 n Appendix 170.66 ppendix 33.51 5a) 3 tive valu -84.07	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3 es) (Tab -84.07	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51 3 	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51 3 84.07 49.99	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51 3 -84.07 56.02	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table 33.51 3 -84.07 58.54	Oct 105.09 16.46 ble 5 150.63 5 33.51 3 -84.07 64.79	Nov 105.09 19.21 163.55 33.51 3 -84.07	Dec 105.09 20.48 175.68 33.51 3 -84.07 75.23	<pre>(66) (67) (68) (69) (70) (71)</pre>
5. Int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3 s e.g. ev -84.07 heating 77.17	ains (see reb 105.09 (calcula 17.69 ins (calc 185.7 (calcula 33.51 ns gains 3 vaporatic -84.07 gains (T 74.65	Table 5 5), Wat Mar 105.09 ted in Ap 14.39 tulated in 180.9 ated in A 33.51 (Table 5 3 on (nega -84.07 Table 5) 70.04	and 5a         Apr         105.09         opendix         10.89         Appendix         170.66         ppendix         33.51         5a)         3         tive valu         -84.07	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3 es) (Tab -84.07	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51 3 	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51 3 84.07 49.99	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51 3 -84.07 56.02	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table 33.51 3 -84.07 58.54	Oct 105.09 16.46 ble 5 150.63 5 33.51 3 -84.07 64.79	Nov 105.09 19.21 163.55 33.51 33.51 -84.07 71.78	Dec 105.09 20.48 175.68 33.51 3 -84.07 75.23	<pre>(66) (67) (68) (69) (70) (71)</pre>

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

Orientation:	Access F Table 6d	actor	Area m²			Flu: Tat	x ble 6a			g_ able 6b		Tab	FF le 6c			Gains (W)	
Northeast 0.9	0.77	x	0.9	9	x	1	1.28	×		0.57	x		0.7		=	6.18	(75)
Northeast 0.9	0.77	x	0.9	9	x	2	2.97	x		0.57	x		0.7		=	12.57	(75)
Northeast 0.9	0.77	x	0.9	9	x	4	1.38	×		0.57	x		0.7		=	22.65	(75)
Northeast 0.9	0.77	x	0.9	9	x	6	7.96	x		0.57	x		0.7		=	37.2	(75)
Northeast 0.9	0.77	x	0.9	9	x	9	1.35	x		0.57	x		0.7		=	50.01	(75)
Northeast 0.9	0.77	x	0.9	9	x	9	7.38	x		0.57	x		0.7		=	53.32	(75)
Northeast 0.9	0.77	x	0.9	9	x	<u></u>	91.1	x		0.57	x		0.7		=	49.88	(75)
Northeast 0.9	0.77	x	0.9	9	x	7	2.63	x		0.57	x		0.7		=	39.76	(75)
Northeast 0.9	0.77	x	0.9	9	x	5	0.42	x		0.57	x		0.7		=	27.6	(75)
Northeast 0.9	0.77	x	0.9	9	x	2	8.07	x		0.57	x		0.7		=	15.37	(75)
Northeast 0.9	0.77	x	0.9	9	x	1	4.2	x		0.57	x		0.7		=	7.77	(75)
Northeast 0.9	0.77	x	0.9	9	x	9	9.21	x		0.57	x		0.7		=	5.04	(75)
Northwest 0.9	0.77	x	0.9	9	x	1	1.28	x		0.57	x		0.7		=	9.27	(81)
Northwest 0.9	0.77	x	0.9	9	x	2	2.97	x		0.57	x		0.7		=	18.86	(81)
Northwest 0.9	0.77	x	0.9	9	x	4	1.38	×		0.57	x		0.7		=	33.98	(81)
Northwest 0.9	0.77	x	0.9	9	x	6	7.96	x		0.57	x		0.7		=	55.81	(81)
Northwest 0.9	0.77	x	0.9	9	x	9	1.35	x		0.57	x		0.7		=	75.02	(81)
Northwest 0.9	0.77	x	0.9	9	x	9	7.38	x		0.57	x		0.7		=	79.97	(81)
Northwest 0.9	0.77	x	0.9	9	x	6	91.1	x		0.57	x		0.7		=	74.81	(81)
Northwest 0.9	0.77	x	0.9	9	x	7	2.63	x		0.57	x		0.7		=	59.64	(81)
Northwest 0.9	0.77	x	0.9	9	x	5	0.42	x		0.57	×		0.7		=	41.41	(81)
Northwest 0.9	0.77	x	0.9	9	x	2	8.07	x		0.57	x		0.7		=	23.05	(81)
Northwest 0.9	0.77	x	0.9	9	x	1	4.2	×		0.57	x		0.7		=	11.66	(81)
Northwest 0.9	0.77	x	0.9	9	x	<u></u>	).21	×		0.57	x		0.7		=	7.57	(81)
								-							-		
Solar gains i			i					<del>` ´</del>	-	m(74)m	(82)r						
(83)m= 15.44		56.64	93.01	125.03		33.29	124.69	99.	41	69.01	38.4	2	19.43	12.	61		(83)
Total gains -			· <i>,</i>	· ,	<u> </u>			050		000.44	0.07		04.40	0.44			(04)
(84)m= 353.8		379.49	396.07	408.28		97.55	377.13	358	.21	338.44	327.	82 3	31.49	341	.53		(84)
7. Mean int			ì		ĺ.												_
Temperatu	•	• •			-			ole 9	, Th1	(°C)						21	(85)
Utilisation f			<u> </u>		Ť		,	<u> </u>		_							
Jar		Mar	Apr	Мау	-	Jun	Jul		ug	Sep	00	_	Nov		ес		
(86)m= 1	1	1	0.99	0.96		0.84	0.68	0.7	73	0.93	0.99	9	1	1			(86)
Mean interr	nal temper	ature in	living ar	ea T1 (	follo	w ste	os 3 to 7	7 in T	able	9c)				-			
<mark>(87)</mark> m= 19.96	6 20.04	20.21	20.47	20.73	2	20.92	20.98	20.	97	20.84	20.5	3	20.2	19.	94		(87)
Temperatu	re during h	eating p	eriods in	n rest o	f dw	elling	from Ta	able	9, Th	2 (°C)							
(88)m= 20.1 ⁻	1 20.11	20.11	20.12	20.12	2	20.13	20.13	20.	14	20.13	20.1	2	20.12	20.	11		(88)
Utilisation f	actor for ga	ains for	rest of d	welling	, h2	,m (se	e Table	9a)	_	_	_	_		_	-		
(89)m= 1	1	0.99	0.98	0.93		0.77	0.56	0.6	61	0.89	0.98	3	1	1			(89)

Moon	interne	l tompor	aturo in	the rest	of dwolli	ng T2 /f		ne 2 to .	7 in Tabl	a ()a)				
(90)m=	18.7	18.82	19.07	19.46	19.82	20.07	20.13	20.12	7 in Tabl 19.98	e 9C) 19.54	19.07	18.69		(90)
(90)11-	10.7	10.02	19.07	19.40	19.02	20.07	20.13	20.12			g area ÷ (4			_ ` `
									'		iy area ÷ (•	+) -	0.38	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	A) × T2					
(92)m=	19.18	19.28	19.51	19.84	20.17	20.4	20.45	20.45	20.31	19.92	19.51	19.17		(92)
Apply	adjustr	nent to t	he mear	n interna	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.03	19.13	19.36	19.69	20.02	20.25	20.3	20.3	20.16	19.77	19.36	19.02		(93)
8. Spa	ace hea	ting requ	uirement	t										
				mperatui using Ta		ied at ste	ep 11 of	Table 9I	b, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hrr	n:							-			
(94)m=	1	1	0.99	0.98	0.93	0.78	0.58	0.64	0.89	0.98	1	1		(94)
Usefu	l gains,	hmGm	, W = (9	4)m x (84	4)m	_			-		_			
(95)m=	352.98	365.7	376.81	388.01	380.02	311.53	219.8	228.22	300.82	321.88	329.97	340.85		(95)
Month	nly aver	age exte	ernal terr	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	oss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m	]	-			
(97)m=	921.78	888.43	800.32	663.25	509.94	341.65	224.08	235.25	368.56	562.08	755.17	917.74		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Wh/mont	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
(98)m=	423.19	351.27	315.09	198.17	96.66	0	0	0	0	178.71	306.15	429.21		
								Tota	l per year	(kWh/year	-) = Sum(9	8)15,912 =	2298.46	(98)
Space	e heatin	a reauire	ement in	kWh/m²	²/vear							ļ	35.71	(99)
•					•		a a la callar a					l	00.11	
			nts – Ind	ividual h	eating sy	ystems I	ncluding	micro-C	HP)					
-	e heatiı on of sp	-	at from s	econdar	y/supple	mentary	system					[	0	(201)
Fracti	on of sr	ace hea	at from n	nain syst	em(s)	-	-	(202) = 1	- (201) =				1	(202)
				main sys	. ,			(204) = (2)	02) × [1 –	(203)] =			1	(204)
			•	-				(201) (2	02) [!	(200)]				<u> </u>
				ing syste									90.3	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above)	)								
	423.19	351.27	315.09	198.17	96.66	0	0	0	0	178.71	306.15	429.21		
(211)m	) = {[(98	)m x (20	)4)]}x1	100 ÷ (20	)6)									(211)
. ,	468.65	389.01	348.94	219.46	, 107.04	0	0	0	0	197.91	339.04	475.31		
			!	!				Tota	l (kWh/yea	ar) =Sum(2	1 211) _{15.10. 12}	=	2545.35	(211)
Snace	heatin	a fuel (s	econdar	y), kWh/	month							l		
•		)1)]}x1			monun									
(215)m=		0		0	0	0	0	0	0	0	0	0		
(,	-				-	-	-		l (kWh/yea	-			0	(215)
\// <b>_</b> +	haatla	-							(	,(	* /15,10. 12		U	
	heating		tor (cala	ulated a	hovo)									
Juipul	184.37	161.05	167.57	ulated a	143.89	126.73	121.42	135.36	136.85	155.83	166.35	180.04		
Efficier		ater hea			1.0.00	120.70	121.72	100.00	100.00	100.00	100.00	100.04	81	(216)
LUCIEI	10 y 01 W												01	(~ '0)

(217)m=	87.26	87.15	86.84	86.07	84.5	81	81	81	81	85.72	86.79	87.34		(217)
	r water h	•												
(219)m (219)m=	= (64)r 211.29	<u>n x 100</u> 184.79	) ÷ (217) 192.96	m 172.69	170.3	156.46	149.9	167.11	168.95	181.8	191.66	206.15		
Ľ								Tota	I = Sum(2	19a) ₁₁₂ =			2154.06	(219)
Annua	l totals									k	Wh/year		kWh/year	
Space I	heating	fuel use	d, main	system 1	1								2545.35	
Water h	heating f	fuel use	d										2154.06	
Electric	city for p	umps, fa	ans and	electric k	keep-ho	t								
mecha	anical ve	entilatior	ı - balan	ced, extr	act or p	ositive ir	nput fror	n outside	е			127.2		(230a)
centra	al heating	g pump:										30		(230c)
Total el	lectricity	for the	above, k	(Wh/year				sum	of (230a)	(230g) =			157.2	(231)
Electric	city for lig	ghting											351.84	(232)
12a. C	CO2 emi	ssions -	- Individ	ual heatir	ng syste	ems inclu	uding mi	cro-CHF	)					
						Fn	ergy			Emiss kg CO	ion fact	tor	Emissions	
							/h/year			Ng OO	Z/KVVN		kg CO2/yea	ar
Space I	heating	(main s	ystem 1)	)		kW	/h/year I) x			0.2		=	kg CO2/yea	ar (261)
	heating heating			)		kW (211					16	=	<u> </u>	_
	heating			)		kW (211 (215	l) x			0.2	16 19		549.8	(261)
Space I Water h	heating	(second	lary)	)		kW (211 (215 (215	1) x 5) x 9) x	+ (263) + (	264) =	0.2	16 19	=	549.8 0	(261) (263)
Space I Water h Space a	heating heating and wate	(second	lary) ng	) electric k	keep-ho	kW (211 (215 (219 (261	1) x 5) x 9) x	+ (263) + (	(264) =	0.2	16 19 16	=	549.8 0 465.28	(261) (263) (264)
Space I Water h Space a Electric	heating heating and wate	(second er heatii umps, fa	lary) ng		eep-ho	kW (211 (215 (219 (261 t (231	<ul> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x&lt;</li></ul>	+ (263) + (	(264) =	0.2	16 19 16 19	=	549.8 0 465.28 1015.07	(261) (263) (264) (265)
Space I Water h Space a Electric Electric	heating heating and wate	(second er heatii umps, fa ghting	lary) ng		eep-ho	kW (211 (215 (219 (261 t (231	<ul> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> </ul>	+ (263) + (		0.2 0.5 0.2	16 19 16 19 19	=	549.8 0 465.28 1015.07 81.59	(261) (263) (264) (265) (267)
Space I Water h Space a Electric Electric Total C	heating heating and wate city for pe city for lig	(second er heatii umps, fa ghting year	lary) ng ans and	electric k	eep-ho	kW (211 (215 (219 (261 t (231	<ul> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> <li>x</li> </ul>	+ (263) + (	sum o	0.2 0.5 0.2 0.5	16 19 16 19 19	=	549.8 0 465.28 1015.07 81.59 182.6	](261) ](263) ](264) ](265) ](267) ](268)

			User D	etails:						
Assessor Name: Software Name:	Chris Hocki Stroma FSA			Stroma Softwa					016363 n: 1.0.4.10	
			Property .		Unit 7-F	Propose	d-Lean			
Address :	Unit 7, 40-42	2 Mill Lane,	London, NW	/6 1NR						
1. Overall dwelling dimer	isions:									
Ground floor				<b>a(m²)</b> 0.76	(1a) x	<b>Av. He</b> i	i <b>ght(m)</b> .11	(2a) =	<b>Volume(m³)</b> 86	(3a)
Total floor area TFA = (1a	)+(1b)+(1c)+( ²	1d)+(1e)+	(1n) 4	0.76	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	86	(5)
2. Ventilation rate:			-							
Number of chimneys Number of open flues	main heating 0	secor heati + +		0 0	] = [ ] = [	<b>total</b> 0 0		40 = 20 =	m ³ per hour	(6a) (6b)
Number of intermittent fan	s	J L	L			0	x ^	10 =	0	] (7a)
Number of passive vents	-					0	× ·	10 =	0	](7b)
								40 =	-	]
Number of flueless gas fire	es					0	X*	+0 -	0	(7c)
								Air ch	anges per hou	ır
Infiltration due to chimney If a pressurisation test has be Number of storeys in the	en carried out or	is intended, pr			continue fro	0 om (9) to (		÷ (5) =	0	](8) ](0)
Additional infiltration		)					[(9)-	-1]x0.1 =	0	(9) (10)
Structural infiltration: 0.2	25 for steel or	timber fram	e or 0.35 fo	r masonr	v constr	uction	[(0)	1,100.1	0	(11)
if both types of wall are pre deducting areas of opening	esent, use the valu gs); if equal user (	ue correspond 0.35	ing to the great	er wall are	a (after					]()
If suspended wooden flo			or 0.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente								·	0	(13)
Percentage of windows Window infiltration	and doors dra	aught strippe		0.25 - [0.2	$\mathbf{v}(14) \div 1$	001 -			0	(14)
Infiltration rate				(8) + (10)		- T	+ (15) =		0	(15)
Air permeability value, c	150 expressed	d in cubic m	etres ner ho					area	0	(16) (17)
If based on air permeabilit					•		molopo	aioa	0.15	(18)
Air permeability value applies						is being us	sed		0.10	
Number of sides sheltered	ł								1	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	9)] =			0.92	(20)
Infiltration rate incorporation	ng shelter fact	or		(21) = (18)	) x (20) =				0.14	(21)
Infiltration rate modified fo	r monthly wind	d speed		i					I	
Jan Feb N	Var Apr	May J	un Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table								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			i						
(22a)m= 1.27 1.25 1	.23 1.1	1.08 0.9	95 0.95	0.92	1	1.08	1.12	1.18		

Adjuste	ed infiltra	ation rate	e (allowir	ng for sh	nelter and	d wind s	peed) =	(21a) x	(22a)m					
	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16		
	<i>ate effec</i> echanica		change h	ate for t	he applic	cable ca	se						0.5	
			uon. Ising Appe	ndix N (2	3h) = (23a	) x Emv (e	ocuation (N	(15)) other	rwise (23h	) = (23a)			0.5	(23a)
		• •	very: efficie		, ,	, ,		,, .	,	) = (23a)			0.5	(23b)
			-	-	-					) ha ha ha (1	20k) v [/	(00.0)	75.65	(23c)
(24a)m=	· · · · ·		anical ve	0.27	0.27	0.25	0.25	1R) (248 0.25	0.26	20)m + (2 0.27	23D) × [ 0.28	0.28	- 100j	(24a)
												0.20		(240)
· · ·			anical ve					r í í	ŕ	, ,	,	0	l	(24b)
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(240)
,			ract vent (23b), th		•	•				5 x (23h	)			
(24c)m=		0	0	0	0	), ourierv 0	0	c) = (22x)	0	0	0	0		(24c)
	-		on or who	•	•	-	÷	-	÷		•	Ŭ		(
,			en (24d)r			•				0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	ctive air o	change	rate - en	ter (24a	) or (24b	) or (24	c) or (24	d) in boy	(25)					
(25)m=	0.3	0.3	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(25)
2 40	at laga a	and ha	at loop n	oromot				1						
		Gros	at loss p			Net Ar	~~	U-valı	10	AXU		k-value		Xk
ELEN		area		Openin m		A,n		W/m2		(W/ł	<)	kJ/m²·l		/K
Doors						2	x	1.5	=	3				(26)
Window	ws Type	1				0.99	x1/	/[1/( 1.4 )+	0.04] =	1.31	=			(27)
Window	ws Type	2				0.99	x1/	/[1/( 1.4 )+	0.04] =	1.31	=			(27)
Windo	ws Type	3					=	/[1/( 1.4 )+	0.041 - [	2.09	=			(27)
Walls 1						1.58	X1	/[ // ·· <del>··</del> /·	0.01	2.09				
	Tvpe1	20.6	5	4 55		1.58	=				Ξ r			(29)
Walls 1		20.6		4.55		16.1	×	0.15		2.42				(29)
Walls T	Гуре2	2.62	2	2		16.1 0.62	x x	0.15		2.42 0.09				(29)
Walls 7	Гуре2 Гуре3	2.62	2	2 0		16.1 0.62 3.08		0.15		2.42 0.09 0.46				(29) (29)
Walls T Walls T	Гуре2 Гуре3 Гуре4	2.62 3.08 21.9	23 31	2 0 0		16.1 0.62 3.08 21.91		0.15 0.14 0.15 0.15		2.42 0.09 0.46 3.29				(29) (29) (29)
Walls T Walls T Roof T	Гуре2 Гуре3 Гуре4 Гуре1	2.62 3.08 21.9 30.84	2 3 1 4	2 0 0		16.1 0.62 3.08 21.91 30.84		0.15 0.14 0.15 0.15 0.1		2.42 0.09 0.46 3.29 3.08				(29) (29) (29) (29) (30)
Walls T Walls T Roof T Roof T	Гуре2 Гуре3 Гуре4 Гуре1 Гуре2	2.62 3.08 21.9 30.8 1.91	2 3 1 4	2 0 0		16.1 0.62 3.08 21.91		0.15 0.14 0.15 0.15		2.42 0.09 0.46 3.29				(29) (29) (29)
Walls T Walls T Roof T Roof T Total a	Гуре2 Гуре3 Гуре4 Гуре1 Гуре2 rea of el	2.62 3.08 21.9 30.8 1.91	2 3 1 4	2 0 0		16.1 0.62 3.08 21.91 30.84		0.15 0.14 0.15 0.15 0.1		2.42 0.09 0.46 3.29 3.08				(29) (29) (29) (29) (30)
Walls T Walls T Roof T Roof T	Гуре2 Гуре3 Гуре4 Гуре1 Гуре2 rea of el	2.62 3.08 21.9 30.8 1.91	2 3 1 4	2 0 0		16.1 0.62 3.08 21.91 30.84 1.91		0.15 0.14 0.15 0.15 0.1		2.42 0.09 0.46 3.29 3.08				(29) (29) (29) (30) (30)
Walls T Walls T Roof T Roof T Total a	Гуре2 Гуре3 Гуре4 Гуре1 Гуре2 rea of el vall	2.62 3.08 21.9 30.8 1.91	2 3 1 4	2 0 0		16.1 0.62 3.08 21.91 30.84 1.91 81.01		0.15 0.14 0.15 0.15 0.1 0.1		2.42 0.09 0.46 3.29 3.08 0.19				(29) (29) (29) (30) (30) (31)
Walls T Walls T Roof T Roof T Total a Party w Party fl * for wind	Гуре2 Гуре3 Гуре4 Гуре1 Гуре2 Irea of el vall loor dows and i	2.62 3.08 21.9 30.8 1.91 ements,	2 3 1 4	2 0 0 0	ndow U-va	16.1 0.62 3.08 21.91 30.84 1.91 81.01 23.33 40.76 <i>lue calcul</i>		0.15 0.14 0.15 0.15 0.1 0.1		2.42 0.09 0.46 3.29 3.08 0.19 0	s given in	paragraph		(29) (29) (29) (30) (30) (31) (32)
Walls 1 Walls 1 Roof 1 Roof 1 Total a Party w Party fl * for wing	Fype2 Fype3 Fype4 Fype1 Fype2 rea of el vall loor dows and i	2.62 3.08 21.9 30.8 1.91 ements,	2 3 1 4 , m ² wws, use ef	2 0 0 0 0	ndow U-va	16.1 0.62 3.08 21.91 30.84 1.91 81.01 23.33 40.76 <i>lue calcul</i>	x x x x x x x x x x x ated using	0.15 0.14 0.15 0.15 0.1 0.1 0.1		2.42 0.09 0.46 3.29 3.08 0.19 0	[ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ ] [ [ [ [ [ ] [ [ [ ] [ [ [ ] [ [ ] [ [ ] [ ] [ [ ] [ ]  [	paragraph		(29) (29) (29) (30) (30) (31) (32)
Walls T Walls T Roof T Roof T Total a Party w Party fl * for wind ** include Fabric	Fype2 Fype3 Fype4 Fype1 Fype2 rea of el vall loor dows and i	2.62 3.08 21.9 30.8 1.91 ements, roof windo s on both s, W/K =	2 3 1 4 , m ² ws, use efficiency of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides o	2 0 0 0 0	ndow U-va	16.1 0.62 3.08 21.91 30.84 1.91 81.01 23.33 40.76 <i>lue calcul</i>	x x x x x x x x x x x ated using	0.15 0.14 0.15 0.15 0.1 0.1 0.1	$ \begin{bmatrix} - & - & - & - \\ - & - & - & - \\ - & - &$	2.42 0.09 0.46 3.29 3.08 0.19 0	-			(29) (29) (29) (30) (30) (31) (32) (32a)
Walls T Walls T Roof T Roof T Total a Party W Party fl * for wind ** include Fabric Heat ca	Fype2 Fype3 Fype4 Fype1 Fype2 rea of el vall loor dows and b dows and b the areas heat loss apacity C	2.62 3.08 21.9 30.8 1.91 ements, roof windc s on both s, W/K = Cm = S(A	2 3 1 4 , m ² ws, use efficiency of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides o	2 0 0 0 0 0 0 0 0	ndow U-va	16.1 0.62 3.08 21.91 30.84 1.91 81.01 23.33 40.76 <i>lue calcula</i> <i>itions</i>	x x x x x x x x x x x ated using	0.15 0.14 0.15 0.15 0.1 0.1 0.1	$ \begin{bmatrix} 1 \\ 1 \\ 2 \\ 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2$	2.42 0.09 0.46 3.29 3.08 0.19 0	2) + (32a)		18.56	(29) (29) (29) (30) (30) (31) (32) (32a) (32a)

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

		00	are not kr	10wn (36)	= 0.15 x (3	1)								_
Total f	abric he	at loss							(33) +	(36) =			35.68	(37)
Ventila	ation hea	at loss ca	alculated	month	у				(38)m	= 0.33 × (	25)m x (5)	)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	8.48	8.38	8.28	7.79	7.69	7.2	7.2	7.1	7.39	7.69	7.89	8.08		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	44.16	44.06	43.96	43.47	43.37	42.88	42.88	42.78	43.07	43.37	43.57	43.76		
								•		Average =	Sum(39)1	12 <b>/12=</b>	43.44	(39)
	oss para	meter (H	HLP), W	/m²K				i -	(40)m	= (39)m ÷	(4)		1	
(40)m=	1.08	1.08	1.08	1.07	1.06	1.05	1.05	1.05	1.06	1.06	1.07	1.07		_
Numb	er of day	/s in mo	nth (Tab	le 1a)						Average =	Sum(40)₁	₁₂ /12=	1.07	(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	tina ene	rgy requ	irement:								kWh/ye	ear:	
			37 - 4-											
		upancy,		[1 ove		040 v /TI	- 120		012 v /	TEA 40		.43		(42)
	A 2 13. A £ 13.		+ 1.70 X	li-exp	0.0003	949 X (11	-A -13.9	9)2)] + 0.0	JU 13 X (	IFA - 13.	.9)			
			ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		68	8.08	]	(43)
		-				-	-	to achieve	a water us	se target o	f		1	
not mor	e that 125	litres per	person pel I	r day (all N 1	ater use, l	not and co I	ia) 1			i	i		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	l able 1c x	(43)					1	
(44)m=	74.89	72.17	69.45	66.72	64	61.28	61.28	64	66.72	69.45	72.17	74.89		_
Energy	content of	^t hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	m x nm x L	DTm / 3600			m(44) _{1 12} = ables 1b, 1		817	(44)
(45)m=	111.06	97.14	100.24	87.39	83.85	72.36	67.05	76.94	77.86	90.74	99.05	107.56		
								•		Total = Su	m(45) _{1 12} =	-	1071.22	(45)
lf instar	taneous w	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46	) to (61)					
(46)m=	16.66	14.57	15.04	13.11	12.58	10.85	10.06	11.54	11.68	13.61	14.86	16.13		(46)
	storage		) includir		olor or M		otorogo	within or	mayaa				1	(47)
-							-	within sa	ame ves	sei		0		(47)
		•			velling, e			n (47) ombi boil	ore) onto	ar '∩' in <i>(</i>	47)			
	storage		not wate		iciuues i	nstantai			ers) ente		<i><b>-</b>77</i>			
	-		eclared I	oss fact	or is kno	wn (kWł	n/day):					0	]	(48)
Temp	erature f	actor fro	m Table	2b			• •					0		(49)
			r storage		ear			(48) x (49	) =			0	]	(50)
-			-	•	loss fact	or is not		· · · · · · · ·	, 			0	]	(00)
		-			le 2 (kW	h/litre/da	ay)					0	]	(51)
	-	-	see secti	on 4.3									1	
		from Ta		<b>2</b> h								0		(52)
			m Table									0	]	(53)
-			r storage	e, kWh/y	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter	(50) or	(54) in ( <del></del>	55)									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 contains	s dedicate	d solar sto	rage, (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	e 3		-					0	(58)
	•	•			month (	59)m = (	(58) ÷ 36	65 × (41)	m				
•	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	ter heati	ng and a	cylinde	r thermo	ostat)		
(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) ÷ 36	65 × (41	)m					_
(61)m=	38.16	33.22	35.39	32.9	32.61	30.22	31.23	32.61	32.9	35.39	35.59	38.16	(61)
Total h	neat requ	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=	149.23	130.35	135.62	120.29	116.46	102.57	98.27	109.55	110.76	126.13	134.64	145.72	(62)
										r contribut	tion to wate	er heating)	
•		· · · · · ·	1	r	NWHRS		· ·		<u>,</u>	1	,	i	1 (20)
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
		ater hea	1										1
(64)m=	149.23	130.35	135.62	120.29	116.46	102.57	98.27	109.55	110.76	126.13	134.64	145.72	
	· •					- /					r (annual)₁		1479.61 (64)
-		i	·		i	-	· ,	· ,		<u> </u>	+ (57)m	· ,	1
(65)m=	46.47	40.6	42.18	37.28	36.03	31.61	30.1	33.74	34.11	39.02	41.83	45.3	(65)
	. ,			. ,	only if c	ylinder i	s in the d	aweiling	or not w	ater is ti	rom com	munity r	leating
				5 and 5a	):								
	olic gain	is (Table	e 5), Wat	ts		lum		A	Con	Ort	Nev	Dee	1
Metab	olic gain Jan	s (Table Feb	e 5), Wat Mar	ts Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Metabo (66)m=	olic gain Jan 71.33	s (Table Feb 71.33	e 5), Wat Mar 71.33	ts Apr 71.33	May 71.33	71.33	71.33	71.33	71.33	Oct 71.33	Nov 71.33	Dec 71.33	(66)
Metabo (66)m= Lightin	olic gain Jan 71.33 g gains	rs (Table Feb 71.33 (calcula	e 5), Wat Mar 71.33 ted in Aj	ts Apr 71.33 opendix	May 71.33 L, equat	71.33 ion L9 o	71.33 r L9a), a	71.33 Iso see	71.33 Table 5	71.33	71.33	71.33	]
Metabo (66)m= Lightin (67)m=	olic gain Jan 71.33 g gains 12.41	r (Table Feb 71.33 (calcula 11.02	e 5), Wat Mar 71.33 ted in Aj 8.97	ts Apr 71.33 opendix 6.79	May 71.33 L, equat 5.07	71.33 ion L9 oi 4.28	71.33 r L9a), a 4.63	71.33 Iso see 6.02	71.33 Table 5 8.07	71.33			(66)
Metabo (66)m= Lightin (67)m= Applia	olic gain Jan 71.33 g gains 12.41 nces ga	s (Table Feb 71.33 (calcula 11.02 ins (calc	5), Wat Mar 71.33 ted in Aj 8.97 culated ir	ts Apr 71.33 opendix 6.79 n Append	May 71.33 L, equat 5.07 dix L, eq	71.33 ion L9 of 4.28 uation L	71.33 r L9a), a 4.63 13 or L1	71.33 Iso see 6.02 3a), also	71.33 Table 5 8.07 see Ta	71.33 10.25 ble 5	71.33	71.33 12.76	(67)
Metabo (66)m= Lightin (67)m= Applia (68)m=	olic gain Jan 71.33 Ig gains 12.41 nces ga 123.45	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73	5), Wat Mar 71.33 ted in Ap 8.97 culated in 121.5	ts Apr 71.33 opendix 6.79 Append 114.63	May 71.33 L, equat 5.07 dix L, eq 105.96	71.33 ion L9 of 4.28 uation L 97.8	71.33 r L9a), a 4.63 13 or L1 92.35	71.33 Iso see 6.02 3a), also 91.07	71.33 Table 5 8.07 see Ta 94.3	71.33 10.25 ble 5 101.17	71.33	71.33	]
Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir	olic gain Jan 71.33 Ig gains 12.41 Inces ga 123.45	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula	2 5), Wat Mar 71.33 ted in Ap 8.97 culated ir 121.5 ated in A	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat	71.33 ion L9 of 4.28 uation L 97.8 ion L15	71.33 r L9a), a 4.63 13 or L1 92.35 or L15a	71.33 Iso see 6.02 3a), also 91.07 ), also se	71.33 Table 5 8.07 9 see Ta 94.3 ee Table	71.33 10.25 ble 5 101.17 5	71.33 11.97 109.85	71.33 12.76 118	) (67) (68)
Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m=	olic gain Jan 71.33 g gains 12.41 nces ga 123.45 ng gains 30.13	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula 30.13	2 5), Wat Mar 71.33 ted in Ay 8.97 culated in 121.5 ated in A 30.13	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13	May 71.33 L, equat 5.07 dix L, eq 105.96	71.33 ion L9 of 4.28 uation L 97.8	71.33 r L9a), a 4.63 13 or L1 92.35	71.33 Iso see 6.02 3a), also 91.07	71.33 Table 5 8.07 see Ta 94.3	71.33 10.25 ble 5 101.17	71.33	71.33 12.76	(67)
Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps	olic gain Jan 71.33 g gains 12.41 nces ga 123.45 ng gains 30.13	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula 30.13	2 5), Wat Mar 71.33 ted in Ap 8.97 culated ir 121.5 ated in A	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13	71.33 r L9a), a 4.63 13 or L1 92.35 or L15a	71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13	71.33 Table 5 8.07 9 see Ta 94.3 ee Table	71.33 10.25 ble 5 101.17 5 30.13	71.33 11.97 109.85 30.13	71.33 12.76 118 30.13	] (67) ] (68) ] (69)
Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	olic gain Jan 71.33 Ig gains 12.41 Inces ga 123.45 Ig gains 30.13 Is and fan 3	s (Table Feb 71.33 (calcula 11.02 ins (calcula 124.73 (calcula 30.13 ns gains 3	2 5), Wat Mar 71.33 ted in Ap 8.97 culated in A 121.5 ated in A 30.13 (Table s 3	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13	71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13	71.33 Iso see 6.02 3a), also 91.07 ), also se	71.33 Table 5 8.07 94.3 94.3 94.3 94.3	71.33 10.25 ble 5 101.17 5	71.33 11.97 109.85	71.33 12.76 118	) (67) (68)
Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses	olic gain Jan 71.33 ng gains 12.41 nces ga 123.45 ng gains 30.13 s and fan 3 s e.g. ev	IS (Table Feb 71.33 (calcula 11.02 ins (calcula 124.73 (calcula 30.13 ns gains 3 raporatic	<ul> <li>5), Wat</li> <li>Mar</li> <li>71.33</li> <li>ted in Ar</li> <li>8.97</li> <li>culated in Ar</li> <li>121.5</li> <li>ated in A</li> <li>30.13</li> <li>(Table \$</li> <li>3</li> <li>on (nega</li> </ul>	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3 tive valu	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13 3 es) (Tab	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13 3 le 5)	71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13 3	71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13 3	71.33 Table 5 8.07 94.3 94.3 94.3 94.3 30.13	71.33 10.25 ble 5 101.17 5 30.13 3	71.33 11.97 109.85 30.13 3	71.33 12.76 118 30.13 3	] (67) ] (68) ] (69)
Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	olic gain Jan 71.33 g gains 12.41 nces ga 123.45 ng gains 30.13 s and fai 3 s e.g. ev -57.07	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula 30.13 ns gains 3 raporatic -57.07	<ul> <li>5), Wat</li> <li>Mar</li> <li>71.33</li> <li>ted in Ap</li> <li>8.97</li> <li>culated in Ap</li> <li>121.5</li> <li>ated in A</li> <li>30.13</li> <li>(Table \$</li> <li>3</li> <li>on (nega</li> <li>-57.07</li> </ul>	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13	71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13	71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13	71.33 Table 5 8.07 94.3 94.3 94.3 94.3	71.33 10.25 ble 5 101.17 5 30.13	71.33 11.97 109.85 30.13	71.33 12.76 118 30.13	] (67) ] (68) ] (69) ] (70)
Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	olic gain Jan 71.33 g gains 12.41 nces ga 123.45 ng gains 30.13 s and fai 3 s e.g. ev -57.07	IS (Table Feb 71.33 (calcula 11.02 ins (calcula 124.73 (calcula 30.13 ns gains 3 raporatic	<ul> <li>5), Wat</li> <li>Mar</li> <li>71.33</li> <li>ted in Ap</li> <li>8.97</li> <li>culated in Ap</li> <li>121.5</li> <li>ated in A</li> <li>30.13</li> <li>(Table \$</li> <li>3</li> <li>on (nega</li> <li>-57.07</li> </ul>	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3 tive valu	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13 3 es) (Tab	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13 3 le 5)	71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13 3	71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13 3	71.33 Table 5 8.07 94.3 94.3 94.3 94.3 30.13	71.33 10.25 ble 5 101.17 5 30.13 3	71.33 11.97 109.85 30.13 3	71.33 12.76 118 30.13 3	] (67) ] (68) ] (69) ] (70)
Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	olic gain Jan 71.33 ng gains 12.41 nces ga 123.45 ng gains 30.13 s and fan 3 s e.g. ev -57.07 heating 62.46	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula 30.13 ns gains 3 raporatic -57.07 gains (T 60.42	<ul> <li>5), Wat</li> <li>Mar</li> <li>71.33</li> <li>ted in Ap</li> <li>8.97</li> <li>culated in Ap</li> <li>121.5</li> <li>ated in A</li> <li>30.13</li> <li>(Table \$</li> <li>3</li> <li>on (nega</li> <li>-57.07</li> <li>Fable 5)</li> <li>56.69</li> </ul>	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3 tive valu -57.07	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13 3 es) (Tab -57.07	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13 3 le 5) -57.07 43.91	71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13 3 -57.07 40.46	71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13 3 -57.07 45.34	71.33 Table 5 8.07 94.3 94.3 94.3 94.3 94.3 94.3 30.13 3 -57.07 47.38	71.33 10.25 ble 5 101.17 5 30.13 3 -57.07 52.44	71.33 11.97 109.85 30.13 3 -57.07	71.33 12.76 118 30.13 3 -57.07 60.89	] (67) ] (68) ] (69) ] (70) ] (71)
Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	olic gain Jan 71.33 ng gains 12.41 nces ga 123.45 ng gains 30.13 s and fan 3 s e.g. ev -57.07 heating 62.46	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula 30.13 ns gains 3 raporatic -57.07 gains (T	<ul> <li>5), Wat</li> <li>Mar</li> <li>71.33</li> <li>ted in Ap</li> <li>8.97</li> <li>culated in Ap</li> <li>121.5</li> <li>ated in A</li> <li>30.13</li> <li>(Table \$</li> <li>3</li> <li>on (nega</li> <li>-57.07</li> <li>Fable 5)</li> <li>56.69</li> </ul>	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3 tive valu -57.07	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13 3 es) (Tab -57.07	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13 3 le 5) -57.07 43.91	71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13 3 -57.07 40.46	71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13 3 -57.07 45.34	71.33 Table 5 8.07 94.3 94.3 94.3 94.3 94.3 94.3 30.13 3 -57.07 47.38	71.33 10.25 ble 5 101.17 5 30.13 3 -57.07 52.44	71.33 11.97 109.85 30.13 3 -57.07 58.1	71.33 12.76 118 30.13 3 -57.07 60.89	] (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	-	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	0.99	×	11.28	×	0.57	x	0.7	=	3.09	(75)
Northeast 0.9x	0.77	x	0.99	×	22.97	×	0.57	x	0.7	=	6.29	(75)
Northeast 0.9x	0.77	x	0.99	×	41.38	×	0.57	x	0.7	=	11.33	(75)
Northeast 0.9x	0.77	x	0.99	×	67.96	×	0.57	x	0.7	=	18.6	(75)
Northeast 0.9x	0.77	x	0.99	×	91.35	×	0.57	x	0.7	=	25.01	(75)
Northeast 0.9x	0.77	x	0.99	x	97.38	×	0.57	x	0.7	=	26.66	(75)
Northeast 0.9x	0.77	x	0.99	x	91.1	×	0.57	x	0.7	=	24.94	(75)
Northeast 0.9x	0.77	x	0.99	×	72.63	×	0.57	x	0.7	=	19.88	(75)
Northeast 0.9x	0.77	x	0.99	×	50.42	×	0.57	x	0.7	=	13.8	(75)
Northeast 0.9x	0.77	x	0.99	×	28.07	×	0.57	x	0.7	=	7.68	(75)
Northeast 0.9x	0.77	x	0.99	x	14.2	x	0.57	x	0.7	=	3.89	(75)
Northeast 0.9x	0.77	x	0.99	x	9.21	×	0.57	x	0.7	=	2.52	(75)
Southeast 0.9x	0.77	x	0.99	×	36.79	×	0.57	x	0.7	=	20.14	(77)
Southeast 0.9x	0.77	x	1.58	x	36.79	×	0.57	x	0.7	=	16.07	(77)
Southeast 0.9x	0.77	x	0.99	x	62.67	×	0.57	x	0.7	=	34.31	(77)
Southeast 0.9x	0.77	x	1.58	x	62.67	×	0.57	x	0.7	=	27.38	(77)
Southeast 0.9x	0.77	x	0.99	x	85.75	×	0.57	x	0.7	=	46.95	(77)
Southeast 0.9x	0.77	x	1.58	x	85.75	x	0.57	x	0.7	=	37.46	(77)
Southeast 0.9x	0.77	x	0.99	x	106.25	x	0.57	x	0.7	=	58.17	(77)
Southeast 0.9x	0.77	x	1.58	x	106.25	x	0.57	x	0.7	=	46.42	(77)
Southeast 0.9x	0.77	x	0.99	×	119.01	×	0.57	x	0.7	=	65.16	(77)
Southeast 0.9x	0.77	x	1.58	x	119.01	x	0.57	x	0.7	=	51.99	(77)
Southeast 0.9x	0.77	x	0.99	×	118.15	×	0.57	x	0.7	=	64.69	(77)
Southeast 0.9x	0.77	x	1.58	×	118.15	×	0.57	x	0.7	=	51.62	(77)
Southeast 0.9x	0.77	x	0.99	×	113.91	×	0.57	x	0.7	=	62.36	(77)
Southeast 0.9x	0.77	x	1.58	x	113.91	x	0.57	x	0.7	=	49.76	(77)
Southeast 0.9x	0.77	x	0.99	×	104.39	×	0.57	x	0.7	=	57.15	(77)
Southeast 0.9x	0.77	x	1.58	x	104.39	x	0.57	x	0.7	=	45.61	(77)
Southeast 0.9x	0.77	x	0.99	×	92.85	×	0.57	x	0.7	=	50.83	(77)
Southeast 0.9x	0.77	x	1.58	×	92.85	×	0.57	x	0.7	=	40.57	(77)
Southeast 0.9x	0.77	x	0.99	x	69.27	x	0.57	x	0.7	=	37.92	(77)
Southeast 0.9x	0.77	x	1.58	x	69.27	x	0.57	x	0.7	=	30.26	(77)
Southeast 0.9x	0.77	x	0.99	x	44.07	x	0.57	x	0.7	=	24.13	(77)
Southeast 0.9x	0.77	x	1.58	×	44.07	×	0.57	x	0.7	=	19.25	(77)
Southeast 0.9x	0.77	x	0.99	×	31.49	×	0.57	x	0.7	=	17.24	(77)
Southeast 0.9x	0.77	x	1.58	×	31.49	×	0.57	x	0.7	=	13.76	(77)

Solar g	Solar gains in watts, calculated for each month       (83)m = Sum(74)m       (82)m         (83)m=       39.31       67.98       95.74       123.19       142.16       142.96       137.07       122.64       105.2       75.87       47.27       33.52													
(83)m=	39.31	67.98	95.74	123.19	142.16	142.96	137.07	122.64	105.2	75.87	47.27	33.52	(83)	
Total g	ains – i	nternal a	ind solar	(84)m =	= (73)m -	+ (83)m	, watts							
(84)m=	285.03	311.56	330.29	343.79	349.02	336.35	321.91	312.47	302.36	287.14	274.58	272.57	(84)	

7. Me	an inter	nal temp	oerature	(heating	season	)								
		during h					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	ible 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.96	0.9	0.75	0.57	0.61	0.84	0.97	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.94	20.07	20.27	20.54	20.79	20.95	20.99	20.99	20.9	20.59	20.22	19.92		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)			-		
(88)m=	20.01	20.02	20.02	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.03	20.02		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.99	0.98	0.95	0.86	0.66	0.45	0.49	0.77	0.95	0.99	1		(89)
Mean	interna	I temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to 3	7 in Tabl	le 9c)				
(90)m=	18.61	18.79	19.09	19.49	19.82	20	20.04	20.04	19.95	19.56	19.03	18.58		(90)
									f	fLA = Livin	ig area ÷ (4	4) =	0.62	(91)
Mean	interna	I temper	ature (fo	or the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	19.43	19.58	19.82	20.14	20.42	20.58	20.62	20.62	20.53	20.2	19.76	19.41		(92)
Apply	v adjustr	nent to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.28	19.43	19.67	19.99	20.27	20.43	20.47	20.47	20.38	20.05	19.61	19.26		(93)
8. Sp	ace hea	ting requ	uirement											
				•		ned at st	ep 11 of	Table 9	b, so tha	it Ti,m=(	76)m an	d re-calc	ulate	
the ut		factor fo	Mar			lun	Jul	A.u.a	San	Oct	Nov	Dee		
l Itilica	Jan ation fac	tor for g		Apr	May	Jun	Jui	Aug	Sep		Nov	Dec		
(94)m=	0.99	0.99	0.98	0.95	0.87	0.7	0.51	0.55	0.79	0.95	0.99	0.99		(94)
		hmGm				•								
(95)m=	283.11	307.95	322.8	325.42	302.81	234.91	163.82	170.83	239.82	272.83	271.02	271.09		(95)
Month	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 mea	an intern	al tempe	erature,	Lm,W:	- =[(39)m :	x [(93)m	– (96)m	]				
(97)m=	661.57	640.12	578.93	481.97	371.5	250.16	166.11	174.17	270.69	409.77	545.15	658.85		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mon ⁻	th = 0.02	24 x [(97	)m – (95	5)m] x (4	1)m			
(98)m=	281.58	223.22	190.56	112.72	51.1	0	0	0	0	101.88	197.38	288.49		
								Tota	l per year	(kWh/yea	r) = Sum(9	8) _{15,912} =	1446.94	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								35.5	(99)
9a. En	ergy red	quiremer	nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heati	-												_
		bace hea				mentary	-						0	(201)
		bace hea		-				(202) = 1		(000)-			1	(202)
		tal heati	•	-				(204) = (2	02) × [1 –	(203)] =			1	(204)
	•	main spa		• •									90.3	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g systen	ז, %						0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space		· ·	<u>`</u>	alculate	r i i i i i i i i i i i i i i i i i i i								I	
	281.58	223.22	190.56	112.72	51.1	0	0	0	0	101.88	197.38	288.49		
(211)m	1 = {[(98 311.83	)m x (20 247.19	4)] } x 1 211.04	100 ÷ (20	)6) 56.59	0	0	0	0	112.83	218.58	319.48	l	(211)
	511.05	247.19	211.04	124.03	50.59	0	0		l (kWh/yea				1602.37	(211)
Space	e heatin	a fuel (s	econdar	y), kWh/	month					, ,	/15,10. 12		1002.01	](=)
•			00 ÷ (20	•										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	al (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	Ē	0	(215)
	heating		ton (		h a a )									
Output	149.23	ater nea 130.35	ter (calc 135.62	ulated a	bove) 116.46	102.57	98.27	109.55	110.76	126.13	134.64	145.72		
Efficier	ncy of w	ater hea	iter										81	(216)
(217)m=	86.85	86.63	86.19	85.25	83.63	81	81	81	81	84.91	86.28	86.95		(217)
		•	kWh/m											
(219)m (219)m=		m x 100 150.47	) ÷ (217) 157.36	)m 141.11	139.27	126.64	121.33	135.25	136.74	148.54	156.04	167.59		
								Tota	I = Sum(2)	19a) ₁₁₂ =			1752.17	(219)
Annua	I totals									k	Wh/year		kWh/year	-
Space	heating	fuel use	ed, main	system	1								1602.37	
Water	heating	fuel use	d										1752.17	]
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 fron	n outside	е			69.51		(230a)
centra	al heatir	ig pump	:									30		(230c)
Total e	lectricity	for the	above,	kWh/yea	r			sum	of (230a)	(230g) =			99.51	(231)
Electric	city for li	ghting											219.2	(232)
12a. (	CO2 em	issions -	– Individ	ual heat	ing syste	ems inclu	uding mi	cro-CHF	þ					-
						En	ergy			Emiee	ion fac	tor	Emissions	
							/h/year			kg CO			kg CO2/yea	ır
Space	heating	(main s	ystem 1	)		(21	1) x			0.2	16	=	346.11	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(21	9) x			0.2	16	=	378.47	(264)
Space	and wa	ter heati	ng			(26	1) + (262)	+ (263) + (	(264) =				724.58	(265)
Electric	city for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	51.65	(267)
Electric	city for li	ghting				(23)	2) x			0.5	19	=	113.76	(268)
Total C	:02, kg/	year							sum o	of (265) (2			889.99	(272)
Dwelli	ng CO2	Emissi	on Rate	•					(272)	÷ (4) =			21.83	(273)
El ratir	ıg (secti	on 14)											86	(274)



Appendix Energy Assessment 40-42 Mill Lane

**GREEN** Scenario

			User D	etails:						
Assessor Name: Software Name:	Chris Hockne Stroma FSA	-		Stroma Softwa					016363 n: 1.0.4.10	
		Р	roperty /	Address:	Unit 6-F	Proposed	d-Green			
Address :	Unit 6, 40-42	Mill Lane, Lon	don, NW	/6 1NR						
1. Overall dwelling dimer	isions:									
Ground floor				<b>a(m²)</b> 4.36	(1a) x	<b>Av. Hei</b>	i <b>ght(m)</b> .16	(2a) =	Volume(m ³ ) 139.02	(3a)
Total floor area TFA = (1a	)+(1b)+(1c)+(1c	d)+(1e)+(1r	n) 6	4.36	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	139.02	(5)
2. Ventilation rate:		-								
Number of chimneys Number of open flues	main heating	secondar heating + 0 + 0	y ] + [ ] + [	0 0 0	] = [ ] = [	<b>total</b> 0 0		40 = 20 =	m ³ per houi	(6a) (6b)
Number of intermittent fan	s					0	x.^	10 =	0	(7a)
								10 =		
Number of passive vents					Ļ	0			0	(7b)
Number of flueless gas fire	es					0	X 2	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	e dwelling (ns)								0	(9)
Additional infiltration							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0.2 if both types of wall are pre deducting areas of opening	esent, use the value gs); if equal user 0	e corresponding to 35	the great	er wall area	a (after	uction			0	(11)
If suspended wooden flo			1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente									0	(13)
Percentage of windows	and doors drau	ught stripped		0.25 - [0.2	$\mathbf{v}(14) \pm 1$	001 -			0	(14)
Window infiltration Infiltration rate				(8) + (10) ·		1	+ (15) =		0	(15)
Air permeability value, c	150 everesed	in cubic metre						area	0	(16) (17)
If based on air permeabilit					•		nvelope	arca	3 0.15	(17)
Air permeability value applies						is being us	sed		0.10	
Number of sides sheltered	1								1	(19)
Shelter factor				(20) = 1 - [	0.075 x (1	9)] =			0.92	(20)
Infiltration rate incorporation	ng shelter facto	r		(21) = (18)	x (20) =				0.14	(21)
Infiltration rate modified fo	r monthly wind	speed								
Jan Feb I	Var Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table	7								
(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 sh	elter an	d wind s	peed) =	(21a) x (	(22a)m					
	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16		
	ate effect chanical		-	ate for ti	he appli	cable ca	se					г Г		
	aust air hea			ndix N (2	3h) = (23a	) x Fmv (e	equation (N	(5)) other	wise (23h	) = (23a)		ľ	0.5	(23a)
	inced with									) - (200)		ľ	0.5	(23b)
							,	,		Dh)m ⊥ //	226) v [	1 (22a)	74.8	(23c)
(24a)m=	i	0.3		0.28	0.28	0.26	0.26	0.25	)III – (22 0.26	0.28	23D) × [ 0.28	1 – (23c) 0.29	÷ 100]	(24a)
Ľ												0.29		(244)
(24b)m=	balanced							0	m = (22)	$\frac{1}{2} \frac{1}{2} \frac{1}$	230)	0		(24b)
	-	-	,	÷	-		-		•	0	0	0		(210)
,	whole ho f (22b)m				•	•				5 × (23b	)			
(24c)m=	0	0.0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If i	natural v	entilatio	n or who	le hous	e positiv	le input v	ventilatic	n from l	oft					
	f (22b)m									0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	ctive air c	hange r	ate - en	ter (24a	) or (24b	o) or (240	c) or (24	d) in box	(25)			-		
(25)m=	0.3	0.3	0.3	0.28	0.28	0.26	0.26	0.25	0.26	0.28	0.28	0.29		(25)
3 Hes	at losses	and he	at lose n	aramete	ar.									
ELEM		Gross		Openin		Net Ar	ea	U-valu	e	AXU		k-value	. Α	Xk
		area (	(m²)	m	2	A ,n	∩²	W/m2	к <u></u>	(W/ł	<)	kJ/m²∙k	(k	J/K
Doors						2	x	1.5	=	3				(26)
Window	ws Type	1				0.99	x1/	[1/( 1.4 )+	0.04] =	1.31				(27)
Window	ws Type	2				0.99	x1/	[1/( 1.4 )+	0.04] =	1.31				(27)
Walls T	Type1	30.12	2	4.95		25.17	×	0.15	=	3.78				(29)
Walls T	ype2	4.78		2		2.78	x	0.14	=	0.39				(29)
Walls T	уре3	3.85		0		3.85	x	0.15	= [	0.58	ו ר		7	(29)
Walls T	ype4	21.55	5	0			= ;						= ==	(29)
Walls T				0		21.55	X	0.15	= [	3.23				
	уре5	8.89		0		21.55 8.89	x x	0.15 0.13	= [ = [	3.23 1.17				(29)
Roof T		Г					× [		╡╏					(29)
Roof T Roof T	ype1	8.89		0		8.89	× [	0.13		1.17				
Roof T	ype1 ype2	8.89 53.89 2.6	)	0		8.89 53.89 2.6		0.13 0.1		1.17 5.39				(30) (30)
Roof T Total a	⊽pe1 ⊽pe2 rea of ele	8.89 53.89 2.6	)	0		8.89 53.89 2.6 125.66		0.13 0.1 0.1		1.17 5.39 0.26				(30) (30) (31)
Roof T Total a Party w	⊽pe1 ⊽pe2 rea of ele vall	8.89 53.89 2.6	)	0		8.89 53.89 2.6 125.64 22.68		0.13 0.1		1.17 5.39				(30) (30) (31) (32)
Roof T Total a Party w Party fl	ype1 ype2 rea of ele vall oor dows and r	8.89 53.89 2.6 ements,	m²	0 0 0		8.89 53.89 2.6 125.68 22.68 64.36 64.36		0.13 0.1 0.1 0		1.17 5.39 0.26 0	[ [ [ [ [ [ [ [ [ [	paragraph		(30) (30) (31)
Roof T Total at Party w Party fl * for wind ** include	ype1 ype2 rea of ele vall oor dows and r e the areas	8.89 53.89 2.6 ements,	m ² ws, use ef	0 0 0		8.89 53.89 2.6 125.68 22.68 64.36 64.36	x   x   x   x   x   x   x   x   x   x	0.13 0.1 0.1 0 formula 1/	= [ = [ = [ = [ = [	1.17 5.39 0.26 0	s given in	paragraph		(30) (30) (31) (32) (32a)
Roof T Total a Party w Party fl * for wind ** include Fabric	ype1 ype2 rea of ele vall oor dows and r e the areas heat loss	8.89 53.89 2.6 ements, coof window s on both s s, W/K =	m ² m ² sides of int S (A x U	0 0 0		8.89 53.89 2.6 125.68 22.68 64.36 64.36	x   x   x   x   x   x   x   x   x   x	0.13 0.1 0.1 0	= [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [ ] = [] = [	1.17 5.39 0.26 0	-	[	24.36	(30) (30) (31) (32) (32a) (32a)
Roof T Total a Party w Party fl * for wind ** include Fabric Heat ca	ype1 ype2 rea of ele vall oor dows and r e the areas heat loss apacity C	8.89 $53.89$ $2.6$ ements, ements, s on both s $S, W/K = Cm = S(A$	m ² m ² sides of int S (A x I A x k )	0 0 0	s and part	8.89 53.89 2.6 125.64 22.68 64.36 alue calcula itions	x   x   x   x   x   x   x   x   x   x	0.13 0.1 0.1 0 formula 1/	$ \begin{bmatrix} - & - & - \\ - & - & - \\ - & - & - \\ - & - &$	$   \begin{array}{r}     1.17 \\     \overline{5.39} \\     0.26 \\     \hline     0 \\     0 \\     ue)+0.04] a \\     (30) + (32) \\   \end{array} $	?) + (32a)	[	24.36 8288.27	(30) (30) (31) (32) (32a) (32a) (33) (34)
Roof T Total a Party w Party fl * for wind ** include Fabric Heat ca Therma	ype1 ype2 rea of ele vall oor dows and r e the areas heat loss	8.89 53.89 2.6 ements, coof windows on both ss, W/K =Cm = S(Aparameter	m ² m ² S (A x t A x k ) er (TMP	0 0 0 ffective win ternal wall J) = Cm ÷	's and part · TFA) in	8.89 53.89 2.6 125.64 22.68 64.36 64.36 alue calcula itions	x   x   x   x   x   x   x   x   x   x	0.13 0.1 0.1 0 formula 1/ (26) (30)	=     =      =	1.17 5.39 0.26 0 <i>(a) + 0.04] a</i> (30) + (32) tive Value:	?) + (32a) Medium	(32e) = [	24.36	(30) (30) (31) (32) (32a) (32a)

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

24.31	(36)
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if details	of therm	al bridging	are not kr	10wn (36) :	= 0.15 x (3	11)								_
Total f	abric he	at loss							(33) +	(36) =			48.68	(37)
Ventila	ation he	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=	13.9	13.74	13.58	12.78	12.62	11.83	11.83	11.67	12.15	12.62	12.94	13.26		(38)
Heat t	ransfer	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	62.57	62.41	62.25	61.46	61.3	60.5	60.5	60.35	60.82	61.3	61.62	61.94		
			•	•		•			,	Average =	Sum(39)1	12 <b>/12=</b>	61.42	(39)
	· · ·	ameter (H	<u>,</u>	1			· · · · ·	,		= (39)m ÷	· · ·		1	
(40)m=	0.97	0.97	0.97	0.95	0.95	0.94	0.94	0.94	0.95	0.95	0.96	0.96		<b>-</b>
Numb	er of da	ys in mo	nth (Tab	le 1a)	_		-			Average =	Sum(40)1	12 <b>/12=</b>	0.95	(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 ene	rgy requ	irement:								kWh/y	ear:	
A			N I										1	
		upancy, 9. N = 1		(1 - exp	)(-0.0003	349 x (TF	- A -13.9	)2)] + 0.(	)013 x ( ⁻	TFA -13.		.1	J	(42)
	A £ 13.				( 0.0000			/_/] 010			,			
								(25 x N)				.12	]	(43)
		-		usage by r day (all w		-	-	to achieve	a water us	se target o	T			
			1	1		r		<b>A</b> 110	Son	Oct	Nov	Dee	1	
Hot wat	Jan er usage i	Feb	Mar dav for e	Apr ach month	May	L Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	92.53	, 89.17	85.8	82.44	79.07	75.71	75.71	79.07	82.44	85.8	89.17	92.53	1	
(++)11-	02.00	00.17	00.0	02.44	10.07	10.11	10.11	10.01			m(44) _{1 12} =		1009.43	(44)
Energy	content of	f hot water	used - ca	lculated m	onthly = 4.	190 x Vd,r	n x nm x L	) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) )					1000.40	
(45)m=	137.22	120.01	123.84	107.97	103.6	89.4	82.84	95.06	96.2	112.11	122.37	132.89	]	
						1	1	1		Total = Su	m(45)1 12 =	•	1323.52	(45)
lf instar	taneous v	vater heati	ng at poin	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46	) to (61)					
(46)m=	20.58	18	18.58	16.2	15.54	13.41	12.43	14.26	14.43	16.82	18.36	19.93		(46)
	storage												1	
-							-	within sa	ame ves	sel		0		(47)
	•	•		ank in dw	•			• •	oro) ont	or (0' in (	47)			
	storage		not wate		iciudes i	nsianiai	ieous cu	ombi boil	ers) ente		47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):					0	]	(48)
		actor fro										0	]	(49)
•				e, kWh/ye	ear			(48) x (49)	) =			0	]	(50)
-			-	cylinder		or is not		( - / ( - )				0	]	(00)
		-		rom Tab	le 2 (kW	h/litre/da	ay)					0		(51)
	•	neating s		on 4.3									1	
		from Ta		. 2h								0		(52)
		actor fro							(50)	50)		0	]	(53)
-		m water (54) in (5	-	e, kWh/ye	ear			(47) x (51)	) x (52) x (	ರಿತ) =		0		(54)
	(50)0	(0-) 11 (3										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	rage, (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	e 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 heati	ng and a	cylinde	r thermo	ostat)		
(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) ÷ 36	65 × (41	)m					
(61)m=	47.15	41.04	43.72	40.65	40.29	37.33	38.58	40.29	40.65	43.72	43.97	47.15	(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=	184.37	161.05	167.57	148.62	143.89	126.73	121.42	135.36	136.85	155.83	166.35	180.04	(62)
Solar Dł	-IW input	calculated	using App	endix G o	Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	tion to wate	er heating)	-
(add a	dditiona	l lines if	FGHRS	and/or \	NWHRS	applies	, see Ap	pendix (	G)	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=	184.37	161.05	167.57	148.62	143.89	126.73	121.42	135.36	136.85	155.83	166.35	180.04	
								Outp	out from w	ater heate	<mark>r (annual)</mark> ₁	12	1828.09 (64)
Heat g	ains fro	m water	heating,	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	]
(65)m=	57.41	50.16	52.11	46.06	44.52	39.06	37.19	41.68	42.15	48.21	51.68	55.97	(65)
inclu	Ido (57)	m in cal											
incit	iue ( <i>31</i> )		culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fi	rom com	munity h	neating
	. ,		e Table 5	. ,	-	ylinder i	s in the o	dwelling	or hot w	ater is fi	rom com	munity h	neating
5. Int	ternal ga	ains (see		5 and 5a	-	ylinder i	s in the o	dwelling	or hot w	ater is fi	rom com	munity h	neating
5. Int	ternal ga	ains (see	e Table 5	5 and 5a	-	ylinder is Jun	s in the o	dwelling Aug	or hot w Sep	ater is fi Oct	rom com	munity h	neating
5. Int	ternal ga olic gain	ains (see ns (Table	e Table 5 e 5), Wat	5 and 5a	):	- I	I	i		I	1		neating (66)
5. Int Metabo (66)m=	ternal ga olic gain Jan 105.09	ains (see ns (Table Feb 105.09	e Table 5 5), Wat Mar 105.09	5 and 5a ts Apr 105.09	): May 105.09	Jun 105.09	Jul 105.09	Aug	Sep 105.09	Oct	Nov	Dec	
5. Inf Metabo (66)m= Lightin	ternal ga olic gain Jan 105.09 g gains	ains (see ns (Table Feb 105.09 (calcula	e Table 5 5), Wat Mar 105.09	5 and 5a tts Apr 105.09 opendix	): May 105.09 L, equat	Jun 105.09	Jul 105.09	Aug 105.09	Sep 105.09	Oct	Nov	Dec	
5. Int Metabo (66)m= Lightin (67)m=	ternal ga olic gain Jan 105.09 g gains 19.92	ains (see ns (Table Feb 105.09 (calcula 17.69	2 Table 5), Wat Mar 105.09 ted in Ap 14.39	5 and 5a ts Apr 105.09 opendix 10.89	): 105.09 L, equat 8.14	Jun 105.09 ion L9 o 6.88	Jul 105.09 r L9a), a 7.43	Aug 105.09 Iso see	Sep 105.09 Table 5 12.96	Oct 105.09 16.46	Nov 105.09	Dec 105.09	(66)
5. Int Metabo (66)m= Lightin (67)m=	ernal ga olic gain Jan 105.09 g gains 19.92 nces ga	ains (see ns (Table Feb 105.09 (calcula 17.69	2 Table 5), Wat Mar 105.09 ted in Ap 14.39	5 and 5a ts Apr 105.09 opendix 10.89	): 105.09 L, equat 8.14	Jun 105.09 ion L9 o 6.88	Jul 105.09 r L9a), a 7.43	Aug 105.09 Iso see 9.66	Sep 105.09 Table 5 12.96	Oct 105.09 16.46	Nov 105.09	Dec 105.09	(66)
5. Int Metabo (66)m= Lightin (67)m= Appliau (68)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79	ains (see reb 105.09 (calcula 17.69 ins (calc 185.7	e Table 5 5), Wat Mar 105.09 ted in Ap 14.39 sulated in 180.9	5 and 5a tts 105.09 opendix 10.89 n Append 170.66	): 105.09 L, equat 8.14 dix L, eq 157.75	Jun 105.09 ion L9 of 6.88 uation L 145.61	Jul 105.09 r L9a), a 7.43 13 or L1 137.5	Aug 105.09 Iso see 9.66 3a), also	Sep 105.09 Table 5 12.96 see Ta 140.4	Oct 105.09 16.46 ble 5 150.63	Nov 105.09 19.21	Dec 105.09 20.48	(66)
5. Int Metabo (66)m= Lightin (67)m= Appliau (68)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79	ains (see reb 105.09 (calcula 17.69 ins (calc 185.7	e Table 5 5), Wat Mar 105.09 ted in Ap 14.39 sulated in 180.9	5 and 5a tts 105.09 opendix 10.89 n Append 170.66	): 105.09 L, equat 8.14 dix L, eq 157.75	Jun 105.09 ion L9 of 6.88 uation L 145.61	Jul 105.09 r L9a), a 7.43 13 or L1 137.5	Aug 105.09 Iso see 9.66 3a), also 135.59	Sep 105.09 Table 5 12.96 see Ta 140.4	Oct 105.09 16.46 ble 5 150.63	Nov 105.09 19.21	Dec 105.09 20.48	(66)
5. Int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m=	ernal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51	ains (see Feb 105.09 (calcula 17.69 ins (calc 185.7 (calcula 33.51	E Table 5 5), Wat Mar 105.09 ted in Ap 14.39 culated in 180.9 ated in A	5 and 5a ts Apr 105.09 opendix 10.89 Append 170.66 ppendix 33.51	): 105.09 L, equat 8.14 dix L, eq 157.75 L, equat	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table	Oct 105.09 16.46 ble 5 150.63 5	Nov 105.09 19.21 163.55	Dec 105.09 20.48 175.68	(66) (67) (68)
5. Int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m=	ernal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51	ains (see Feb 105.09 (calcula 17.69 ins (calc 185.7 (calcula 33.51	2 Table 5 3 5), Wat Mar 105.09 ted in Ap 14.39 culated in 180.9 ated in A 33.51	5 and 5a ts Apr 105.09 opendix 10.89 Append 170.66 ppendix 33.51	): 105.09 L, equat 8.14 dix L, eq 157.75 L, equat	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table	Oct 105.09 16.46 ble 5 150.63 5	Nov 105.09 19.21 163.55	Dec 105.09 20.48 175.68	(66) (67) (68)
5. Int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3	ains (see reb 105.09 (calcula 17.69 ins (calcula 185.7 (calcula 33.51 ns gains 3	Table 5 5), Wat Mar 105.09 ted in Ap 14.39 sulated in 180.9 ated in A 33.51 (Table 5	5 and 5a ts Apr 105.09 500 10.89 10.89 10.89 170.66 ppendix 33.51 5a) 3	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51	Sep 105.09 Table 5 12.96 see Ta 140.4 ee Table 33.51	Oct 105.09 16.46 ble 5 150.63 5 33.51	Nov 105.09 19.21 163.55 33.51	Dec 105.09 20.48 175.68 33.51	(66) (67) (68) (69)
5. Int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3	ains (see reb 105.09 (calcula 17.69 ins (calcula 185.7 (calcula 33.51 ns gains 3	<ul> <li>Table 5</li> <li>5), Wat</li> <li>Mar</li> <li>105.09</li> <li>ted in Ap</li> <li>14.39</li> <li>sulated in A</li> <li>180.9</li> <li>ated in A</li> <li>33.51</li> <li>(Table 5</li> <li>3</li> </ul>	5 and 5a ts Apr 105.09 500 10.89 10.89 10.89 170.66 ppendix 33.51 5a) 3	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51	Sep 105.09 Table 5 12.96 see Ta 140.4 ee Table 33.51	Oct 105.09 16.46 ble 5 150.63 5 33.51	Nov 105.09 19.21 163.55 33.51	Dec 105.09 20.48 175.68 33.51	(66) (67) (68) (69)
5. Int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3 s e.g. ev -84.07	ains (see Feb 105.09 (calcula 17.69 ins (calcula 185.7 (calcula 33.51 ns gains 3 vaporatic	E Table 5 Mar 105.09 ted in Ag 14.39 sulated in 180.9 ated in A 33.51 (Table 5 3 on (nega -84.07	5 and 5a tts Apr 105.09 opendix 10.89 n Append 170.66 ppendix 33.51 5a) 3 tive valu	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3 es) (Tab	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51 3 .1e 5)	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table 33.51	Oct 105.09 16.46 ble 5 150.63 5 33.51 3	Nov 105.09 19.21 163.55 33.51 3	Dec 105.09 20.48 175.68 33.51 3	(66) (67) (68) (69) (70)
5. Int Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3 s e.g. ev -84.07	ains (see reb 105.09 (calcula 17.69 ins (calc 185.7 (calcula 33.51 ns gains 3 vaporatic -84.07	E Table 5 Mar 105.09 ted in Ag 14.39 sulated in 180.9 ated in A 33.51 (Table 5 3 on (nega -84.07	5 and 5a tts Apr 105.09 opendix 10.89 n Append 170.66 ppendix 33.51 5a) 3 tive valu	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3 es) (Tab	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51 3 .1e 5)	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table 33.51	Oct 105.09 16.46 ble 5 150.63 5 33.51 3	Nov 105.09 19.21 163.55 33.51 3	Dec 105.09 20.48 175.68 33.51 3	(66) (67) (68) (69) (70)
5. Int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3 s e.g. ev -84.07 heating 77.17	ains (see Feb 105.09 (calcula 17.69 ins (calcula 185.7 (calcula 33.51 ns gains 3 /aporatic -84.07 gains (T	Table 5 5), Wat Mar 105.09 ted in Ap 14.39 tulated in 180.9 ated in A 33.51 (Table 5 3 on (nega -84.07 Table 5) 70.04	5 and 5a ts Apr 105.09 opendix 10.89 n Appendix 170.66 ppendix 33.51 5a) 3 tive valu -84.07	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3 es) (Tab -84.07	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51 3 	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51 3 84.07 49.99	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51 3 -84.07 56.02	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table 33.51 3 -84.07 58.54	Oct 105.09 16.46 ble 5 150.63 5 33.51 3 -84.07 64.79	Nov 105.09 19.21 163.55 33.51 3 -84.07	Dec 105.09 20.48 175.68 33.51 3 -84.07 75.23	<pre>(66) (67) (68) (69) (70) (71)</pre>
5. Int Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	ternal ga olic gain Jan 105.09 g gains 19.92 nces ga 183.79 ng gains 33.51 s and fai 3 s e.g. ev -84.07 heating 77.17	ains (see reb 105.09 (calcula 17.69 ins (calc 185.7 (calcula 33.51 ns gains 3 vaporatic -84.07 gains (T 74.65	Table 5 5), Wat Mar 105.09 ted in Ap 14.39 tulated in 180.9 ated in A 33.51 (Table 5 3 on (nega -84.07 Table 5) 70.04	5 and 5a ts Apr 105.09 opendix 10.89 n Appendix 170.66 ppendix 33.51 5a) 3 tive valu -84.07	): May 105.09 L, equat 8.14 dix L, eq 157.75 L, equat 33.51 3 es) (Tab -84.07	Jun 105.09 ion L9 of 6.88 uation L 145.61 ion L15 33.51 3 	Jul 105.09 r L9a), a 7.43 13 or L1 137.5 or L15a 33.51 3 84.07 49.99	Aug 105.09 Iso see 9.66 3a), also 135.59 ), also se 33.51 3 -84.07 56.02	Sep 105.09 Table 5 12.96 5 see Ta 140.4 ee Table 33.51 3 -84.07 58.54	Oct 105.09 16.46 ble 5 150.63 5 33.51 3 -84.07 64.79	Nov 105.09 19.21 163.55 33.51 33.51 -84.07 71.78	Dec 105.09 20.48 175.68 33.51 3 -84.07 75.23	<pre>(66) (67) (68) (69) (70) (71)</pre>

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

Orientation:	Access F Table 6d	actor	Area m²			Flu: Tat	x ble 6a			g_ able 6b		Tab	FF le 6c			Gains (W)	
Northeast 0.9	0.77	x	0.9	9	x	1	1.28	×		0.57	x		0.7		=	6.18	(75)
Northeast 0.9	0.77	x	0.9	9	x	2	2.97	x		0.57	x		0.7		=	12.57	(75)
Northeast 0.9	0.77	x	0.9	9	x	4	1.38	×		0.57	x		0.7		=	22.65	(75)
Northeast 0.9	0.77	x	0.9	9	x	6	7.96	x		0.57	x		0.7		=	37.2	(75)
Northeast 0.9	0.77	x	0.9	9	x	9	1.35	x		0.57	x		0.7		=	50.01	(75)
Northeast 0.9	0.77	x	0.9	9	x	9	7.38	x		0.57	x		0.7		=	53.32	(75)
Northeast 0.9	0.77	x	0.9	9	x	<u></u>	91.1	x		0.57	x		0.7		=	49.88	(75)
Northeast 0.9	0.77	x	0.9	9	x	7	2.63	x		0.57	x		0.7		=	39.76	(75)
Northeast 0.9	0.77	x	0.9	9	x	5	0.42	x		0.57	x		0.7		=	27.6	(75)
Northeast 0.9	0.77	x	0.9	9	x	2	8.07	x		0.57	x		0.7		=	15.37	(75)
Northeast 0.9	0.77	x	0.9	9	x	1	4.2	x		0.57	x		0.7		=	7.77	(75)
Northeast 0.9	0.77	x	0.9	9	x	9	9.21	x		0.57	x		0.7		=	5.04	(75)
Northwest 0.9	0.77	x	0.9	9	x	1	1.28	x		0.57	x		0.7		=	9.27	(81)
Northwest 0.9	0.77	x	0.9	9	x	2	2.97	x		0.57	x		0.7		=	18.86	(81)
Northwest 0.9	0.77	x	0.9	9	x	4	1.38	×		0.57	x		0.7		=	33.98	(81)
Northwest 0.9	0.77	x	0.9	9	x	6	7.96	x		0.57	x		0.7		=	55.81	(81)
Northwest 0.9	0.77	x	0.9	9	x	9	1.35	x		0.57	x		0.7		=	75.02	(81)
Northwest 0.9	0.77	x	0.9	9	x	9	7.38	x		0.57	x		0.7		=	79.97	(81)
Northwest 0.9	0.77	x	0.9	9	x	6	91.1	x		0.57	x		0.7		=	74.81	(81)
Northwest 0.9	0.77	x	0.9	9	x	7	2.63	x		0.57	x		0.7		=	59.64	(81)
Northwest 0.9	0.77	x	0.9	9	x	5	0.42	x		0.57	×		0.7		=	41.41	(81)
Northwest 0.9	0.77	x	0.9	9	x	2	8.07	x		0.57	x		0.7		=	23.05	(81)
Northwest 0.9	0.77	x	0.9	9	x	1	4.2	×		0.57	x		0.7		=	11.66	(81)
Northwest 0.9	0.77	x	0.9	9	x	<u></u>	).21	x		0.57	x		0.7		=	7.57	(81)
								-							-		
Solar gains i			i					<del>` ´</del>	-	m(74)m	(82)r						
(83)m= 15.44		56.64	93.01	125.03		33.29	124.69	99.	41	69.01	38.4	2	19.43	12.	61		(83)
Total gains -			· <i>,</i>	· ,	<u> </u>			050		000.44	0.07		04.40	0.44			(04)
(84)m= 353.8		379.49	396.07	408.28		97.55	377.13	358	.21	338.44	327.	82 3	31.49	341	.53		(84)
7. Mean int			ì		ĺ.												_
Temperatu	•	• •			-			ole 9	, Th1	(°C)						21	(85)
Utilisation f			<u> </u>		Ť		,	<u> </u>		_				_			
Jar		Mar	Apr	Мау	-	Jun	Jul		ug	Sep	00	_	Nov		ес		
(86)m= 1	1	1	0.99	0.96		0.84	0.68	0.7	73	0.93	0.99	9	1	1			(86)
Mean interr	nal temper	ature in	living ar	ea T1 (	follo	w ste	os 3 to 7	7 in T	able	9c)				-			
<mark>(87)</mark> m= 19.96	6 20.04	20.21	20.47	20.73	2	20.92	20.98	20.	97	20.84	20.5	3	20.2	19.	94		(87)
Temperatu	re during h	eating p	eriods in	n rest o	f dw	elling	from Ta	able	9, Th	2 (°C)							
(88)m= 20.1 ⁻	1 20.11	20.11	20.12	20.12	2	20.13	20.13	20.	14	20.13	20.1	2	20.12	20.	11		(88)
Utilisation f	actor for ga	ains for	rest of d	welling	, h2	,m (se	e Table	9a)	_	_	_	_		_	-		
(89)m= 1	1	0.99	0.98	0.93		0.77	0.56	0.6	61	0.89	0.98	3	1	1			(89)

Moon	interne	l tompor	aturo in	the rest	of dwolli	ng T2 /f		ne 2 to .	7 in Tabl	a ()a)				
(90)m=	18.7	18.82	19.07	19.46	19.82	20.07	20.13	20.12	7 in Tabl 19.98	e 9C) 19.54	19.07	18.69		(90)
(90)11-	10.7	10.02	19.07	19.40	19.02	20.07	20.13	20.12			g area ÷ (4			_ ` `
									'		iy area ÷ (•	+) -	0.38	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	A) × T2					
(92)m=	19.18	19.28	19.51	19.84	20.17	20.4	20.45	20.45	20.31	19.92	19.51	19.17		(92)
Apply	adjustr	nent to t	he mear	n interna	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.03	19.13	19.36	19.69	20.02	20.25	20.3	20.3	20.16	19.77	19.36	19.02		(93)
8. Spa	ace hea	ting requ	uirement	t										
				mperatui using Ta		ied at ste	ep 11 of	Table 9I	b, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hrr	n:							-			
(94)m=	1	1	0.99	0.98	0.93	0.78	0.58	0.64	0.89	0.98	1	1		(94)
Usefu	l gains,	hmGm	, W = (9	4)m x (84	4)m	_			-		_			
(95)m=	352.98	365.7	376.81	388.01	380.02	311.53	219.8	228.22	300.82	321.88	329.97	340.85		(95)
Month	nly aver	age exte	ernal terr	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	oss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m	]	-			
(97)m=	921.78	888.43	800.32	663.25	509.94	341.65	224.08	235.25	368.56	562.08	755.17	917.74		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Wh/mont	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
(98)m=	423.19	351.27	315.09	198.17	96.66	0	0	0	0	178.71	306.15	429.21		
								Tota	l per year	(kWh/year	-) = Sum(9	8)15,912 =	2298.46	(98)
Space	e heatin	a reauire	ement in	kWh/m²	²/vear							ļ	35.71	(99)
•					•		a a la callar a					l	00.11	
			nts – Ind	ividual h	eating sy	ystems I	ncluding	micro-C	HP)					
-	e heatiı on of sp	-	at from s	econdar	y/supple	mentary	system					[	0	(201)
Fracti	on of sr	ace hea	at from n	nain syst	em(s)	-	-	(202) = 1	- (201) =				1	(202)
				main sys	. ,			(204) = (2)	02) × [1 –	(203)] =			1	(204)
			•	-				(201) (2	02) [!	(200)]				<u> </u>
				ing syste									90.3	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g system	n, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above)	)								
	423.19	351.27	315.09	198.17	96.66	0	0	0	0	178.71	306.15	429.21		
(211)m	i = {[(98	)m x (20	)4)]}x1	100 ÷ (20	)6)									(211)
. ,	468.65	389.01	348.94	219.46	, 107.04	0	0	0	0	197.91	339.04	475.31		
			!	!				Tota	l (kWh/yea	ar) =Sum(2	1 211) _{15.10. 12}	=	2545.35	(211)
Snace	heatin	a fuel (s	econdar	y), kWh/	month							l		
•		)1)]}x1			monun									
(215)m=		0		0	0	0	0	0	0	0	0	0		
(,	-				-	-	-		l (kWh/yea	-			0	(215)
\// <b>_</b> +	haatla	-							(	,(	* /15,10. 12		U	
	heating		tor (cala	ulated a	hovo)									
Juipul	184.37	161.05	167.57	ulated a	143.89	126.73	121.42	135.36	136.85	155.83	166.35	180.04		
Efficier		ater hea			1.0.00	120.70	121.72	100.00	100.00	100.00	100.00	100.04	81	(216)
LUCIEI	10 y 01 W												01	(~ '0)

				<u> </u>								1	(047)
(217)m= 87.26	87.15	86.84	86.07	84.5	81	81	81	81	85.72	86.79	87.34		(217)
Fuel for water $(219)m = (64)$													
(219)m= 211.29	184.79	192.96	172.69	170.3	156.46	149.9	167.11	168.95	181.8	191.66	206.15		
		۱				1	Tota	l = Sum(2	19a) ₁₁₂ =	1	1	2154.06	(219)
Annual totals									k	Wh/year		kWh/year	-
Space heating	fuel use	ed, main	system	1								2545.35	
Water heating	fuel use	d										2154.06	
Electricity for p	oumps, fa	ans and	electric l	keep-ho	t								
mechanical v	entilatio	n - balan	ced, ext	ract or p	ositive in	nput fror	n outside	e			127.2		(230a)
central heatin	g pump:	:									30		(230c)
Total electricity	for the	above, k	wh/yea	r			sum	of (230a)	(230g) =			157.2	(231)
Electricity for li	ghting											351.84	(232)
Electricity gene	erated by	y PVs										-1381.79	(233)
12a. CO2 em	issions -	– Individ	ual heati	ng syste	ems inclu	uding mi	cro-CHF	)					_
120.002.001													
					En	orav			Emico	ion fao	tor	Emissions	
						<b>ergy</b> /h/year			Emiss kg CO2	<b>ion fac</b> 2/kWh	tor	Emissions	
Space heating			)		kW	•••				2/kWh	tor =		
	(main s	ystem 1)	)		kW (212	/h/year			kg CO	2/kWh		kg CO2/ye	ar T
Space heating	(main s	ystem 1)	)		kW (211 (215	/h/year 1) x			kg CO2	2/kWh 16 19	=	kg CO2/yes	ar ](261)
Space heating Space heating	(main s (secono	ystem 1) dary)	)		kW (211 (218 (218	/h/year 1) x 5) x 9) x	+ (263) + (	264) =	kg CO2	2/kWh 16 19	=	kg CO2/yea	ar ](261) ](263)
Space heating Space heating Water heating	(main s (secono ter heati	ystem 1) dary) ng		keep-ho	kW (211 (215 (215 (261	/h/year 1) x 5) x 9) x	+ (263) + (	264) =	kg CO2	2/kWh 16 19 16	=	kg CO2/yea 549.8 0 465.28	ar ](261) ](263) ](264)
Space heating Space heating Water heating Space and wat	(main s (second ter heati pumps, fa	ystem 1) dary) ng		keep-ho	kW (211 (215 (215 (215 (267 t (231	/h/year 1) x 5) x 9) x 1) + (262)	+ (263) + (	264) =	kg CO2	2/kWh 16 19 16 19	= =	kg CO2/yea 549.8 0 465.28 1015.07	ar (261) (263) (264) (265)
Space heating Space heating Water heating Space and wat Electricity for p	(main s (secono ter heati pumps, fa ghting	ystem 1) dary) ng ans and	electric I	-	kW (211 (215 (215 (215 (267 t (231	/h/year 1) x 5) x 9) x 1) + (262) 1) x	+ (263) + (	264) =	kg CO2 0.2 0.5 0.2	2/kWh 16 19 16 19 19	-	kg CO2/yea 549.8 0 465.28 1015.07 81.59 182.6	ar (261) (263) (264) (265) (265) (267) (268)
Space heating Space heating Water heating Space and wat Electricity for p Electricity for li Energy saving Item 1	(main s (second ter heati pumps, fa ghting /generat	ystem 1) dary) ng ans and	electric I	-	kW (211 (215 (215 (215 (267 t (231	/h/year 1) x 5) x 9) x 1) + (262) 1) x	+ (263) + (		kg CO2 0.2 0.5 0.2	2/kWh 16 19 16 19 19 19	-	kg CO2/yea 549.8 0 465.28 1015.07 81.59 182.6 -717.15	ar (261) (263) (264) (265) (267) (268) (268)
Space heating Space heating Water heating Space and wat Electricity for p Electricity for li Energy saving Item 1 Total CO2, kg/	(main s (second ter heati pumps, fa ghting /generat	ystem 1) dary) ng ans and ion tech	electric I nologies	-	kW (211 (215 (215 (215 (267 t (231	/h/year 1) x 5) x 9) x 1) + (262) 1) x	+ (263) + (	sum o	kg CO2 0.2 0.5 0.2 0.5 0.5 (0.5 (265) (2	2/kWh 16 19 16 19 19 19	-	kg CO2/yea 549.8 0 465.28 1015.07 81.59 182.6 -717.15 562.11	ar (261) (263) (264) (265) (267) (268) (269) (272)
Space heating Space heating Water heating Space and wat Electricity for p Electricity for li Energy saving Item 1	(main s (second ter heati bumps, fa ghting /generat /year Emissi	ystem 1) dary) ng ans and ion tech	electric I nologies	-	kW (211 (215 (215 (215 (267 t (231	/h/year 1) x 5) x 9) x 1) + (262) 1) x	+ (263) + (	sum o	kg CO2 0.2 0.5 0.5 0.5	2/kWh 16 19 16 19 19 19	-	kg CO2/yea 549.8 0 465.28 1015.07 81.59 182.6 -717.15	ar (261) (263) (264) (265) (267) (268) (268)

User Details:		
Assessor Name:Chris HocknellStroma NumberSoftware Name:Stroma FSAP 2012Software Vers		TRO016363 ersion: 1.0.4.10
Property Address: Unit 7-Pr	oposed-Green	
Address : Unit 7, 40-42 Mill Lane, London, NW6 1NR		
1. Overall dwelling dimensions:		
Ground floor Area(m ² ) A 40.76 (1a) x	2.11 (2a	Volume(m ³ ) ) = 86 (3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 40.76 (4)		
Dwelling volume (3a)+(3b)+(	3c)+(3d)+(3e)+(3n)	= 86 (5)
2. Ventilation rate:		
main heatingsecondary heatingotherNumber of chimneys $0$ $+$ $0$ $+$ $0$ $=$ Number of open flues $0$ $+$ $0$ $+$ $0$ $=$	total 0 x 40 = 0 x 20 =	0 (00)
Number of intermittent fans	0 x 10 =	0 (7a)
Number of passive vents	0 x 10 =	
Number of flueless gas fires		
Number of fueless gas files	0 x 40 =	0 (7c)
	А	ir changes per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from	0 ÷ (5)	
Number of storeys in the dwelling (ns) Additional infiltration	[(9)-1]x0	0  (9) 0.1 = 0  (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construct		0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 x (14) ÷ 100	1 -	0 (14)
Window infiltration         0.25 - [0.2 x (14) ÷ 100           Infiltration rate         (8) + (10) + (11) + (12)	•	0 (15)
Air permeability value, q50, expressed in cubic metres per hour per square met		a 3 (17)
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$ , otherwise $(18) = (16)$		a <u>3</u> (17) 0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is	being used	0.13
Number of sides sheltered		1 (19)
Shelter factor (20) = 1 - [0.075 x (19)	] =	0.92 (20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$		0.14 (21)
Infiltration rate modified for monthly wind speed		
Jan Feb Mar Apr May Jun Jul Aug Sep	Oct Nov [	Dec
Monthly average wind speed from Table 7		
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4	4.3 4.5 4	1.7
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	ation rate	e (allowir) ؛	ng for sh	nelter and	d wind s	peed) =	(21a) x	(22a)m					
	0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16		
	a <i>te effec</i> echanica		change h	ate for t	he applic	cable ca	se		-					
				ndiv N (2	(2b) = (22c)		austion (N	N5)) , othei	nuico (23h	) = (22a)			0.5	(23a)
								n Table 4h		) = (23a)			0.5	(23b)
					Ū				,			(00 - )	75.65	(23c)
, i			0.29	0.27	0.27	0.25	0.25	HR) (24a 0.25	a)m = (22)	20)m + (4 0.27	23D) × [* 0.28	<u> </u>	÷ 100]	(24a)
(24a)m=												0.28		(240)
, i r		r	r			neat rec		MV) (24b	m = (22)	r i	,		l	(24b)
(24b)m=	0	0	0	0	0	-	•	0	Ů	0	0	0		(240)
,					•	•		on from c c) = (22b		5 x (23h	)			
(24c)m=	0	0.5 ×	(230), 1	0	0		0	$\frac{1}{0} = \frac{1}{22}$		0 1 0	)	0		(24c)
	-	-		-	Ţ	-		Dn from I	-	Ů	0	Ŭ		()
								0.5 + [(2		0.5]				
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effec	ctive air o	change i	rate - en	ter (24a	) or (24b	) or (240	c) or (24	d) in boy	< (25)					
(25)m=	0.3	0.3	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(25)
		Gros	at loss p			Net Ar	00	U-valı		AXU		k-value	λ Λ	Xk
ELEN	IENI	area		Openin m	-	A,n		W/m2		(W/ł	<)	kJ/m ² ·ł		/K
Doors						2	x	1.5	=	3				(26)
Window	ws Type	1				0.99		/[1/( 1.4 )+	0.04] =	1.31				(27)
Window	ws Type	2				0.99		/[1/( 1.4 )+	0.04] =	1.31				(27)
Window	ws Type	3				1.58		/[1/( 1.4 )+	0.04] =	2.09				(27)
Walls T		20.65	5						F		$\dashv$ ,			
Walls T				4.55		16.1	X	0.15	=	2.42				(29)
	Tvpe2	2.62		4.55		16.1	×	0.15	;	2.42	╡┟			(29)
Walls T		2.62	2	2		0.62	×	0.14		0.09				(29)
Walls T	Гуре3	3.08	2	2		0.62		0.14		0.09				(29) (29)
Walls T	Гуре3 Гуре4	3.08 21.9	23 31	2 0 0		0.62 3.08 21.91		0.14		0.09 0.46 3.29				(29) (29) (29)
Walls T Roof T	Гуре3 Гуре4 Гуре1	3.08 21.9 ⁻ 30.8 ⁴	2 3 1 4	2 0 0		0.62 3.08 21.91 30.84		0.14 0.15 0.15 0.1		0.09 0.46 3.29 3.08				(29) (29) (29) (29) (30)
Walls T Roof T Roof T	Гуре3 Гуре4 Гуре1 Гуре2	3.08 21.9 30.8 1.91	2 3 1 4	2 0 0		0.62 3.08 21.91		0.14		0.09 0.46 3.29				(29) (29) (29) (30) (30)
Walls T Roof T Roof T Total a	Гуре3 Гуре4 Гуре1 Гуре2 rea of el	3.08 21.9 30.8 1.91	2 3 1 4	2 0 0		0.62 3.08 21.91 30.84		0.14 0.15 0.15 0.1		0.09 0.46 3.29 3.08				(29) (29) (29) (29) (30) (30) (31)
Walls T Roof T Roof T Total a Party w	Гуре3 Гуре4 Гуре1 Гуре2 rea of el vall	3.08 21.9 30.8 1.91	2 3 1 4	2 0 0		0.62 3.08 21.91 30.84 1.91		0.14 0.15 0.15 0.1		0.09 0.46 3.29 3.08				(29) (29) (29) (30) (30)
Walls T Roof T Roof T Total a	Гуре3 Гуре4 Гуре1 Гуре2 rea of el vall	3.08 21.9 30.8 1.91	2 3 1 4	2 0 0		0.62 3.08 21.91 30.84 1.91 81.01		0.14 0.15 0.15 0.1 0.1		0.09 0.46 3.29 3.08 0.19				(29) (29) (29) (29) (30) (30) (31)
Walls T Roof T Roof T Total a Party w Party fl	Fype3 Fype4 Fype1 Fype2 rea of el vall loor dows and i	3.08 21.9 30.8 1.91 ements,	2 3 1 4 m ²	2 0 0 0	ndow U-va	0.62 3.08 21.91 30.84 1.91 81.01 23.33 40.76		0.14 0.15 0.15 0.1 0.1		0.09 0.46 3.29 3.08 0.19 0	[ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ ] [ [ [ [ [ ] [ [ [ ] [ [ ] [ [ ] [ ] [ [ ] [ ] [	paragraph		(29) (29) (29) (30) (30) (31) (32)
Walls T Roof T Roof T Total a Party w Party fl * for wind ** include	Fype3 Fype4 Fype1 Fype2 rea of el vall loor dows and i e the areas	3.08 21.9 30.8 1.91 ements,	2 3 1 4 4 m ² wws, use ef	2 0 0 0 0	ndow U-va	0.62 3.08 21.91 30.84 1.91 81.01 23.33 40.76	x x x x x x x ated using	0.14 0.15 0.15 0.1 0.1 0.1		0.09 0.46 3.29 3.08 0.19 0	[ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ [ ]]	paragraph		(29) (29) (29) (30) (30) (31) (32)
Walls T Roof T Roof T Total a Party w Party fl * for wind ** include Fabric	Fype3 Fype4 Fype1 Fype2 rea of el vall loor dows and i e the areas	3.08 21.9 30.8 1.91 ements, roof windo s on both s s, W/K =	2 3 1 4 4 m ² ws, use efficiency of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides	2 0 0 0 0	ndow U-va	0.62 3.08 21.91 30.84 1.91 81.01 23.33 40.76	x x x x x x x ated using	0.14 0.15 0.15 0.1 0.1 0.1	$ \begin{bmatrix} 1 \\ 1 \\ 2 \\ 1 \\ 2 \\ 1 \\ 2 \\ 2 \\ 2 \\ 2 \\$	0.09 0.46 3.29 3.08 0.19 0	-			(29) (29) (29) (30) (30) (31) (32) (32a)
Walls T Roof T Roof T Total a Party w Party fl * for wind ** include Fabric Heat ca	Type3 Type4 Type1 Type2 rea of el vall loor dows and t e the areas heat loss apacity C	3.08 21.9 30.8 1.91 ements, roof windo s on both s s, W/K = Cm = S(/	2 3 1 4 4 m ² ws, use efficiency of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides of inter- sides	2 0 0 0 0	ndow U-va	0.62 3.08 21.91 30.84 1.91 81.01 23.33 40.76 ilue calcula itions	x x x x x x x	0.14 0.15 0.15 0.1 0.1 0.1	$ \begin{bmatrix} - & - & - & - \\ - & - & - & - \\ - & - &$	0.09 0.46 3.29 3.08 0.19 0	2) + (32a)		18.56	(29) (29) (29) (30) (30) (31) (32) (32a) (32a)

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

17.12	(36)
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		00	are not kr	10wn (36)	= 0.15 x (3	1)							-	_
Total f	abric he	at loss							(33) +		35.68	(37)		
Ventila	ation hea	at loss ca	alculated	month	у				(38)m	= 0.33 × (	25)m x (5)	)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	8.48	8.38	8.28	7.79	7.69	7.2	7.2	7.1	7.39	7.69	7.89	8.08		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	44.16	44.06	43.96	43.47	43.37	42.88	42.88	42.78	43.07	43.37	43.57	43.76		
								•		Average =	Sum(39)1	12 <b>/12=</b>	43.44	(39)
	oss para	meter (H	HLP), W	/m²K				i -	(40)m	= (39)m ÷	(4)		1	
(40)m=	1.08	1.08	1.08	1.07	1.06	1.05	1.05	1.05	1.06	1.06	1.07	1.07		_
Numb	er of day	/s in mo	nth (Tab	le 1a)						Average =	Sum(40)₁	₁₂ /12=	1.07	(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	tina ene	rgy requ	irement:								kWh/ye	ear:	
			37.545											
		upancy,		[1 a.v.a			- 400		042	TEA 40		.43		(42)
	A 2 13. A £ 13.		+ 1.70 X	li-exp	0.0003	549 X (11	-A - 13.9	)2)] + 0.0	JU 13 X (	IFA - 13.	.9)			
			ater usa	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		68	8.08	]	(43)
		-				-	-	to achieve	a water us	se target o	f		1	
not mor	e that 125	litres per	person pe	r day (all w	ater use, l	hot and co	ia)						1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pei	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)				ī		
(44)m=	74.89	72.17	69.45	66.72	64	61.28	61.28	64	66.72	69.45	72.17	74.89		_
Energy	content of	^t hot water	used - ca	culated m	onthly = 4.	190 x Vd,r	m x nm x [	DTm / 3600			m(44) _{1 12} = ables 1b, 1		817	(44)
(45)m=	111.06	97.14	100.24	87.39	83.85	72.36	67.05	76.94	77.86	90.74	99.05	107.56		
								•		Total = Su	m(45) _{1 12} =	-	1071.22	(45)
lf instar	taneous w	vater heati	ng at point	t of use (no	o hot wate	r storage),	enter 0 in	boxes (46	) to (61)					
(46)m=	16.66	14.57	15.04	13.11	12.58	10.85	10.06	11.54	11.68	13.61	14.86	16.13		(46)
	storage		) includir		olor or M		otorogo	within or	mayaa				1	(47)
-							-	within sa	ame ves	sei		0		(47)
		•			velling, e			n (47) ombi boil	ore) onto	ar '∩' in <i>(</i>	47)			
	storage		not wate		iciuues i	nstantai			ers) ente		<i><b>-</b>77</i>			
	-		eclared l	oss fact	or is kno	wn (kWł	n/day):					0	]	(48)
Temp	erature f	actor fro	m Table	2b								0		(49)
			r storage		ear			(48) x (49	) =			0	]	(50)
-			-	•	loss fact	or is not						0	]	(00)
		-			le 2 (kW	h/litre/da	ay)					0	]	(51)
	-	-	see secti	on 4.3									1	
		from Ta		<b>0</b> h								0		(52)
			m Table									0	]	(53)
-			r storage	e, kWh/y	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter	(50) or	(54) in ( <del></del>	55)									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 contains	s dedicate	d solar sto	rage, (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	e 3		-	-				0	(58)
	•	•			month (	59)m = (	(58) ÷ 36	65 × (41)	m				
•	dified by	factor f	rom Tab	le H5 if t	here is s	olar wat	ter heati	ng and a	cylinde	r thermo	ostat)		
(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) ÷ 36	65 × (41	)m					_
(61)m=	38.16	33.22	35.39	32.9	32.61	30.22	31.23	32.61	32.9	35.39	35.59	38.16	(61
Total h	neat requ	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=	149.23	130.35	135.62	120.29	116.46	102.57	98.27	109.55	110.76	126.13	134.64	145.72	(62
										r contribut	tion to wate	er heating)	
•		· · · · · ·		r	NWHRS		· ·	I	<u>,</u>	1	,	1	1
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63
		ater hea	r										1
(64)m=	149.23	130.35	135.62	120.29	116.46	102.57	98.27	109.55	110.76	126.13	134.64	145.72	
	· •					- /					r (annual)₁		1479.61 (64)
-		· · · · · ·	<u> </u>		i	-	· ,	. ,		<u> </u>	+ (57)m	· ,	1
(65)m=	46.47	40.6	42.18	37.28	36.03	31.61	30.1	33.74	34.11	39.02	41.83	45.3	(65)
Incil	ide (57)	m in caid	culation	ot (65)m	only if c	yiinaer i	s in the d	aweiling	or not w	ater is ti	rom com	munitv r	leating
		• /			<b>\</b>			J				incincy i	
				5 and 5a	):			0				incinty i	
	olic gain	is (Table	e 5), Wat	ts		luna	I	-		I	1		1
Metab	olic gain Jan	s (Table Feb	e 5), Wat Mar	ts Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabo (66)m=	olic gain Jan 71.33	s (Table Feb 71.33	e 5), Wat Mar 71.33	ts Apr 71.33	May 71.33	71.33	Jul 71.33	Aug 71.33	Sep 71.33	I	1		(66)
Metabo (66)m= Lightin	olic gain Jan 71.33 g gains	rs (Table Feb 71.33 (calcula	5), Wat Mar 71.33 ted in Aj	ts Apr 71.33 opendix	May 71.33 L, equat	71.33 ion L9 o	Jul 71.33 r L9a), a	Aug 71.33 Iso see	Sep 71.33 Table 5	Oct 71.33	Nov 71.33	Dec 71.33	(66
Metabo (66)m= Lightin (67)m=	olic gain Jan 71.33 g gains 12.41	r (Table Feb 71.33 (calcula 11.02	e 5), Wat Mar 71.33 ted in Ap 8.97	ts Apr 71.33 opendix 6.79	May 71.33 L, equat 5.07	71.33 ion L9 oi 4.28	Jul 71.33 r L9a), a 4.63	Aug 71.33 Iso see 6.02	Sep 71.33 Table 5 8.07	Oct 71.33 10.25	Nov	Dec	
Metabo (66)m= Lightin (67)m= Applia	olic gain Jan 71.33 g gains 12.41 nces ga	s (Table Feb 71.33 (calcula 11.02 ins (calc	5), Wat Mar 71.33 ted in Aj 8.97 culated ir	ts Apr 71.33 opendix 6.79 n Append	May 71.33 L, equat 5.07 dix L, eq	71.33 ion L9 of 4.28 uation L	Jul 71.33 r L9a), a 4.63 13 or L1	Aug 71.33 Iso see 6.02 3a), also	Sep 71.33 Table 5 8.07 9 see Ta	Oct 71.33 10.25 ble 5	Nov 71.33 11.97	Dec 71.33 12.76	(66)
Metabo (66)m= Lightin (67)m= Applia (68)m=	olic gain Jan 71.33 Ig gains 12.41 nces ga 123.45	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73	5), Wat Mar 71.33 ted in Ap 8.97 ulated in 121.5	ts Apr 71.33 opendix 6.79 Append 114.63	May 71.33 L, equat 5.07 dix L, eq 105.96	71.33 ion L9 of 4.28 uation L 97.8	Jul 71.33 r L9a), a 4.63 13 or L1 92.35	Aug 71.33 Iso see 6.02 3a), also 91.07	Sep 71.33 Table 5 8.07 9 see Ta 94.3	Oct 71.33 10.25 ble 5 101.17	Nov 71.33	Dec 71.33	(66
Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir	olic gain Jan 71.33 Ig gains 12.41 Inces ga 123.45	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula	2 5), Wat Mar 71.33 ted in Ap 8.97 culated ir 121.5 ated in A	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat	71.33 ion L9 of 4.28 uation L 97.8 ion L15	Jul 71.33 r L9a), a 4.63 13 or L1 92.35 or L15a	Aug 71.33 Iso see 6.02 3a), also 91.07 ), also se	Sep 71.33 Table 5 8.07 9 see Ta 94.3 ee Table	Oct 71.33 10.25 ble 5 101.17 5	Nov 71.33 11.97 109.85	Dec 71.33 12.76 118	(66)
Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m=	olic gain Jan 71.33 g gains 12.41 nces ga 123.45 ng gains 30.13	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula 30.13	2 5), Wat Mar 71.33 ted in Ay 8.97 sulated in 121.5 ated in A 30.13	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13	May 71.33 L, equat 5.07 dix L, eq 105.96	71.33 ion L9 of 4.28 uation L 97.8	Jul 71.33 r L9a), a 4.63 13 or L1 92.35	Aug 71.33 Iso see 6.02 3a), also 91.07	Sep 71.33 Table 5 8.07 9 see Ta 94.3	Oct 71.33 10.25 ble 5 101.17	Nov 71.33 11.97	Dec 71.33 12.76	(66)
Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps	olic gain Jan 71.33 g gains 12.41 nces ga 123.45 ng gains 30.13	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula 30.13	2 5), Wat Mar 71.33 ted in Ap 8.97 culated ir 121.5 ated in A	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13	Jul 71.33 r L9a), a 4.63 13 or L1 92.35 or L15a	Aug 71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13	Sep 71.33 Table 5 8.07 9 see Ta 94.3 ee Table	Oct 71.33 10.25 ble 5 101.17 5 30.13	Nov 71.33 11.97 109.85 30.13	Dec 71.33 12.76 118 30.13	(66 (67 (68
Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m=	olic gain Jan 71.33 Ig gains 12.41 Inces ga 123.45 Ig gains 30.13 Is and fan 3	s (Table Feb 71.33 (calcula 11.02 ins (calcula 124.73 (calcula 30.13 ns gains 3	5), Wat Mar 71.33 ted in A 8.97 culated in 121.5 ated in A 30.13 (Table s 3	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13	Jul 71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13	Aug 71.33 Iso see 6.02 3a), also 91.07 ), also se	Sep 71.33 Table 5 8.07 94.3 94.3 ee Table 30.13	Oct 71.33 10.25 ble 5 101.17 5	Nov 71.33 11.97 109.85	Dec 71.33 12.76 118	(66)
Metabo (66)m= Lightin (67)m= Applian (68)m= Cookir (69)m= Pumps (70)m= Losses	olic gain Jan 71.33 ng gains 12.41 nces ga 123.45 ng gains 30.13 s and fan 3 s e.g. ev	IS (Table Feb 71.33 (calcula 11.02 ins (calcula 124.73 (calcula 30.13 ns gains 3 raporatic	5), Wat Mar 71.33 ted in Ap 8.97 ulated in 121.5 ated in A 30.13 (Table 9 3 on (nega	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3 tive valu	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13 3 es) (Tab	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13 3 le 5)	Jul 71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13 3	Aug 71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13 3	Sep 71.33 Table 5 8.07 94.3 94.3 ee Table 30.13	Oct 71.33 10.25 ble 5 101.17 5 30.13 3	Nov 71.33 11.97 109.85 30.13 3	Dec 71.33 12.76 118 30.13 3	(66 (67 (68
Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	olic gain Jan 71.33 g gains 12.41 nces ga 123.45 ng gains 30.13 s and fai 3 s e.g. ev -57.07	s (Table Feb 71.33 (calcula 11.02 ins (calc 124.73 (calcula 30.13 ns gains 3 raporatic -57.07	5), Wat Mar 71.33 ted in Ap 8.97 ulated in 121.5 ated in A 30.13 (Table 9 3 on (nega -57.07	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13	Jul 71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13	Aug 71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13	Sep 71.33 Table 5 8.07 94.3 94.3 ee Table 30.13	Oct 71.33 10.25 ble 5 101.17 5 30.13	Nov 71.33 11.97 109.85 30.13	Dec 71.33 12.76 118 30.13	(66 (67 (68 (69 (70)
Metabo (66)m= Lightin (67)m= Applia (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m=	olic gain Jan 71.33 g gains 12.41 nces ga 123.45 ng gains 30.13 s and fai 3 s e.g. ev -57.07	IS (Table Feb 71.33 (calcula 11.02 ins (calcula 124.73 (calcula 30.13 ns gains 3 raporatic	5), Wat Mar 71.33 ted in Ap 8.97 ulated in 121.5 ated in A 30.13 (Table 9 3 on (nega -57.07	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3 tive valu	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13 3 es) (Tab	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13 3 le 5)	Jul 71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13 3	Aug 71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13 3	Sep 71.33 Table 5 8.07 94.3 94.3 ee Table 30.13	Oct 71.33 10.25 ble 5 101.17 5 30.13 3	Nov 71.33 11.97 109.85 30.13 3	Dec 71.33 12.76 118 30.13 3	(66 (67 (68 (69 (70)
Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	olic gain Jan 71.33 ng gains 12.41 nces ga 123.45 ng gains 30.13 s and fan 3 s e.g. ev -57.07 heating 62.46	IS (Table Feb 71.33 (calcula 11.02 ins (calcula 124.73 (calcula 30.13 ns gains 3 raporatic -57.07 gains (T 60.42	5), Wat Mar 71.33 ted in Ap 8.97 ulated in 121.5 ated in A 30.13 (Table 8 3 on (nega -57.07 Table 5) 56.69	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3 tive valu -57.07	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13 3 es) (Tab -57.07	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13 3 le 5) -57.07 43.91	Jul 71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13 3 -57.07 40.46	Aug 71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13 3 -57.07 45.34	Sep 71.33 Table 5 8.07 94.3 94.3 ee Table 30.13 3 -57.07 47.38	Oct 71.33 10.25 ble 5 101.17 5 30.13 3 -57.07 52.44	Nov 71.33 11.97 109.85 30.13 3 -57.07	Dec 71.33 12.76 118 30.13 3 -57.07 60.89	(66) (67) (68) (69) (70) (71)
Metabo (66)m= Lightin (67)m= Appliat (68)m= Cookir (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	olic gain Jan 71.33 ng gains 12.41 nces ga 123.45 ng gains 30.13 s and fan 3 s e.g. ev -57.07 heating 62.46	s (Table Feb 71.33 (calcula 11.02 ins (calcula 124.73 (calcula 30.13 ns gains 3 raporatic -57.07 gains (T	5), Wat Mar 71.33 ted in Ap 8.97 ulated in 121.5 ated in A 30.13 (Table 8 3 on (nega -57.07 Table 5) 56.69	ts Apr 71.33 opendix 6.79 Appendix 114.63 ppendix 30.13 5a) 3 tive valu -57.07	May 71.33 L, equat 5.07 dix L, eq 105.96 L, equat 30.13 3 es) (Tab -57.07	71.33 ion L9 of 4.28 uation L 97.8 ion L15 30.13 3 le 5) -57.07 43.91	Jul 71.33 r L9a), a 4.63 13 or L1 92.35 or L15a 30.13 3 -57.07 40.46	Aug 71.33 Iso see 6.02 3a), also 91.07 ), also se 30.13 3 -57.07 45.34	Sep 71.33 Table 5 8.07 94.3 94.3 ee Table 30.13 3 -57.07 47.38	Oct 71.33 10.25 ble 5 101.17 5 30.13 3 -57.07 52.44	Nov 71.33 11.97 109.85 30.13 3 -57.07 58.1	Dec 71.33 12.76 118 30.13 3 -57.07 60.89	(66) (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	-	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	0.99	×	11.28	×	0.57	x	0.7	=	3.09	(75)
Northeast 0.9x	0.77	x	0.99	×	22.97	×	0.57	x	0.7	=	6.29	(75)
Northeast 0.9x	0.77	x	0.99	×	41.38	×	0.57	x	0.7	=	11.33	(75)
Northeast 0.9x	0.77	x	0.99	×	67.96	×	0.57	x	0.7	=	18.6	(75)
Northeast 0.9x	0.77	x	0.99	×	91.35	×	0.57	x	0.7	=	25.01	(75)
Northeast 0.9x	0.77	x	0.99	x	97.38	×	0.57	x	0.7	=	26.66	(75)
Northeast 0.9x	0.77	x	0.99	x	91.1	×	0.57	x	0.7	=	24.94	(75)
Northeast 0.9x	0.77	x	0.99	×	72.63	×	0.57	x	0.7	=	19.88	(75)
Northeast 0.9x	0.77	x	0.99	×	50.42	×	0.57	x	0.7	=	13.8	(75)
Northeast 0.9x	0.77	x	0.99	×	28.07	×	0.57	x	0.7	=	7.68	(75)
Northeast 0.9x	0.77	x	0.99	x	14.2	x	0.57	x	0.7	=	3.89	(75)
Northeast 0.9x	0.77	x	0.99	x	9.21	×	0.57	x	0.7	=	2.52	(75)
Southeast 0.9x	0.77	x	0.99	×	36.79	×	0.57	x	0.7	=	20.14	(77)
Southeast 0.9x	0.77	x	1.58	x	36.79	×	0.57	x	0.7	=	16.07	(77)
Southeast 0.9x	0.77	x	0.99	x	62.67	×	0.57	x	0.7	=	34.31	(77)
Southeast 0.9x	0.77	x	1.58	x	62.67	×	0.57	x	0.7	=	27.38	(77)
Southeast 0.9x	0.77	x	0.99	x	85.75	×	0.57	x	0.7	=	46.95	(77)
Southeast 0.9x	0.77	x	1.58	x	85.75	x	0.57	x	0.7	=	37.46	(77)
Southeast 0.9x	0.77	x	0.99	x	106.25	×	0.57	x	0.7	=	58.17	(77)
Southeast 0.9x	0.77	x	1.58	x	106.25	x	0.57	x	0.7	=	46.42	(77)
Southeast 0.9x	0.77	x	0.99	×	119.01	×	0.57	x	0.7	=	65.16	(77)
Southeast 0.9x	0.77	x	1.58	x	119.01	x	0.57	x	0.7	=	51.99	(77)
Southeast 0.9x	0.77	x	0.99	×	118.15	×	0.57	x	0.7	=	64.69	(77)
Southeast 0.9x	0.77	x	1.58	×	118.15	×	0.57	x	0.7	=	51.62	(77)
Southeast 0.9x	0.77	x	0.99	×	113.91	×	0.57	x	0.7	=	62.36	(77)
Southeast 0.9x	0.77	x	1.58	×	113.91	×	0.57	x	0.7	=	49.76	(77)
Southeast 0.9x	0.77	x	0.99	x	104.39	x	0.57	x	0.7	=	57.15	(77)
Southeast 0.9x	0.77	x	1.58	×	104.39	x	0.57	x	0.7	=	45.61	(77)
Southeast 0.9x	0.77	x	0.99	×	92.85	×	0.57	x	0.7	=	50.83	(77)
Southeast 0.9x	0.77	x	1.58	×	92.85	×	0.57	x	0.7	=	40.57	(77)
Southeast 0.9x	0.77	x	0.99	x	69.27	x	0.57	x	0.7	=	37.92	(77)
Southeast 0.9x	0.77	x	1.58	x	69.27	x	0.57	x	0.7	=	30.26	(77)
Southeast 0.9x	0.77	x	0.99	x	44.07	x	0.57	x	0.7	=	24.13	(77)
Southeast 0.9x	0.77	x	1.58	×	44.07	×	0.57	x	0.7	=	19.25	(77)
Southeast 0.9x	0.77	x	0.99	×	31.49	×	0.57	x	0.7	=	17.24	(77)
Southeast 0.9x	0.77	x	1.58	×	31.49	×	0.57	x	0.7	=	13.76	(77)

Solar g	ains in	watts, ca	alculated	for eac	h month		_	(83)m = S	um(74)m	(82)m			
(83)m=	39.31	67.98	95.74	123.19	142.16	142.96	137.07	122.64	105.2	75.87	47.27	33.52	(83)
Total g	ains – ii	nternal a	ind solar	(84)m =	= (73)m -	+ (83)m	, watts						
(84)m=	285.03	311.56	330.29	343.79	349.02	336.35	321.91	312.47	302.36	287.14	274.58	272.57	(84)

7. Me	an inter	nal temp	oerature	(heating	season	)								
		during h					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	ible 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.96	0.9	0.75	0.57	0.61	0.84	0.97	0.99	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=	19.94	20.07	20.27	20.54	20.79	20.95	20.99	20.99	20.9	20.59	20.22	19.92		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)	-	-			
(88)m=	20.01	20.02	20.02	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.03	20.02		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.99	0.98	0.95	0.86	0.66	0.45	0.49	0.77	0.95	0.99	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	eps 3 to 3	7 in Tabl	e 9c)				
(90)m=	18.61	18.79	19.09	19.49	19.82	20	20.04	20.04	19.95	19.56	19.03	18.58		(90)
									f	fLA = Livin	g area ÷ (4	4) =	0.62	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	19.43	19.58	19.82	20.14	20.42	20.58	20.62	20.62	20.53	20.2	19.76	19.41		(92)
Apply	adjustr	nent to t	he mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	19.28	19.43	19.67	19.99	20.27	20.43	20.47	20.47	20.38	20.05	19.61	19.26		(93)
8. Sp	8. Space heating requirement													
		mean int		•		ned at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
the ut	Jan	factor fo	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa		tor for g			iviay	Jun	Jui	Aug	Oep	001	NOV	Dec		
(94)m=	0.99	0.99	0.98	0.95	0.87	0.7	0.51	0.55	0.79	0.95	0.99	0.99		(94)
	L Il gains,	hmGm	W = (94	1)m x (84	L 4)m									
(95)m=	283.11	307.95	322.8	325.42	, 302.81	234.91	163.82	170.83	239.82	272.83	271.02	271.09		(95)
Month	nly aver	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 mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m	]				
(97)m=	661.57	640.12	578.93	481.97	371.5	250.16	166.11	174.17	270.69	409.77	545.15	658.85		(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=	281.58	223.22	190.56	112.72	51.1	0	0	0	0	101.88	197.38	288.49		
								Tota	l per year	(kWh/year	[.] ) = Sum(9	8) _{15,912} =	1446.94	(98)
Space	e heatin	g require	ement in	kWh/m ²	/year								35.5	(99)
9a. En	ergy reo	quiremer	nts – Indi	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heati	<b>ng:</b> bace hea	t from o	ocondar	visunnio	montory	evetom						0	(201)
		bace hea				mentary	-	(202) = 1	_ (201) =				0	(201)
		tal heati		-					02) × [1 –	(203)] =			1	(202)
			•	-						(/]				(204)
Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, %										90.3	(208)			
			'y suppi	chichtar	yncaun	y system	, /0						0	(200)

						i .							I <i></i>	
Snace	Jan	Feb	Mar	Apr alculate	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	281.58	223.22	190.56	112.72	51.1	0	0	0	0	101.88	197.38	288.49		
(211)m	ובבבים n = {[(98]	)m x (20	u 4)]}x1	ا 00 ÷ (20		<u> </u>			<u> </u>					(211)
( )	311.83	247.19	211.04	124.83	56.59	0	0	0	0	112.83	218.58	319.48		. ,
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	2	1602.37	(211)
•				y), kWh/	month									_
•••	ŕ	/	00 ÷ (20	r Ó		0		0	0	0	0			
(215)m=	0	0	0	0	0	0	0	-	-	u ar) =Sum(2	-	0	0	(215)
Water	heating								(,	,	- 7/15,10. 12	2	0	
	-		ter (calc	ulated a	bove)	-			-	-	-	-		
	149.23	130.35	135.62	120.29	116.46	102.57	98.27	109.55	110.76	126.13	134.64	145.72		_
	ncy of w		1	1						1			81	(216)
(217)m=		86.63	86.19	85.25	83.63	81	81	81	81	84.91	86.28	86.95		(217)
			kWh/mo ) ÷ (217)											
. ,	171.83	150.47	157.36	141.11	139.27	126.64	121.33	135.25	136.74	148.54	156.04	167.59		
								Tota	l = Sum(2	19a) ₁₁₂ =			1752.17	(219)
	l totals	<i>c</i> ,								k	Wh/year		kWh/year	7
	-			system	1								1602.37	ļ
Water	heating	fuel use	d										1752.17	
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t								
mech	anical v	entilatio	n - balar	nced, ext	ract or p	ositive i	nput fron	n outside	Э			69.51		(230a)
centra	al heatin	g pump	:									30		(230c)
Total e	electricity	for the	above, l	kWh/yea	ır			sum	of (230a)	(230g) =			99.51	(231)
Electric	city for li	ghting											219.2	(232)
Electric	city gene	erated b	y PVs										-1381.79	(233)
12a. (	CO2 em	issions -	– Individ	ual heat	ina svste	ems inclu	udina mi	cro-CHF	)					
							Ŭ					•••	- · ·	
							<b>ergy</b> /h/year			kg CO	<b>ion fac</b> 2/kWh	tor	Emissions kg CO2/yea	ar
Space	heating	(main s	ystem 1	)		(21	1) x			0.2	16	=	346.11	(261)
Space	heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
Water	heating					(219	9) x			0.2	16	=	378.47	(264)
Space	and wat	ter heati	ng			(26	1) + (262) ·	+ (263) + (	264) =	L			724.58	_ (265)
Electric	citv for p	umps, fa	ans and	electric	keep-ho	t (23 [.]	1) x			0.5	19	=	51.65	(267)
	city for li						2) x			0.5		=	113.76	(268)
Energy	•		ion tech	nologies	;	,					13		115.70	
Item 1														Lana
										0.5	19	=	-717.15	(269)

#### **Dwelling CO2 Emission Rate**

El rating (section 14)

(272) ÷ (4) =

4.24	(273)
97	(274)