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Planning Statement Energy Assessment Ellerdale Road: Single Basement Scheme

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Executive Summary Energy Assessment Ellerdale Road

About the Scheme:

The project consists of the new construction of a 2 storey dwelling at the rear of land at 1 Ellerdale Road in the London Borough of Camden, with one basement level and a small garden. The dwelling has a total Gross Internal Area of 154 m^2 .

Planning Policy

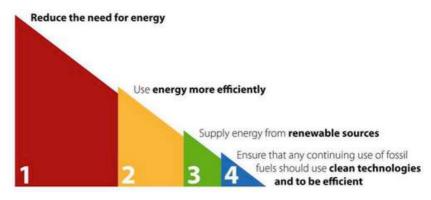
The scheme does not have to comply with the London Plan Policy based on the floor area, however the aspiration of the scheme is to achieve a 35% carbon reduction target (beyond Part L 2013) as set out in The London Plan Policy 5.2.

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) – The actual building CO₂ emissions rate (DER) is no greater than the notional building CO₂ target emissions rate.

The Energy Hierarchy:

The proposed scheme has followed the energy hierarchy that is illustrated below:



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)	2.51	2.46	-	1.44		
CO ₂ emissions saving (Tonnes CO ₂ /yr)	-	0.04	-	1.03		
Saving from each stage (%)	-	1.8	-	40.9		
Total CO ₂ emissions saving (Tonnes CO ₂ /yr)	1.07					

42.7% Total carbon emissions savings over Part L of the Building Regulations 2013 achieved

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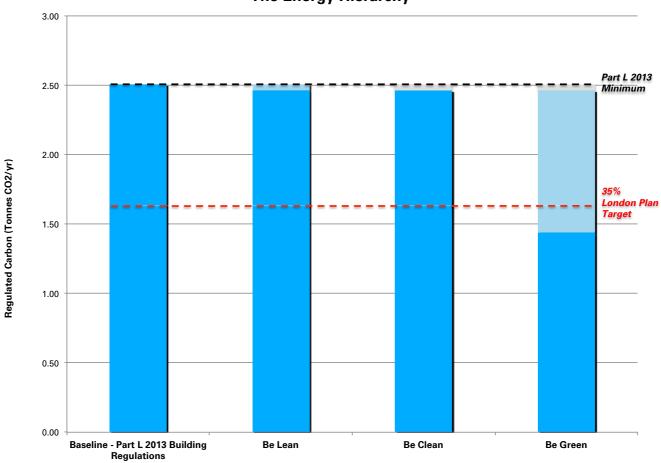
Executive Summary Energy Assessment Ellerdale Road

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 1.8% from the fabric energy efficiency measures described in the 'Be Lean' section, and will reduce total carbon emissions by 42.7% over Building Regulations with the further inclusion of low and zero carbon technologies (PV panels).

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Executive Summary

Energy Assessment Ellerdale Road

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	0.04	1.8%			
Savings from 'Be Clean-After CHP	0.00	0.0%			
Savings from 'Be Green-After renewable energy	1.03	40.9%			
Total Cumulative Savings	1.07	42.7%			
Total Target Savings	0.88	35%			
Annual Surplus	0.19				
	Annual Shortfall (Tonnes CO2/yr)	Cumulative Shortfall (Tonnes CO2)			
Shortfall	-	-			

Carbon offset contribution required: £0

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 Unregulated Total Emissions Emissions Emissions							
Baseline: Part L 2013	2.51	1.42	3.93				
Be Lean: After demand reduction	2.46	1.42	3.88				
Be Clean: After CHP	-	-	-				
Be Green: After Renewable energy	1.44	1.42	2.86				

Introduction Energy Assessment Ellerdale Road

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 in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the document "ENERGY PLANNING: Greater London Authority guidance on preparing energy assessments (April 2014)"

This report has followed these documents and comprises the following components:

- BASELINE: A calculation of the Part L 2013 Building Regulations complaint CO₂ emission baseline using approved software. The baseline assumes a gas boiler would provide heating and any active cooling would be electrically powered.
- LEAN: A calculation of the impact of demand reduction measures. For example, passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading, and active design measures such as high efficacy lighting and efficient mechanical ventilation with heat recovery.
- COOLING HIERARCHY: in accordance with Policy 5.9 of London Plan, measures that are proposed to reduce the demand for cooling have been set out such as minimisation of solar and internal gains and night cooling strategies.
- CLEAN: in accordance with Policy 5.6 of London Plan, this report has demonstrated how the scheme has selected heating, cooling and power systems to minimise carbon emissions. This comprises an evaluation of the feasibility of connecting to existing low carbon heat networks, planned networks, site-wide and communal 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 sitespecific 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 Ellerdale Road

Building Regulations Part L 2013 Minimum Compliance:

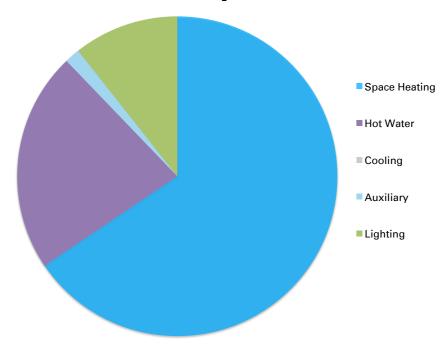
The 'baseline' carbon emissions for the development are 2.51 Tonnes CO₂/yr.

The pie chart below provides a breakdown of the scheme's baseline carbon emissions by system over the course of one year.

Carbon	Emissions	in	Tonnes
CO ₂ /yr			

Heating	Hot Water	Cooling	Auxiliary	Lighting
1.64	0.56	0.00	0.04	0.27

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.

'Be Lean': Demand Reduction Measures Energy Assessment

Ellerdale Road

Be Lean - Summary:

Demand reduction measures have reduced the scheme's carbon emissions by 1.8% over the minimum Part L 2013 Building Regulations baseline.

Site Layout Passive Design measures: The development is located at the rear of land at 1 Ellerdale Road and is protected by other developments on two sides. The compact shape of the dwelling means that the external area is minimised and consequently the heat losses through the building envelope are reduced. Windows (total glazing area is 27.4% of the external wall) are mainly placed towards the south (22.5%) to exploit the passive solar heat gains and reduce the heating demand. However, there are few openings that are placed towards the north (4.9%) in order to enable cross ventilation, resulting in more effective air change rate and reducing the overheating risk.

Building Fabric Passive Design measures:

Element	Minimum Building Regulations U-value	Proposed U-value
	W/m ² K	W/m²K
External Wall	0.30	0.18
Basement Wall	0.30	0.18
Ground Floor	0.25	0.11
Flat Roof	0.20	0.11
Glazing (window)	2.00	1.20
Glazing (rooflight)	2.00	1.20
Doors	2.00	1.20

Airtightness:

The target air permeability for the scheme 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.

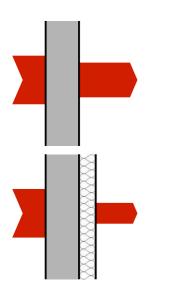
Services leakage occurs at penetrations from pipes and cables entering the building. These can be sewerage pipes, water pipes and heating pipes. As well as electricity cables there may also be telecommunication cables. Attention therefore, needs to be paid to sealing all penetrations during constriction.

Thermal Bridging:

The scheme has been indicatively modelled with the default thermal bridge y-values for all junction types, $0.15 \text{W/m}^2 \text{K}$.

Thermal Mass:

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

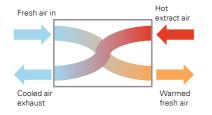


Graphic illustrations of the heat flow through a wall and how is it minimized with low uvalue (consequence of the additional insulation).



'Be Lean': Demand Reduction Measures Energy Assessment Ellerdale Road

Energy Efficient Services Active Design measures:



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

Heating:

Heating will be provided by a gas boiler, featuring time and temperature zone control by suitable arrangement of plumbing and electrical services, delayed thermostat and a weather compensator. The heat will be distributed via radiators. The gas boiler will have a minimum efficiency of 89.5%.

Ventilation:

Balanced mechanical ventilation with heat recovery (90% efficiency) will be provided to dwellings and wet rooms with a specific fan power of 0.52 W/l/s.

Air Conditioning

Cooling will be provided to the principle four rooms by split systems, the systems will have an energy label class of A.

Lighting:

All lightings of the development have been specified to be high efficient.

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'Be Clean': Heating Infrastructure & CHP

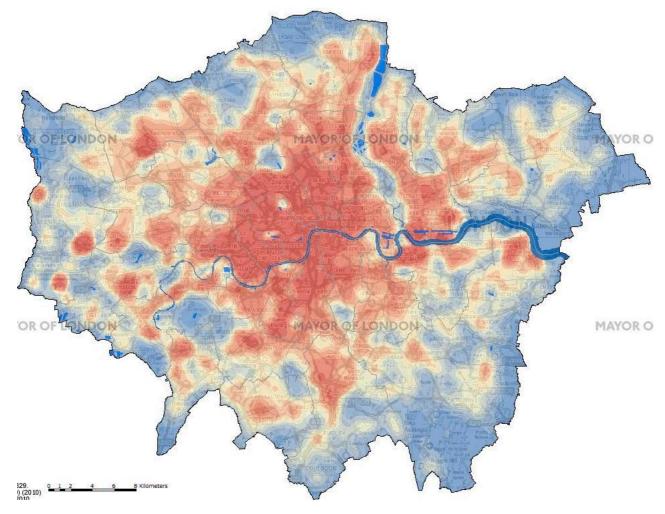
Energy Assessment Ellerdale Road

Heating Infrastructure including CHP:

Once demand for energy has been minimised, schemes must demonstrate how their energy systems have been selected in accordance with the order of preference in Policy 5.6B of London Plan. This has involved a systematic appraisal of the potential to connect to existing or planned heating networks and on site communal and CHP systems.

Heating Infrastructure:

The London Heat Map (shown below) has been consulted to establish the possibility of connecting to heating infrastructure.



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

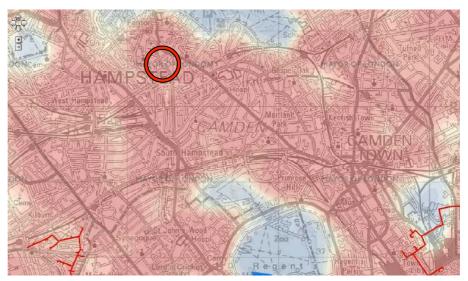
'Be Clean': Connection to Existing and Planned Networks

Energy Assessment Ellerdale Road

Existing and Planned Networks:

Existing networks:

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



Existing DH NetworksPotential DH Networks

There are no existing or potential networks within the vicinity of the scheme, therefore a connection is not possible.

'Be Clean': Site Wide Networks and CHP Energy Assessment Ellerdale Road

Site-wide Heat Networks:

In accordance with section 8.2 of the GLA guidance for Energy Planning, where it is demonstrable that a site wide network is not feasible then an individual heating strategy can be implemented. A site wide network will not be adopted because the dwellings on site will not have adequate density and local conditions are not favourable to centralised distribution. Therefore, it is considered that distribution losses would be relatively large and the effectiveness and carbon reducing potential would be undermined when compared to an individual servicing strategy.

Combined Heat and Power (CHP)

In accordance with section 8.3 of the GLA guidance for Energy Planning where connection to an area wide heat network will not be available in the foreseeable future i.e. 5 years following completion, or the development is of such a scale that it could be the catalyst for an area wide heat network, applicants should evaluate the feasibility of on-site CHP

GLA guidance stipulates that small, or purely residential developments of less than 350 dwellings will not be expected to include on-site CHP. CHP systems are best utilised where there is a consistent and high demand for heat. Because of the small electricity supplies and demand of this scheme, a CHP installed to meet the base heat load would typically require the export of electricity to the grid. The administrative burden of managing CHP electricity sales at a small scale without an active energy service companies (ESCOs) is prohibitive for smaller operators of residential developments.

The heat demand profile of this residential scheme is not suitable to CHP. The implemented fabric improvements from the 'Be Lean' scenario have also reduced the energy demand from space heating to hot water. For CHP systems to be economically viable they need to run for at least 5,000 hours per year. Therefore, a CHP system would most likely be oversized, and as a result less efficient and economic.

'Be Clean': Cooling Energy Assessment Ellerdale Road

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)
- 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:



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

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 lighting will also be specified (>45 lumens per circuit watt). LED lighting will be specified and a lumen per circuit watt figure of 9W/m² will be targeted.

'Be Clean': Cooling Energy Assessment Ellerdale Road

Avoiding Overheating Measures taken:

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 all methods controlling solar gain to within tolerable limits have been considered. The location, size, design and type of window openings and glazing have been optimised, and reduced solar gain factors from low emissivity windows with a g-value of 0.55 have been specified.
- Dark-coloured curtain/roller blinds will be specified to limit solar gain. The shading has also been optimised to avoid substantially reducing daylighting or increasing the requirement for electric lighting.

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

- Insulation levels have been maximised and the resulting u-values are lower than required by Building Regulations. The build-ups therefore prevent the penetration of heat as much as practically possible. See the 'Be Lean' section of this report for target u values.
- A reduced air permeability rate of 3 m³/(hr.m²) @ 50 pa has been targeted to minimise uncontrolled air infiltration. This will require attention to detailing and sealing. See 'Be Lean' section of this report for details of how this will be achieved.

Manage the heat within the building through thermal mass, room height and green roofs.

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

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



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

'Be Clean': Cooling Energy Assessment Ellerdale Road

Avoiding Overheating Measures taken:

- Room heights high ceilings are traditionally used in hot climates to allow thermal stratification so that occupants can inhabit the lower cooler space, and to decrease the transfer of heat gain through the roof. The existing building has floor to ceiling heights of approximately 2.8m. As the roof will be well insulated to achieve a U-value of 0.11 W/m²K, there will be minimal penetration of heat through the roof.
- Green roofs a green roof has been specified for the scheme. This will
 act as an insulation barrier and the ecological processes will reduce the
 amount of solar energy absorbed by the roof membrane, so will reduce
 temperatures below the surface and cool the building areas directly
 below.



Typical building section demonstrating passive cross ventilation.

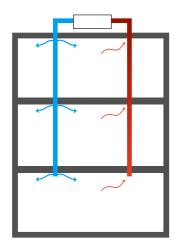
4) Passive ventilation

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

> Openable windows are specified on the two main external facades of the building. Cross ventilation will be achieved by opening windows on two facades and ensuring there is a clear path for airflow.

'Be Clean': Cooling Energy Assessment Ellerdale Road

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.
- Fan powered ventilation: single point extracts will be used in WCs and kitchen. 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:
 - ✓ Specific fan power of 0.52 W/l/s for whole ventilation systems with heat recovery
 - ✓ Heat recovery efficiency of 90%

Overheating Risk:

The overheating risk considering all the above strategies, described passive measures, has been assessed for the development and is presented in the table below:

Dwellings	Overheating risk according to SAP
1 Ellerdale Road	Slight

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

'Be Clean': Cooling Energy Assessment Ellerdale Road

Efficiency Measures taken:

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

Passive design measures and the use of natural and mechanical ventilation result in slightly overheating risk. In order to guarantee the occupant's comfort, an air conditioning system has been specified for. Following the methodology of the cooling hierarchy has significantly reduced the demand for cooling.

The monthly cooling requirements of the dwelling are presented in the table below.

	Monthly Cooling Requirement (kWh/m²/year)					
Dwellings	June	July	August	Annual		
1 Ellerdale Road	0.92	1.11	0.88	2.91		

To ensure the cooling system is the most carbon efficient possible the following parameters have been selected:

- Location: Indoor cooling units have been specified on a localised basis where internal gains are too high. The units will be fully fitted with local temperature controls for optimal usage.
- The location of the outdoor units that 'dump' the heat has been carefully
 considered so as not to cause problems for people and the environment,
 and not to add to the urban heat island effect. They will be located on the
 roof space and will allow adequate air movement around the condensing
 units, this will ensure maximum operating efficiency and will limit the
 impacts of dumped heat on people and the environment.
- The AC systems will have the following efficiencies which are in compliance with the Domestic Building Services Compliance Guide:
 - Energy label class of A.

'Be Green': Renewable Energy

Energy Assessment Ellerdale Road

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 have also been provided for renewable energy technologies for the feasible options.

Renewable Energy Technology Comparison:

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:

✓ ✓ ✓ ✓ ✓ = 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)
 - o Local planning criteria = 🗸 🗸
 - o Land used by all components = ✓
 - o Noise impact from operation = ✓
- Suitability and design impact: (Maximum score of 4)
 - o Interaction on the current building design = 🗸
 - o Building orientation suitability =
 - o Buildability of installation = ✓
- Economic viability: (Maximum score of 5)
 - o Capital cost of all components = ✔ ✔
 - o Grants and funding available = ✔
 - o Payback periods (years) 3-5, 5-10, 10-15 = ✓ ✓ ✓
- Operation and maintenance: (Maximum score of 3)
 - o Servicing requirements (low or high) = ✓
 - o Maintenance costs (low or high) =
 - o Resource use from future maintenance (low or high) = ✔
- CO₂ and sustainability: (Maximum score of 10)
 - o Carbon saving per year = V V V V
 - o Impact of future grid decarbonisation (gas vs. electric) = 🗸 🗸
 - o Local air quality/pollution = ✓ ✓
 - o Resource use of installation = ✓ ✓

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 technology is undertaken on the following pages.

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

'Be Green': Renewable Energy Energy Assessment Ellerdale Road

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. In order to meet the 35% CO_2 emissions reduction a biomass boiler would need to be installed. The likely installed cost would be circa £15,000. The additional cost of providing and storing the bio-fuel also needs to be accounted for. The site is likely to be unsuitable for biomass boilers due to site constraints such as limited transport/access issues, and storage of the biomass fuel. A detailed feasibility study will be required to investigate the suitability.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO ₂ and sustainability
Biomass Boiler	V V V V	///	VVV V	V V V	V V V V V V V V V V V V V V V V V V V
	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 8 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 Ellerdale Road

Photovoltaic (PV):

Accepted



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

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

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

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

The most suitable location for mounting photovoltaic panels is on roofs as they usually have the greatest exposure to the sun. The proposed site has a potential useable roof area of approximately 65 m² and is orientated southwest.

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, 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 wiring and metering.	Increased capital costs of installation, typical payback of 8 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 Ellerdale Road

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 proposed site has a potential useable roof area of approximately 65 m² and is orientated southwest.

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	V V V V	/// /	/// //	V V V	V V V V V
	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 Assessment

Energy Assessment Ellerdale Road

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 CO₂ emissions reduction target approximately 1 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 CO₂ emissions reduction would cost approximately £3,000.

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	CO₂ and sustainability
Wind Energy	No local air quality impacts, use of unutilised roof space, conservation officer will have concerns for the site, minor noise issues.	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, low embodied energy of panels.

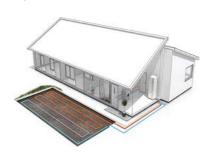


'Be Green': Renewable Energy

Energy Assessment Ellerdale Road

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 £16,000-20,000 for a smaller commercial or domestic size installation, with general installation costs at £1200 /kW of energy produced.

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



'Be Green': Renewable Energy Energy Assessment Ellerdale Road

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°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 £10,000 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 Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO₂ and sustainability
ASHP	No local air quality impacts, conservation officer may have minor concerns over visual impact, no noise issues.	Can be added to the roof, good airflow 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 Ellerdale Road

Summary Comparison Matrix:

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

Renewable Technology	Local, site- specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO₂ and sustainability	Total Score
Biomass Boiler	V V V V	VVV	VVV V	V V V	V V V V V	15 out of 26
Photovoltaic	V V V	VVV	<i>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</i>	V V V	V V V V V	17 out of 26
Solar Thermal	VV V	V V V V	<i>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</i>	VVV	V V V V V	16 out of 26
Wind Energy	V V V V	VV V	VVVV	VVV	V V V V V	17 out of 26
GSHP	VVV	V V V V	V V V V V	V V V	VVVVV VVVVV	15 out of 26
ASHP	VV VV	V V V V	V V V V	V V V	V V V V V	15 out of 26

Renewable Technology Conclusion & Specification:

Photovoltaic panels and wind energy 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. Therefore, photovoltaic panels in combination have been considered to be the optimum balance of sustainable and economic objectives.

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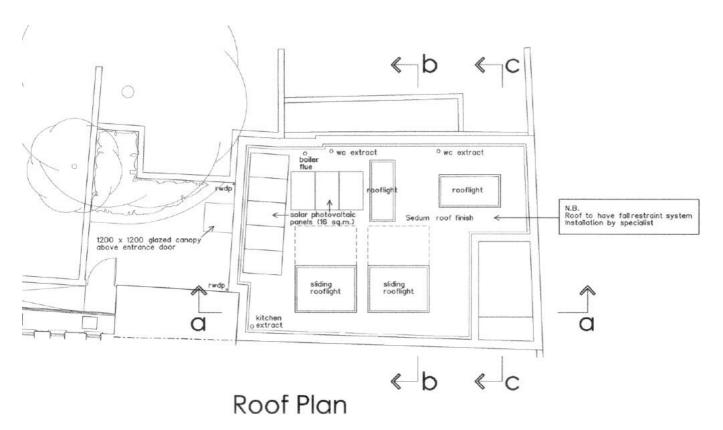
'Be Green': Photovoltaic Energy Assessment Ellerdale Road

Summary:

A photovoltaic panel system of 2.6 kWp has been specified (approximately 8 high efficient photovoltaic panels) for the development and detailed summary of the lifecycle cost, revenue and payback for the photovoltaic panels is presented in this section.

Location:

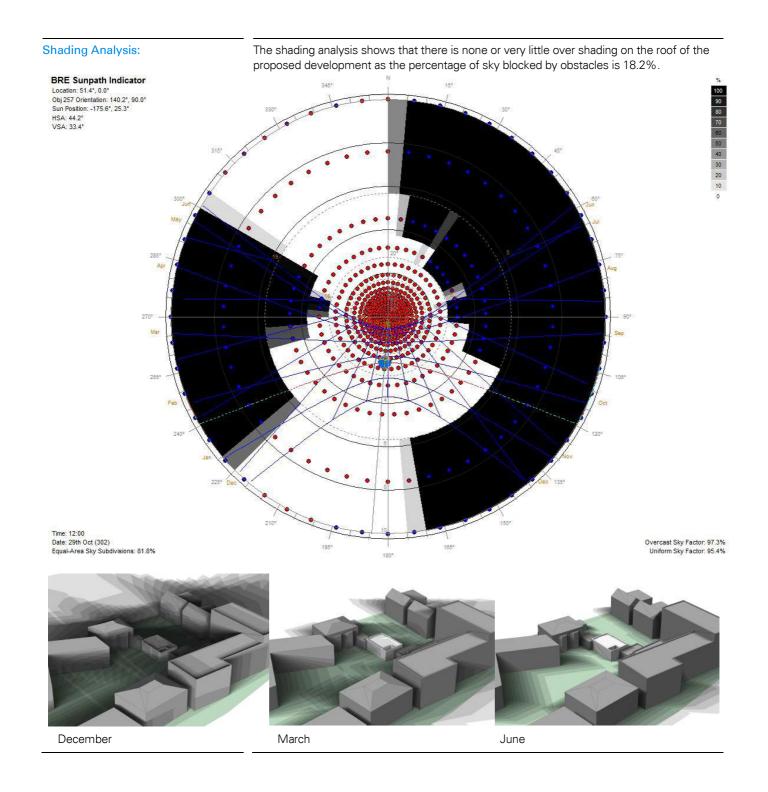
The following drawing shows that there is 65m^2 of available roof that could be used to install photovoltaic modules and lack of shading. PV panels will be oriented southwest, placed horizontal, covering 16m^2 of the roof.



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'Be Green': Photovoltaic

Energy Assessment Ellerdale Road



'Be Green': Photovoltaic

Energy Assessment Ellerdale Road

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 = £5,200
- Maintenance Cost = £1,500
- Operation Cost = £900 (replacement inverters etc.)
- Total Costs = £7,600

Revenue and Payback Parameters:

- The cost of electricity to be displaced is 12p/kWh.
- The 2.6kWp system is estimated to generate 1,977 kWh/yr. Based on the assumption that 50% of the electricity will be used on site, an offset saving of £119/yr will be achieved.
- With the current Feed in Tariff, a tariff of 14.77p/kWh will be received for generation, and 4.77p/kWh will be received for export, which gives an additional saving of £339 per year.

Summary Performance Calculations:

The following tables summarise the reduction in carbon emissions and the life cycle cost of the photovoltaic system.

Energy and Carbon Performance Criteria	Value
Predicted Annual Energy Saved (kWh/yr)	1,977
Annual Carbon Emissions Reductions (kg CO ₂ /year)	1,026
CO ₂ Emissions Reduction (%)	40.9

Cost Performance Criteria	Value
Total Cost Over Life Cycle (£)	7,600
Predicted Annual Savings (£)	458
Payback Period (yeas)	16.6



Conclusion Energy Assessment Ellerdale Road

Summary

The baseline carbon emissions for the scheme are 2.51 Tonnes CO₂/yr.

As demonstrated, the development will reduce carbon emissions by 1.8% from the fabric energy efficiency measures described in the "Be Lean" section, and will reduce total carbon emissions by 42.7% over Building Regulations with the further inclusion of low and zero carbon technologies.

GLA's Energ	y Hierarchy – Reg	ulated Carbon Emiss	sions	
	Baseline:	Be Lean:	Be Clean:	Be Green:
CO ₂ emissions (Tonnes CO ₂ /yr)	2.51	2.46	-	1.44
CO ₂ emissions saving (Tonnes CO ₂ /yr)	-	0.04	-	1.03
Saving from each stage (%)	-	1.8	-	40.9
Total CO ₂ emissions saving (Tonnes CO ₂ /yr)		1.	.07	ı

42.7% Total carbon emissions savings over Part L of the Building Regulations 2013 achieved

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Appendix Energy Assessment Ellerdale Road

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 – TER from the Lean SAP TER Worksheets.

Lean – DER from the Lean SAP DER Worksheets.

Clean - There in no CHP scenario.

Green - DER from the Green SAP DER Worksheets.

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Appendix Energy Assessment Ellerdale Road

Baseline Scenario

User Details: **Assessor Name:** Stroma Number: **Software Version: Software Name:** Stroma FSAP 2012 Version: 1.0.1.25 Property Address: House 1-LEAN 1 Ellerdale Road Address: 1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³) **Basement** (1a) x 2.6 (2a) =174.2 (3a) 67 Ground floor (2b) (1b) x (3b) 87.44 3 262.32 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)154.44 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n)(5) 436.52 2. Ventilation rate: main secondary other total m³ per hour heating heating Number of chimneys x 40 =(6a) 0 0 0 0 0 x 20 =Number of open flues 0 0 0 0 0 (6b) Number of intermittent fans x 10 =(7a)40 4 Number of passive vents x 10 =(7b) 0 0 Number of flueless gas fires x 40 =(7c) 0 0 Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = \div (5) = 0.09 (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) (9)0 Additional infiltration [(9)-1]x0.1 =(10)0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 (12)0 If no draught lobby, enter 0.05, else enter 0 0 (13)Percentage of windows and doors draught stripped (14)0 $0.25 - [0.2 \times (14) \div 100] =$ Window infiltration 0 (15)(8) + (10) + (11) + (12) + (13) + (15) =Infiltration rate 0 (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise (18) = (16)0.34 (18)Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered (19)Shelter factor $(20) = 1 - [0.075 \times (19)] =$ 0.85 (20)Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ (21)0.29 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

4

4.3

4.5

4.7

4.9

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5

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Windows Type 4 7.75 $x1/[1/(1.4) + 0.04] = 10.27$ Windows Type 5 3.68 $x1/[1/(1.4) + 0.04] = 4.88$ Windows Type 6 3.97 $x1/[1/(1.4) + 0.04] = 5.26$ Rooflights Type 1 2.009708 $x1/[1/(1.7) + 0.04] = 3.416503$ Rooflights Type 2 2.009708 $x1/[1/(1.7) + 0.04] = 4.933431$ Floor 87.44 $x 0.13$ $x 1/[1/(1.7) + 0.04] = 11.3672$ Walls Type 1 81.4 0 81.4 $x 0.18$ $x 0.18$ $x 0.18$	indows Typ	e 2				4.25	x1.	/[1/(1.4)+	0.04] =	5.63				(27
Windows Type 5 3.68 x1/[1/(1.4) + 0.04] = 4.88 Windows Type 6 3.97 x1/[1/(1.4) + 0.04] = 5.26 Rooflights Type 1 2.009708 x1/[1/(1.7) + 0.04] = 3.416503 Rooflights Type 2 2.009708 x1/[1/(1.7) + 0.04] = 4.933431 Floor 87.44 x 0.13 = 11.3672 Walls Type 1 81.4 0 81.4 x 0.18 = 14.65	indows Typ	e 3				6.8	х1.	/[1/(1.4)+	0.04] =	9.02				(27
Windows Type 6 3.97 x1/[1/(1.4) + 0.04] = 5.26 Rooflights Type 1 2.009708 x1/[1/(1.7) + 0.04] = 3.416503 Rooflights Type 2 2.009708 x1/[1/(1.7) + 0.04] = 3.416503 Rooflights Type 3 2.902018 x1/[1/(1.7) + 0.04] = 4.933431 Floor 87.44 x 0.13 = 11.3672 Walls Type 1 81.4 0 81.4 x 0.18 = 14.65	indows Typ	e 4				7.75	х1.	/[1/(1.4)+	0.04] =	10.27				(27
Rooflights Type 1 2.009708 x1/[1/(1.7) + 0.04] = 3.416503 Rooflights Type 2 2.009708 x1/[1/(1.7) + 0.04] = 3.416503 Rooflights Type 3 2.902018 x1/[1/(1.7) + 0.04] = 4.933431 Floor 87.44 x 0.13 = 11.3672 Walls Type 1 81.4 0 81.4 x 0.18 = 14.65	indows Typ	e 5				3.68	x1.	/[1/(1.4)+	0.04] =	4.88				(27
Rooflights Type 2 2.009708 x1/[1/(1.7) + 0.04] = 3.416503 Rooflights Type 3 2.902018 x1/[1/(1.7) + 0.04] = 4.933431 Floor 87.44 x 0.13 = 11.3672 Walls Type 1 81.4 0 81.4 x 0.18 = 14.65	indows Typ	e 6				3.97	x1.	/[1/(1.4)+	0.04] =	5.26				(27
Rooflights Type 3 2.902018 x1/[1/(1.7) + 0.04] = 4.933431 Floor 87.44 x 0.13 = 11.3672 Walls Type 1 81.4 0 81.4 x 0.18 = 14.65	ooflights Ty	pe 1				2.0097	08 x1	/[1/(1.7) +	0.04] =	3.41650	3			(27
Floor 87.44 × 0.13 = 11.3672	ooflights Ty	pe 2				2.0097	08 x1	/[1/(1.7) +	0.04] =	3.41650	3			(27
Walls Type1 81.4 0 81.4 x 0.18 = 14.65	oflights Ty	ре 3				2.9020	18 x1	/[1/(1.7) +	0.04] =	4.93343	1			(27
	oor					87.44	1 x	0.13	=	11.3672	<u></u>		\neg \vdash	(28
	alls Type1	81.	4	0		81.4	x	0.18		14.65	٦ i		-	(29
Walls Type2 122.79 28.78 94.01 x 0.18 = 16.92	alls Type2				8		=				≓ i		-	(29
Roof 87.44 9.82 77.62 × 0.13 = 10.09					=		=				=		7 7	(30
Fotal area of elements, m ² 379.07		L		0.02			=	<u> </u>						(3
Party wall 12.41 × 0 = 0			•			575.0	<u>:</u>							(32

(26) (30) + (32) =

Fabric heat loss, $W/K = S (A \times U)$

106.25

(33)

Heat capacity Cm = So	(Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	45878.65	(34)
Thermal mass parame	•	P = Cm -	: TFA) ir	n kJ/m²K			Indica	tive Value:	Medium	, ,	250	(35)
For design assessments wh	•		,			ecisely the				able 1f	200	(00)
can be used instead of a de	tailed calc	ulation.										
Thermal bridges : S (L	x Y) cal	culated (using Ap	pendix I	K						18.95	(36)
if details of thermal bridging	are not kn	own (36) =	= 0.15 x (3	1)								
Total fabric heat loss							(33) +	, ,			125.2	(37)
Ventilation heat loss ca		monthly	У	<u> </u>	1	1	` '	= 0.33 × (25)m x (5)	1	7	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 81.9 81.52	81.14	79.37	79.04	77.51	77.51	77.22	78.1	79.04	79.71	80.41		(38)
Heat transfer coefficier	nt, W/K						(39)m	= (37) + (3	38)m		_	
(39)m= 207.1 206.72	206.34	204.58	204.25	202.71	202.71	202.43	203.3	204.25	204.92	205.61		
Heat loss parameter (I	HLP), W/	/m²K						Average = = (39)m ÷		12 /12=	204.58	(39)
(40)m= 1.34 1.34	1.34	1.32	1.32	1.31	1.31	1.31	1.32	1.32	1.33	1.33		
L !		!		Į.				Average =	Sum(40) ₁	12 /12=	1.32	(40)
Number of days 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. Water heating ene	rgy requi	irement:								kWh/y	ear:	
0												
Assumed occupancy, if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was	+ 1.76 x ater usaç	ge in litre	es per da	y Vd,av	erage =	(25 x N)	+ 36		9)	94 4.05]	(42)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1	+ 1.76 x ater usag hot water	ge in litre	es per da 5% if the o	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		9)]	, ,
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average	+ 1.76 x ater usag hot water	ge in litre	es per da 5% if the o	ay Vd,av Iwelling is	erage = designed	(25 x N) to achieve	+ 36 a water us		9)]	, ,
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per	+ 1.76 x ater usag hot water person per	ge in litre usage by rday (all w	es per da 5% if the d vater use, I	y Vd,av welling is not and co	erage = designed i ld)	(25 x N) to achieve	+ 36	se ta <u>rget o</u> i	9)	4.05]	, ,
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per	+ 1.76 x ater usag hot water person per	ge in litre usage by rday (all w	es per da 5% if the d vater use, I	y Vd,av welling is not and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se ta <u>rget o</u> i	9)	4.05]	, ,
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29	+ 1.76 x ater usage hot water person per Mar r day for ea	ge in litre usage by a r day (all w Apr Apr ach month	es per da 5% if the day vater use, I May Vd,m = fac 97.8	y Vd,av lwelling is not and co Jun ctor from 1	erage = designed and designed a	(25 x N) to achieve Aug (43) 97.8	+ 36 a water us Sep	Oct 106.13 Fotal = Sui	Nov 110.29 m(44) _{1 12} =	4.05 Dec 114.45	1248.56	, ,
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per	+ 1.76 x ater usage hot water person per Mar r day for ea	ge in litre usage by a r day (all w Apr Apr ach month	es per da 5% if the day vater use, I May Vd,m = fac 97.8	y Vd,av lwelling is not and co Jun ctor from 1	erage = designed and designed a	(25 x N) to achieve Aug (43) 97.8	+ 36 a water us Sep	Oct 106.13 Fotal = Sui	Nov 110.29 m(44) _{1 12} =	4.05 Dec 114.45	1248.56	(43)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29	+ 1.76 x ater usage hot water person per Mar r day for ea	ge in litre usage by a r day (all w Apr Apr ach month	es per da 5% if the day vater use, I May Vd,m = fac 97.8	y Vd,av lwelling is not and co Jun ctor from 1	erage = designed and designed a	(25 x N) to achieve Aug (43) 97.8	+ 36 a water us Sep	Oct 106.13 Fotal = Sui	Nov 110.29 m(44) _{1 12} =	4.05 Dec 114.45	1248.56	(43)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water	+ 1.76 x ater usage hot water person per Mar r day for ear 106.13 used - call 153.18	ge in litre usage by r day (all w Apr ach month 101.97 culated me 133.55	es per da 5% if the orater use, I May Vd,m = far 97.8 onthly = 4.	Jun ctor from 1 93.64	erage = designed and designed a	(25 x N) to achieve Aug (43) 97.8 97.7 117.58	+ 36 a water us Sep 101.97 0 kWh/mon 118.99	Oct 106.13 Fotal = Suith (see Ta	Nov 110.29 m(44) _{1 12} = 15bles 1b, 1 151.37	4.05 Dec 114.45 c, 1d) 164.37	1248.56	(43)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water (45)m= 169.73 148.45	+ 1.76 x ater usage hot water person per Mar r day for ear 106.13 used - call 153.18	Apr ach month 101.97 culated me 133.55	es per da 5% if the orater use, I May Vd,m = far 97.8 onthly = 4.	y Vd,av Iwelling is not and co Jun ctor from 7 93.64 190 x Vd,r 110.58	erage = designed and dolor dol	(25 x N) to achieve Aug (43) 97.8 07m / 3600 117.58 boxes (46)	+ 36 a water us Sep 101.97 0 kWh/more 118.99	Oct 106.13 Fotal = Sun 138.67 Fotal = Sun	Nov 110.29 m(44) _{1 12} = 151.37 m(45) _{1 12} =	4.05 Dec 114.45 c, 1d) 164.37]	(43)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water (45)m= 169.73 148.45	+ 1.76 x ater usage hot water person per Mar r day for ear 106.13 used - call 153.18	ge in litre usage by r day (all w Apr ach month 101.97 culated me 133.55	es per da 5% if the orater use, I May Vd,m = far 97.8 onthly = 4.	Jun ctor from 1 93.64	erage = designed and designed a	(25 x N) to achieve Aug (43) 97.8 97.7 117.58	+ 36 a water us Sep 101.97 0 kWh/mon 118.99	Oct 106.13 Fotal = Sur th (see Ta	Nov 110.29 m(44) _{1 12} = 15bles 1b, 1 151.37	4.05 Dec 114.45 c, 1d) 164.37]	(43)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water (45)m= 169.73 148.45 If instantaneous water heatif (46)m= 25.46 22.27	+ 1.76 x ater usage hot water person per Mar r day for each 106.13 used - calconding at point 22.98	ge in litre usage by a day (all we have month) 101.97 culated month 133.55 for use (not) 20.03	es per da 5% if the orater use, I May Vd,m = far 97.8	y Vd,av lwelling is not and co Jun ctor from 1 93.64 190 x Vd,r 110.58	erage = designed and dolor dol	(25 x N) to achieve Aug (43) 97.8 07m / 3600 117.58 boxes (46) 17.64	+ 36 a water us Sep 101.97 118.99 1 to (61) 17.85	Oct 106.13 Total = Sur 138.67 Total = Sur 20.8	Nov 110.29 m(44) _{1 12} = 15les 1b, 1 151.37 m(45) _{1 12} = 22.7	4.05 Dec 114.45 c, 1d) 164.37]	(43)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water (45)m= 169.73 148.45 If instantaneous water heatif (46)m= 25.46 22.27 Water storage loss:	ter usage hot water person per Mar 106.13 used - calconding at point 22.98 including the same services at the sa	Apr Apr ach month 101.97 culated me 133.55 for use (no	es per da 5% if the orater use, I May Vd,m = far 97.8 onthly = 4. 128.14 o hot water 19.22 olar or W	y Vd,av lwelling is not and co Jun ctor from 1 93.64 190 x Vd,r 110.58 storage),	erage = designed and designed a	(25 x N) to achieve Aug (43) 97.8 07m / 3600 117.58 boxes (46) 17.64 within sa	+ 36 a water us Sep 101.97 118.99 1 to (61) 17.85	Oct 106.13 Total = Sur 138.67 Total = Sur 20.8	Nov 110.29 m(44) _{1 12} = 15les 1b, 1 151.37 m(45) _{1 12} = 22.7	4.05 Dec 114.45 = c, 1d) 164.37 = 24.66]	(43) (44) (45) (46)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water (45)m= 169.73 148.45 If instantaneous water heati (46)m= 25.46 22.27 Water storage loss: Storage volume (litres) If community heating a Otherwise if no stored	+ 1.76 x ater usage hot water person per Mar 106.13 used - calconding at point 22.98 including and no talconding at point at p	ge in litre usage by day (all w Apr ach month 101.97 culated mo 133.55 for use (no 20.03 and any so ank in dw	es per da 5% if the of water use, I May Vd,m = factor 97.8 128.14 19.22 plar or Water velling, e	Jun ctor from 1 93.64 190 x Vd,r 110.58 storage),	erage = designed ind) Jul Table 1c x 93.64 m x nm x E 102.47 enter 0 in 15.37 storage litres in	(25 x N) to achieve Aug (43) 97.8 07m / 3600 117.58 boxes (46) 17.64 within sa (47)	+ 36 a water us Sep 101.97 118.99 10 (61) 17.85 American	Oct 106.13 Total = Sur 138.67 Total = Sur 20.8	Nov 110.29 m(44) _{1 12} = bles 1b, 1 151.37 m(45) _{1 12} = 22.7	4.05 Dec 114.45 = c, 1d) 164.37 = 24.66]	(43) (44) (45) (46)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot was Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water (45)m= 169.73 148.45 If instantaneous water heatif (46)m= 25.46 22.27 Water storage loss: Storage volume (litres) If community heating a Otherwise if no stored Water storage loss:	ter usage hot water person per Mar 106.13 used - calcal 153.18 ng at point 22.98 including and no talcal hot water hot water person per water hot water h	Apr Apr ach month 101.97 culated me 133.55 for use (not) 20.03 and any so ank in dw er (this in	es per da 5% if the o rater use, I May Vd,m = fac 97.8 128.14 19.22 Dlar or W relling, e acludes i	Jun ctor from 1 93.64 190 x Vd,r 110.58 16.59 /WHRS nter 110	erage = designed and designed a	(25 x N) to achieve Aug (43) 97.8 07m / 3600 117.58 boxes (46) 17.64 within sa (47)	+ 36 a water us Sep 101.97 118.99 10 (61) 17.85 American	Oct 106.13 Total = Sur 138.67 Total = Sur 20.8	Nov 110.29 m(44) _{1 12} = bles 1b, 1 151.37 m(45) _{1 12} = 22.7	4.05 Dec 114.45 c, 1d) 164.37 24.66]	(43) (44) (45) (46) (47)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water (45)m= 169.73 148.45 If instantaneous water heati (46)m= 25.46 22.27 Water storage loss: Storage volume (litres) If community heating a Otherwise if no stored Water storage loss: a) If manufacturer's de	+ 1.76 x ater usage hot water person per Mar r day for ear 106.13 used - call 153.18 and at point 22.98 including and no tall hot water eclared less than 1.76 x	Apr ach month 101.97 culated mo 133.55 of use (no 20.03 and any so ank in dw er (this in	es per da 5% if the o rater use, I May Vd,m = fac 97.8 128.14 19.22 Dlar or W relling, e acludes i	Jun ctor from 1 93.64 190 x Vd,r 110.58 16.59 /WHRS nter 110	erage = designed and designed a	(25 x N) to achieve Aug (43) 97.8 07m / 3600 117.58 boxes (46) 17.64 within sa (47)	+ 36 a water us Sep 101.97 118.99 10 (61) 17.85 American	Oct 106.13 Total = Sur 138.67 Total = Sur 20.8	Nov 110.29 m(44) _{1 12} = bles 1b, 1 151.37 m(45) _{1 12} = 22.7	4.05 Dec 114.45 = c, 1d) 164.37 = 24.66]	(43) (44) (45) (46) (47)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water (45)m= 169.73 148.45 If instantaneous water heati (46)m= 25.46 22.27 Water storage loss: Storage volume (litres) If community heating a Otherwise if no stored Water storage loss: a) If manufacturer's de Temperature factor from	ter usage hot water person per Mar 106.13 used - calconding at point 22.98 including and no talconding the water hot water person per Mar 22.98 including at point and no talconding the water person per Mar 106.13	Apr ach month 101.97 culated mo 133.55 for use (no 20.03 and in dw er (this in	es per da 5% if the of	Jun ctor from 1 93.64 190 x Vd,r 110.58 16.59 /WHRS nter 110	erage = designed in designed i	(25 x N) to achieve Aug (43) 97.8 07m / 3600 117.58 boxes (46) 17.64 within sa (47) ombi boil	+ 36 a water us Sep 101.97 118.99 10 (61) 17.85 ame vess ers) enter	Oct 106.13 Total = Sur 138.67 Total = Sur 20.8	Nov 110.29 m(44) _{1 12} = 151.37 m(45) _{1 12} = 22.7	4.05 Dec 114.45 c, 1d) 164.37 24.66]	(43) (44) (45) (46) (47) (48) (49)
if TFA > 13.9, N = 1 if TFA £ 13.9, N = 1 Annual average hot wa Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 114.45 110.29 Energy content of hot water (45)m= 169.73 148.45 If instantaneous water heati (46)m= 25.46 22.27 Water storage loss: Storage volume (litres) If community heating a Otherwise if no stored Water storage loss: a) If manufacturer's de	ter usage hot water person per Mar 106.13 used - call 153.18 ng at point 22.98 including and no tall hot water and rable restorage	ge in litre usage by r day (all w Apr ach month 101.97 culated me 133.55 of use (no 20.03 ang any so ank in dw er (this in oss facto 2b	es per da 5% if the of water use, I May Vd,m = far 97.8 onthly = 4. 128.14 o hot water 19.22 colar or Water velling, eacludes in the color is known.	y Vd,av welling is not and co Jun ctor from 1 93.64 190 x Vd,r 110.58 storage), 16.59 /WHRS nter 110 nstantar	erage = designed and designed a	(25 x N) to achieve Aug (43) 97.8 07m / 3600 117.58 boxes (46) 17.64 within sa (47)	+ 36 a water us Sep 101.97 118.99 10 (61) 17.85 ame vess ers) enter	Oct 106.13 Total = Sur 138.67 Total = Sur 20.8	Nov 110.29 m(44) _{1 12} = 151.37 m(45) _{1 12} = 22.7	4.05 Dec 114.45 c, 1d) 164.37 24.66 0]	(43) (44) (45) (46) (47)

Hot water storage loss			e 2 (kW	h/litre/da	ıy)					0		(51)
If community heating s Volume factor from Ta		on 4.3								0		(52)
Temperature factor from		2b								0		(52)
Energy lost from water			ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (54) in (5	_	,	Jui			() x (0.)	/	3 0)		0		(55)
Water storage loss cal	•	for each	month			((56)m = (55) × (41):	m		-	l	` ,
(56)m= 0 0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0 0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit loss (ar	nnual) fro	om Table	e 3	_		_		-		0		(58)
Primary circuit loss ca				59)m = ((58) ÷ 36	65 × (41)	m					
(modified by factor f	rom Tab	le H5 if t	here is s	solar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(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= 50.96 46.03	50.96	49.32	49.84	46.18	47.72	49.84	49.32	50.96	49.32	50.96		(61)
Total heat required for	water h	eating ca	alculated	for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	' (59)m + (61)n	า
(62)m= 220.69 194.47	204.14	182.86	177.98	156.76	150.19	167.42	168.3	189.63	200.68	215.33		(62)
Solar DHW input calculated	using App	endix G oı	· Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contribut	ion to wate	er heating)		
(add additional lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix C	3)					
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water hea	ıter											
(64)m= 220.69 194.47	204.14	182.86	177.98	156.76	150.19	167.42	168.3	189.63	200.68	215.33		
						Outp	ut from wa	ater heate	r (annual)₁	12	2228.45	(64)
Heat gains from water	heating.	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	1] + 0.8 >	([(46)m	+ (57)m	+ (59)m	1	
(65)m= 69.17 60.86	63.67	56.73	55.07	48.31	46	51.56	51.89	58.85	62.66	67.39	_	(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	i leating	
5. Internal gains (see	e Table 5	and 5a):									
Metabolic gains (Table												
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 147.05 147.05	147.05	147.05	147.05	147.05	147.05	147.05	147.05	147.05	147.05	147.05		(66)
Lighting gains (calcula	ted in Ar	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				l	
(67)m= 29 25.76	20.95	15.86	11.86	10.01	10.81	14.06	18.87	23.96	27.96	29.81		(67)
Appliances gains (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	!	!		
(68)m= 325.31 328.69	320.18	302.07	279.21	257.73	243.37	240	248.5	266.61	289.47	310.96		(68)
Cooking gains (calcula	ated in A	ppendix	L, equat	ion L15	or L15a)	, also se	e Table	5			•	
(69)m= 37.7 37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7		(69)
Pumps and fans gains	(Table 5	 5а)									•	
(70)m= 3 3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. evaporation	on (nega	tive valu	es) (Tab	le 5)							•	
(71)m= -117.64 -117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64		(71)
Water heating gains (Table 5)	•	•					•	•	•	•	
(72)m= 92.98 90.57	85.58	78.8	74.02	67.1	61.83	69.3	72.07	79.09	87.02	90.58		(72)
	•	•	•					•	•	•	•	

Total internal			460.04	435.19	· ·	1		n + (69)m + (6 409.56		1			(73
73)m= 517.4 6. Solar gains	515.13	496.82	466.84	435.19	404.95	386.13	393.46	409.56	439.78	474.57	501.46		(73
Solar gains are		using sola	r flux from	Table 6a	and asso	ciated equa	itions to	convert to th	e applica	able orientat	ion.		
Orientation: A		•	Area			ux		g_		FF		Gains	
	Table 6d		m²		Ta	able 6a		Table 6b	-	Table 6c		(W)	
Southeast _{0.9x}	0.77	х	6.	8	х	36.79	x	0.63	x	0.7	=	76.46	(77
Southeast 0.9x	0.77	x	7.7	75	x	36.79	×	0.63	x	0.7	-	87.15	(77
Southeast _{0.9x}	0.77	x	6.	8	x	62.67	×	0.63	x	0.7		130.25	(77
Southeast 0.9x	0.77	х	7.7	75	х	62.67	x	0.63	×	0.7	=	148.44	(77
Southeast _{0.9x}	0.77	x	6.	8	х	85.75	x	0.63	_ x	0.7	=	178.21	(77
Southeast _{0.9x}	0.77	x	7.7	75	x	85.75	x	0.63	x	0.7	=	203.11	(77
Southeast _{0.9x}	0.77	X	6.	8	X	106.25	x	0.63	x	0.7	=	220.81	(77
Southeast _{0.9x}	0.77	x	7.7	75	x	106.25	×	0.63	x [0.7	<u> </u>	251.66	(77
Southeast _{0.9x}	0.77	X	6.	8	X	119.01	x	0.63	x [0.7	=	247.32	(77
Southeast _{0.9x}	0.77	X	7.7	75	X	119.01	x	0.63	x [0.7	=	281.88	(77
Southeast _{0.9x}	0.77	X	6.	8	X	118.15	Х	0.63	Х	0.7		245.54	(77
Sout <mark>heast _{0.9x} [</mark>	0.77	x	7.7	75	X	118.15	х	0.63	х	0.7		279.84	(77
Southeast _{0.9x}	0.77	x	6.	8	X	113.91	×	0.63	х	0.7	=	236.72	(77
Southeast _{0.9x}	0.77	x	7.7	75	x	113.91	x [0.63	х	0.7	=	2 <mark>69.79</mark>	(77
Sout <mark>heast _{0.9x} [</mark>	0.77	x	6.	8	x	104.39	x	0.63	х	0.7	=	216.94	(77
Southeast _{0.9x} [0.77	x	7.7	75	x	104.39	х	0.63	х	0.7	=	2 <mark>47.25</mark>	(77
Sout <mark>heast _{0.9x} [</mark>	0.77	x	6.	8	x	92.85	x [0.63	х	0.7	=	192.96	(77
Southeast _{0.9x}	0.77	X	7.7	75	x	92.85	x	0.63	x	0.7	=	219.92	(77
Southeast _{0.9x}	0.77	X	6.	8	X	69.27	x	0.63	x [0.7	=	143.95	(77
Southeast _{0.9x}	0.77	X	7.7	75	X	69.27	x	0.63	x [0.7	=	164.06	(77
Southeast _{0.9x}	0.77	X	6.	8	X	44.07	X	0.63	x [0.7	=	91.59	(77
Southeast _{0.9x}	0.77	X	7.7	75	X	44.07	x	0.63	x [0.7	=	104.38	(77
Southeast _{0.9x}	0.77	X	6.	8	X	31.49	x	0.63	x [0.7	=	65.44	(77
Southeast _{0.9x}	0.77	X	7.7	75	X	31.49	X	0.63	x [0.7	=	74.58	(77
Southwest _{0.9x}	0.77	X	3.6	88	X	36.79		0.63	x [0.7	=	41.38	(79
Southwest _{0.9x}	0.77	X	3.9	97	X	36.79		0.63	x [0.7	=	44.64	(79
Southwest _{0.9x}	0.77	X	3.6	88	X	62.67		0.63	x [0.7	=	70.49	(79
Southwest _{0.9x}	0.77	X	3.9	97	X	62.67		0.63	x [0.7	=	76.04	(79
Southwest _{0.9x}	0.77	X	3.6	88	x	85.75		0.63	x [0.7	=	96.44	(79
Southwest _{0.9x}	0.77	X	3.9	97	x	85.75		0.63	x [0.7	=	104.04	(79
Southwest _{0.9x}	0.77	X	3.6	88	X	106.25		0.63	x	0.7	=	119.5	(79
Southwest _{0.9x}	0.77	X	3.9	97	X	106.25		0.63	x	0.7	=	128.91	(79
Southwest _{0.9x}	0.77	X	3.6	88	X	119.01		0.63	x [0.7	=	133.85	(79
Southwest _{0.9x}	0.77	x	3.9	97	X	119.01	1 🗂	0.63	X	0.7	=	144.39	(79

Southwosto		1		1		1		1		1		7(70)
Southwest _{0.9x}	0.77	X	3.68	X	118.15] 1	0.63	X	0.7	=	132.88	(79)
Southwest _{0.9x}	0.77	X	3.97	X	118.15	<u> </u>	0.63	X	0.7	=	143.35	(79)
Southwest _{0.9x}	0.77	X	3.68	X	113.91	<u> </u>	0.63	X	0.7	=	128.11	(79)
Southwest _{0.9x}	0.77	X	3.97	X	113.91		0.63	X	0.7	=	138.2	(79)
Southwest _{0.9x}	0.77	X	3.68	X	104.39	<u> </u>	0.63	X	0.7	=	117.4	(79)
Southwest _{0.9x}	0.77	X	3.97	X	104.39	<u> </u>	0.63	X	0.7	=	126.66	(79)
Southwest _{0.9x}	0.77	X	3.68	X	92.85	<u> </u>	0.63	X	0.7	=	104.43	(79)
Southwest _{0.9x}	0.77	X	3.97	X	92.85	[0.63	X	0.7	=	112.66	(79)
Southwest _{0.9x}	0.77	X	3.68	X	69.27		0.63	X	0.7	=	77.9	(79)
Southwest _{0.9x}	0.77	X	3.97	X	69.27	_	0.63	X	0.7	=	84.04	(79)
Southwest _{0.9x}	0.77	X	3.68	X	44.07	<u> </u>	0.63	X	0.7	=	49.56	(79)
Southwest _{0.9x}	0.77	X	3.97	X	44.07	<u> </u>	0.63	X	0.7	=	53.47	(79)
Southwest _{0.9x}	0.77	X	3.68	X	31.49]	0.63	X	0.7	=	35.41	(79)
Southwest _{0.9x}	0.77	X	3.97	X	31.49		0.63	X	0.7	=	38.2	(79)
Northwest _{0.9x}	0.77	X	0.57	X	11.28	X	0.63	X	0.7	=	1.97	(81)
Northwest 0.9x	0.77	X	4.25	X	11.28	x	0.63	X	0.7	=	14.65	(81)
Northwest 0.9x	0.77	X	0.57	X	22.97	x	0.63	X	0.7	=	4	(81)
Northwest 0.9x	0.77	X	4.25	X	22.97	Х	0.63	X	0.7	=	29.83	(81)
Northwest 0.9x	0.77	x	0.57	х	41.38	x	0.63	x	0.7	=	7.21	(81)
Northwest 0.9x	0.77	x	4.25	х	41.38	x	0.63	x	0.7	=	53.75	(81)
Northwest 0.9x	0.77	x	0.57	X	67.96	x	0.63	x	0.7	=	11.84	(81)
Northwest _{0.9x}	0.77	x	4.25	x	67.96	Х	0.63	x	0.7	=	88.26	(81)
Northwest _{0.9x}	0.77	x	0.57	x	91.35	X	0.63	x	0.7	=	15.91	(81)
Northwest 0.9x	0.77	X	4.25	х	91.35	x	0.63	x	0.7	=	118.65	(81)
Northwest _{0.9x}	0.77	x	0.57	X	97.38	x	0.63	x	0.7	=	16.96	(81)
Northwest _{0.9x}	0.77	X	4.25	X	97.38	x	0.63	x	0.7	=	126.49	(81)
Northwest _{0.9x}	0.77	X	0.57	X	91.1	x	0.63	x	0.7	=	15.87	(81)
Northwest _{0.9x}	0.77	x	4.25	X	91.1	x	0.63	x	0.7	=	118.33	(81)
Northwest _{0.9x}	0.77	x	0.57	X	72.63	x	0.63	x	0.7	=	12.65	(81)
Northwest 0.9x	0.77	x	4.25	X	72.63	x	0.63	x	0.7	=	94.33	(81)
Northwest _{0.9x}	0.77	X	0.57	x	50.42	x	0.63	x	0.7	=	8.78	(81)
Northwest _{0.9x}	0.77	X	4.25	x	50.42	x	0.63	X	0.7	=	65.49	(81)
Northwest 0.9x	0.77	X	0.57	x	28.07	x	0.63	x	0.7	=	4.89	(81)
Northwest _{0.9x}	0.77	x	4.25	x	28.07	x	0.63	x	0.7	=	36.46	(81)
Northwest _{0.9x}	0.77	x	0.57	x	14.2	x	0.63	x	0.7	=	2.47	(81)
Northwest _{0.9x}	0.77	x	4.25	x	14.2	x	0.63	x	0.7	j =	18.44	(81)
Northwest _{0.9x}	0.77	×	0.57	x	9.21	x	0.63	x	0.7] =	1.61	(81)
Northwest _{0.9x}	0.77	x	4.25	x	9.21	x	0.63	x	0.7	j =	11.97	(81)
Rooflights _{0.9x}	1	x	2.01	x	26	x	0.63	x	0.7	j =	20.74	(82)
Rooflights _{0.9x}	1	x	2.01	x	26	x	0.63	x	0.7	=	20.74	(82)
Rooflights _{0.9x}	1	×	2.9	x	26	x	0.63	x	0.7	i =	59.89	(82)
<u></u>								ı		•		_

Rooflights 0.9x 1	1 🗸	2.04	l v	5 4] x	0.00	7 x [0.7		40.07	(82)
D = afficients] X] ,,	2.01	X	54]]	0.63	╡ ;	0.7	=	43.07	=
Deeflighte] X] ,,	2.01	l x	54] X] ,	0.63]	0.7	=	43.07	(82)
Daaflighta]	2.9	X	54] x] x	0.63	」×[] _× [0.7	=	124.4	(82)
Destista] X] ,,	2.01	l x l	96] 1	0.63	╡	0.7	=	76.57	╡`′
D = 40 -1-4-] X] _v	2.01	X	96] x] x	0.63	」 ×	0.7	_ =	76.57	(82)
Destinber] X] _v	2.9	l x	96]]	0.63]	0.7	=	221.15	╡`′
D = 40 -1-4-] X]	2.01	l X	150] X]	0.63]	0.7	_ =	119.65	(82)
Daaflighta] X]	2.01	X I	150	X 	0.63]	0.7	=	119.65	(82)
D fli - l-t] X]	2.9	X 	150	X 	0.63	_ X	0.7	╡ =	345.54	(82)
Rooflights 0.9x 1	X	2.01	X I	192	X	0.63	」 ×	0.7	╡ =	153.15	(82)
Rooflights 0.9x 1	X	2.01	X	192	X	0.63] × [0.7	_ =	153.15	(82)
Rooflights 0.9x 1	X	2.9	X	192	X	0.63] × [0.7	_ =	442.3	(82)
Rooflights 0.9x 1	X	2.01	X	200	X	0.63]	0.7	=	159.53	(82)
Rooflights 0.9x 1	X	2.01	X	200	X	0.63	_ x [0.7	=	159.53	(82)
Rooflights 0.9x	X	2.9	X	200	X	0.63	_ x [0.7	=	460.72	(82)
Rooflights 0.9x	X	2.01	X	189	X	0.63	X	0.7	=	150.76	(82)
Rooflights 0.9x	X	2.01	X	189	X	0.63	x	0.7	=	150.76	(82)
Rooflights 0.9x	X	2.9	X	189	Х	0.63	Х	0.7		435.38	(82)
Rooflights 0.9x	X	2.01	х	157	x	0.63	x	0.7	=	125.23	(82)
Rooflights 0.9x	X	2.01	X	157	X	0.63	x	0.7	=	125.23	(82)
Rooflights 0.9x 1	X	2.9	X	157	X	0.63	х	0.7	=	3 <mark>61.67</mark>	(82)
Rooflights 0.9x] x	2.01	X	115	Х	0.63	х	0.7	=	91.73	(82)
Rooflights 0.9x 1	X	2.01	х	115	X	0.63	х	0.7	=	91.73	(82)
Rooflights 0.9x	X	2.9	х	115	x	0.63	x	0.7	=	264.92	(82)
Rooflights _{0.9x} 1	X	2.01	x	66	x	0.63] x [0.7	=	52.65	(82)
Rooflights _{0.9x} 1	X	2.01	X	66	x	0.63	x [0.7	=	52.65	(82)
Rooflights _{0.9x} 1	X	2.9	x	66	X	0.63	x [0.7	=	152.04	(82)
Rooflights _{0.9x} 1	X	2.01	x	33	x	0.63] x [0.7	=	26.32	(82)
Rooflights _{0.9x} 1	X	2.01	x	33	x	0.63] x [0.7	=	26.32	(82)
Rooflights 0.9x 1	X	2.9	х	33	х	0.63	x	0.7	=	76.02	(82)
Rooflights 0.9x 1	x	2.01	x	21	x	0.63	x	0.7	_ =	16.75	(82)
Rooflights 0.9x 1	X	2.01	x	21	x	0.63	_ x	0.7	_ =	16.75	(82)
Rooflights 0.9x 1	X	2.9	x	21	x	0.63	i x	0.7	<u> </u>	48.38	(82)
	_				•						_
Solar gains in watts, calcul	ated	for each mon	th		(83)m	n = Sum(74)m	(82)m				
(83)m= 367.62 669.59 101	7.05	1405.82 1690.5	9 17	² 24.84 1643.92	1427	7.36 1152.61	768.63	448.58	309.08		(83)
Total gains – internal and	solar	(84)m = (73) n	า + (83)m , watts							
(84)m= 885.03 1184.72 151	3.87	1872.66 2125.7	'9 21	29.79 2030.05	1820).83 1562.17	1208.4	923.15	810.55		(84)
7. Mean internal tempera	ture ((heating seaso	on)								
Temperature during heati				area from Tab	ole 9	, Th1 (°C)				21	(85)
Utilisation factor for gains	for li	ving area, h1,	m (s	ee Table 9a)							_
Jan Feb N	1ar	Apr May	<u>/</u>	Jun Jul	Α	ug Sep	Oct	Nov	Dec		
										=	

(86)m= 1	0.99	0.98	0.91	0.77	0.58	0.43	0.5	0.77	0.96	1	1		(86)
Mean intern	al tempe	rature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m= 19.49	19.74	20.11	20.55	20.84	20.97	20.99	20.99	20.88	20.43	19.86	19.44		(87)
Temperatur	e during h	neating p	eriods ir	n rest of	dwelling	from Ta	able 9, T	h2 (°C)					
(88)m= 19.81		19.81	19.82	19.82	19.83	19.83	19.83	19.83	19.82	19.82	19.82		(88)
Utilisation fa	actor for o	ains for	rest of d	wellina.	h2.m (se	e Table	9a)	•	•	•	!		
(89)m= 1	0.99	0.97	0.88	0.71	0.49	0.32	0.38	0.68	0.95	0.99	1		(89)
Mean intern	al tempe	rature in	the rest	of dwelli	na T2 (fo	ollow ste	ens 3 to	7 in Tabl	le 9c)				
(90)m= 17.8	18.17	18.71	19.32	19.68	19.81	19.83	19.83	19.74	19.18	18.36	17.75		(90)
	Į	!	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	1	fLA = Livir	ng area ÷ (4) =	0.26	(91)
Mean intern	al tempo	ratura (fo	r the wh	ole dwe	lling) – fl	. ∧ ∨ ⊤1	⊥ (1 _ fl	۸) × T2					
(92)m= 18.25	1	19.08	19.64	19.99	20.11	20.13	20.13	20.04	19.51	18.76	18.19		(92)
Apply adjus		he mear		l temper		m Table	<u> </u>	<u> </u>				I	
(93)m= 18.25		19.08	19.64	19.99	20.11	20.13	20.13	20.04	19.51	18.76	18.19		(93)
8. Space he	ating req	uirement											
Set Ti to the			_		ed at ste	ep 11 of	Table 9	b, so tha	nt Ti,m=(76)m an	d re-calc	:ulate	
the utilisatio		Ţ				/				l	_		
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fa	0.99	0.96	0.88	0.71	0.51	0.35	0.41	0.7	0.94	0.99	1		(94)
Useful gains					0.01	0.00	0.41	0.7	0.54	0.55		I	(0.)
(95)m= 881.85			1641.99	_	1088.22	712.23	747.14	1094.95	1136.61	915.17	808.54		(95)
Monthly ave	erage exte	rnal tem	perature	from Ta	able 8		1					ı	
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	ite for me	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]	-			
` '	6 2827.71		2197.38	ļ		716.39	755.4	1208.12	<u> </u>	<u> </u>	2876.74		(97)
Space heati		1						<u> </u>		 		ı	
(98)m= 1492.7	7 1113.74	848.9	399.88	128.9	0	0	0	0	508.69	1060.83			
							Tota	ıl per year	(kWh/yea	r) = Sum(9	8)15,912 =	7092.37	(98)
Space heati	ng requir	ement in	kWh/m²	² /year								45.92	(99)
9a. Energy re	equireme	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space heat	•			/							ĺ		(oo t)
Fraction of s	•		,		mentary	•		(004)				0	(201)
Fraction of	•		•	` ,			(202) = 1					1	(202)
Fraction of t		•	-				(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of	f main spa	ace heat	ing syste	em 1								93.4	(206)
Efficiency of	f seconda	ary/suppl	ementar	y heatin	g system	າ, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/	year
Space heati		- `)							ı	
1492.7	7 1113.74	848.9	399.88	128.9	0	0	0	0	508.69	1060.83	1538.74		
$(211)m = \{[(9)]$			· `			i	ı	ı		•		ı	(211)
1598.1	8 1192.44	908.89	428.14	138.01	0	0	0 Tata	0	544.64		1647.47		<u></u>
							lota	ıı (KVVN/yea	ar) =5um()	211) _{15,10. 12}	2	7593.55	(211)

15)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	(2
ater heating							•		_
utput from water heater (calculated above)	50.70	150.40	407.40	400.0	400.00	200.68	245.22		
220.69 194.47 204.14 182.86 177.98 15 ficiency of water heater	56.76 1	150.19	167.42	168.3	189.63	200.68	215.33	80.3	(2
	80.3	80.3	80.3	80.3	87.41	88.63	89.03	00.3	(2
uel for water heating, kWh/month		00.0	00.0	00.0	01111	00.00	00.00		`
19)m = (64)m x 100 ÷ (217)m									
9)m= 248.08 219.15 231.33 210.27 211.25 19	95.21 1	187.03	208.49	209.59	216.93	226.43	241.88		_
			Tota	I = Sum(2°				2605.63	(2
nnual totals bace heating fuel used, main system 1					K\	Wh/year	· [kWh/yea 7593.55	r
							[╡
ater heating fuel used								2605.63	
ectricity for pumps, fans and electric keep-hot									
entral heating pump:							30		(2
poiler with a fan-assisted flue							45		(2
							45		(2
otal electricity for the above, kWh/year			sum	of (230a)	(230g) =		45	75	
			sum	of (230a)	(230g) =		45	75 512.18	(2
ectricity for lighting	s includ	ling mic			(230g) =		45		(2
ectricity for lighting								512.18	(2
ectricity for lighting	Ener					ion fac			(2)(2 S
ectricity for lighting 2a. CO2 emissions – Individual heating systems	Ener	r gy /year			Emiss	ion fac 2/kWh		512.18	(2)(2)(2)s
ectricity for lighting 2a. CO2 emissions – Individual heating systems pace heating (main system 1)	Ene r kWh	rgy /year ×			Emiss kg CO	ion fac 2/kWh	tor	512.18 Emission: kg CO2/ye	(2)(2) s ear
ectricity for lighting 2a. CO2 emissions – Individual heating systems pace heating (main system 1) pace heating (secondary)	Ener kWh.	rgy /year x			Emiss kg CO2	ion fac 2/kWh 16	tor	Emission kg CO2/ye	(2 sear (2
ectricity for lighting 2a. CO2 emissions – Individual heating systems pace heating (main system 1) pace heating (secondary) atter heating	Ener kWh. (211) (215) (219)	rgy /year × ×			Emiss kg CO2	ion fac 2/kWh 16	tor = [512.18 Emission kg CO2/ye 1640.21	(2 (2 (2 (2 (2
ectricity for lighting 2a. CO2 emissions – Individual heating systems pace heating (main system 1) pace heating (secondary) ater heating pace and water heating	Ener kWh. (211) (215) (219)	rgy /year x x x + (262) +	cro-CHP		Emiss kg CO2	ion fac 2/kWh 16 19 16	tor = [512.18 Emission kg CO2/ye 1640.21 0 562.82	(22 (22 (22 (22 (22 (22 (22 (22 (22 (22
ectricity for lighting 2a. CO2 emissions – Individual heating systems bace heating (main system 1) bace heating (secondary) ater heating bace and water heating ectricity for pumps, fans and electric keep-hot ectricity for lighting	Ener kWh. (211) (215) (219) (261) -	rgy /year x x x + (262) +	cro-CHP		Emiss kg CO2 0.2 0.5 0.2	ion fac 2/kWh 16 19	tor = [= [= [512.18 Emission kg CO2/ye 1640.21 0 562.82 2203.02	(2)(2 S

TER =

(273)

16.24

eight associates

Appendix Energy Assessment Ellerdale Road

LEAN Scenario

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	SAP 201			Strom Softwa	are Vei	rsion:		Versio	on: 1.0.1.25	
Address :	1 Ellerdale	Road	Р	roperty .	Address	: House	1-LEAN				
1. Overall dwelling dime		rtoau									
				Area	a(m²)		Av. He	ight(m)		Volume(m³)	
Basement						(1a) x		2.6	(2a) =	174.2	(3a)
Ground floor				8	37.44	(1b) x		3	(2b) =	262.32	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+	(1d)+(1e)+(1r	1) 1	54.44	(4)			_		_
Dwelling volume						(3a)+(3b))+(3c)+(3d	l)+(3e)+	.(3n) =	436.52	(5)
2. Ventilation rate:	main	Se	econdar	V	other		total			m³ per houi	
Number of chimneys	heating		eating	, 7 +		7 = [40 =		_
ŕ	0	_	0	- - - - - - - - -	0	」 ⁻	0		20 =	0	(6a)
Number of open flues	0	_]	0	J T L	0	」 ⁻	0		10 =	0	[6b)
Number of intermittent fa						Ļ	0			0	(7a)
Number of passive vents						Ĺ	0		10 =	0	(7b)
Number of flueless gas fi	res					L	0	X 2	40 =	0	(7c)
									Air ch	nanges per ho	ur
Infiltration due to chimne	ys, flues and f	ans = (6	a)+(6b)+(7	'a)+(7b)+(7c) =	Г	0	Η.	÷ (5) =	0	(8)
If a pressurisation test has b			ed, procee	d to (17), d	otherwise o	continue fr	om (9) to (, ,		
Number of storeys in the	ne dw <mark>elling</mark> (n	s)								0	(9)
Additional infiltration	OF for stool o	r timbor t	romo or	0.25 for	r maaan	n, oonotn	uction	[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0 if both types of wall are pi						•	uction			0	(11)
deducting areas of opening	• / .			. , .							_
If suspended wooden f		•	ed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en Percentage of windows	·		rinnad							0	(13)
Window infiltration		augiii si	пррец		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expresse	ed in cub	ic metre	s per ho	our per s	quare m	etre of e	nvelope	area	3	(17)
If based on air permeabil	ity value, then	(18) = [(1	7) ÷ 20]+(B), otherwi	ise (18) =	(16)				0.15	(18)
Air permeability value applie		on test has	been dor	ne or a deg	gree air pe	rmeability	is being us	sed			-
Number of sides sheltere Shelter factor	ed				(20) = 1 -	[0.075 x (1	9)] =			0.85	(19) (20)
Infiltration rate incorporat	ing shelter fac	ctor			(21) = (18	`	-71			0.83	(21)
Infiltration rate modified for	_					,				0.13	
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Tab	le 7			-					-	
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
			·					(0.4.)	(22.)				ı	
Adjuste T	0.16	ation rat	e (allowi	ng for sr 0.14	o.14	d wind s	peed) = 0.12	(21a) x	(22a)m 0.13	0.14	0.14	0.15	1	
L Calcula				rate for t	_	_	· ·	0.12	0.13	0.14	0.14	0.13	J	
		al ventila											0.9	5 (2
			0 11	, ,	, (, ,	, ,	N5)) , othe	`) = (23a)			0.9	5 (2
			-	•	_			n Table 4h					76	.5 (2
Ĺ							- ` ` 	, 	i `	, 	` 	1 – (23c)	i ÷ 100] I	(0
24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27]	(2
· F							- 	MV) (24b	í `	r ´ `	- 	Ι ,	1	(2
24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(2
•					•	-		on from (·c) = (22b		.5 × (23b	o)			
4c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(2
d) If r	natural v	ventilatio	on or wh	ole hous	e positiv	re input	ventilatio	on from l	loft	<u>!</u>	!	!	J	
								0.5 + [(2		0.5]			-	
24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(2
Effoc	tive oir				10.41	10.4	\ (0.4		(0.5)					
LIIEC	live all	change	rate - er	nter (24a) or (2 <mark>4</mark> k	o) or (24	c) or (24	ld) in box	x (25)					
Г	0.28	0.28	rate - er 0.27	o.26) or (24t 0.25	0.24	c) or (24 0.24	ld) in box	0.24	0.25	0.26	0.27		(2
25)m= [0.28	0.28	0.27		0.25		· `		· /	0.25	0.26	0.27		(2
25)m= [3. Hea	0.28	0.28 s and he	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar	0.24 ea	U-val	0.24 ue	AXU		k-value	-	AXk
25)m= [3. Hea LEM	0.28	0.28	0.27	0.26	0.25 er:	0.24 Net Ar A ,r	0.24 ea m²	U-vali W/m2	0.24 ue 2K	A X U	K)		-	A X k kJ/K
3. Hea ELEM	0.28 at losses	0.28 s and he Gros area	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar	0.24 ea m²	U-vali W/m2	0.24 ue eK	AXU	K)	k-value	-	A X k kJ/K
25)m= [3. Hea ELEM Doors Vindov	0.28 at losses ENT	0.28 s and he Gros	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r	0.24 ea m² x1	U-valu W/m2 1.2 /[1/(1.2)+	0.24 ue 2K = 0.04] = [A X U	K)	k-value	-	A X k kJ/K
3. Head Selection (25)m= [25)m= [25]m= [25]m	0.28 ENT vs Type vs Type	0.28 s and he Gros area	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r	0.24 ea m² x1 x1	U-vali W/m2 1.2 /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [A X U (W/) 2.112	K)	k-value	-	A X k kJ/K (2
3. Head Section 19 Sec	0.28 ENT vs Type vs Type vs Type	0.28 s and he Gros area	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76	0.24 ea m² x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [A X U (W// 2.112 0.81	K)	k-value	-	A X k kJ/K (2 (2 (2
25)m= [3. Head Doors Vindov Vindov Vindov Vindov	o.28 It osses ENT vs Type vs Type vs Type vs Type	0.28 S and he Gros area	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29	0.24 ea m² x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [A X U (W/) 2.112 0.81 6.06	K)	k-value	-	A X k kJ/K (2 (2 (2
3. Head Selection (25)m= [3. Head Selection (25	o.28 IENT INT INT INT INT INT INT IN	0.28 s and he Gros area 1 2 3 4 4 5	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46	0.24 ea m² x1 x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [A X U (W// 2.112 0.81 6.06 9.69	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2
3. Head Section 1. Sec	o.28 It osses ENT vs Type vs Type vs Type vs Type	0.28 s and he Gros area 1 2 3 4 4 5	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64	0.24 ea m² x1 x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [A X U (W/) 2.112 0.81 6.06 9.69 11.04	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Section 1985 1985 1985 1985 1985 1985 1985 1985	o.28 IENT INT INT INT INT INT INT IN	0.28 s and he Gros area 1 2 3 4 5 6 6	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58	0.24 ea m² x1 x1 x1 x1 x1 x1	U-value W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Selection (1997) 4. Head Selection (19	o.28 It osses IENT IVS Type	0.28 S and he Gros area 1 1 2 2 3 4 4 5 5 6 6 6 6 6 1	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58	0.24 ea m² x1 x1 x1 x1 x1 x1 x1	U-value W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Selection (1997) 4. Head Selection (19	o.28 It ossesses to see the control of the control	0.28 S and he Gros area 1 1 2 2 2 3 4 4 4 5 5 6 6 6 6 1 6 2	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.24 0.24 0.04] = [0.	A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Selection of the control of	o.28 IENT IVS Type	0.28 S and he Gros area 1 1 2 2 2 3 4 4 4 5 5 6 6 6 6 1 6 2	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [A X U (W/) 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3	K)	k-value	-	AXk
3. Head Section 19 19 19 19 19 19 19 19 19 19 19 19 19	o.28 IENT IVS Type	0.28 S and he Gros area 1 1 2 2 2 3 4 4 4 5 5 6 6 6 6 1 6 2	0.27 eat loss es (m²)	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5 3.61	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-value W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2) + /[1/(1.2) +	0.24 0.24 0.24 0.24 0.04] = [0.	A X U (W/) 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3 4.332	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head SELEM Doors Vindov Vindov Vindov Vindov Vindov Vindov Roofligh	o.28 It ossesses IENT IVS Type IVS T	0.28 s and he Gros area 41 42 43 44 45 66 e 1 e 2 e 3	0.27 eat loss ss (m²)	0.26 paramete Openin	0.25 er: gs ₁ ²	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5 3.61 87.44	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-value W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2) + /[1/(1.2) + /[1/(1.2) +	0.24 0.24 0.24 0.24 0.24 0.04] = [0.04]	A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3 4.332 9.61840	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Selection 1998 1998 1998 1998 1998 1998 1998 199	o.28 It ossesses IENT IVS Type IVS T	0.28 s and he Gros area 4 1 4 2 4 3 4 4 5 6 6 e 1 6 e 2 6 3	0.27 eat loss ss (m²)	0.26 Openin m	0.25 er: gs ₁ 2	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5 3.61 87.44 81.4	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.24 0.04] = [0.04] =	A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3 4.332 9.61840 14.65	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Selection (25)m = [3.	vs Type hts Type hts Type hts Type	0.28 s and he Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 1 e 2 e 3	0.27 pat loss (m²)	0.26 Openin m	0.25 er: gs ₁ 2	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5 3.61 87.44 81.4	0.24 ea	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.24 0.24 0.24 0.04] = [0.04]	A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3 4.332 9.61840 14.65 15.73	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2

(26) (30) + (32) =

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

Fabric heat loss, $W/K = S (A \times U)$

102.88

(33)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²k	Heat capacity Cm = S(A x k)	((28) (30) + (32) + (32a) (32e) = 44603.0	08 (34)
For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 11 can be used instead of a detailed calculation. Thermal bridges: S (L × Y) calculated using Appendix K if details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss calculated monthly Ventilation heat loss calculated monthly Ventilation heat loss calculated monthly Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (39)m = 0.33 × (25)m × (5) Heat transfer coefficient, W/K (39)m = (30)m = (37) + (38)m (39)m = (37) + (38)m (40)m = (39)m + (4) (40)m = (30)m + (4) (40)m = (30)m + (4) (40)m = (30)m + (4) (Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium 250	(35)
Total fabric heat loss	, ,	licative values of TMP in Table 1f	`` ′
Total fabric heat loss calculated monthly (38)m = 0.33 * (25)m × (5)	Thermal bridges : S (L x Y) calculated using Appendix K	56.86	(36)
Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	if details of thermal bridging are not known (36) = $0.15 \times (31)$		
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Total fabric heat loss	(33) + (36) =	4 (37)
(38) me	Ventilation heat loss calculated monthly	(38) m = $0.33 \times (25)$ m x (5)	
Heat transfer coefficient, W/K (39)m= 200.08 199.62 199.16 196.87 196.41 194.11 194.11 193.65 195.03 196.41 197.33 198.25 Average = Sum(39), v, /12= 196.75 (39) Heat loss parameter (HLP), W/m²K (40)m= 1.3 1.29 1.29 1.27 1.27 1.26 1.26 1.25 1.26 1.27 1.28 1.28 Average = Sum(40), v, /12= 1.27 (40) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (41)m= 31 28 31 30 31 30 31 31 30 31 30 31 30 31 (41) 4. Water heating energy requirement: Assumed occupancy, N if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9)9 if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9)9 if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9)9 if TFA ≥ 13.9,	Jan Feb Mar Apr May Jun Jul Aug	Sep Oct Nov Dec	
(39)ma	(38)m= 40.34 39.88 39.43 37.13 36.67 34.37 34.37 33.92 3	5.29 36.67 37.59 38.51	(38)
Average = Sum(39), 12/12= 196.75 (39) Heat loss parameter (HLP), W/m²K (40)m = (39)m + (4) (40)m = 1.3	Heat transfer coefficient, W/K	(39)m = (37) + (38)m	
Heat loss parameter (HLP), W/m²K (40)m= 1.3	(39)m= 200.08 199.62 199.16 196.87 196.41 194.11 194.11 193.65 19	95.03 196.41 197.33 198.25	
Average = Sum(40), 12 / 12 1.27 (40)	Heat loss parameter (HLP), W/m²K	. ,	(39)
Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (41)m= 31 28 31 30 31 30 31 30 31 31 30 31 30 31 30 31 (41) 4. Water heating energy requirement: **Reduce the annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Energy content of hot water used - calculated monthly = 4.190 x Vd, m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45), 12 = 1637.06 (45) It instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	(40)m= 1.3 1.29 1.29 1.27 1.27 1.26 1.26 1.25 1	1.26 1.27 1.28 1.28	
4. Water heating energy requirement: Assumed occupancy, N If TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA -13.9)2)] + 0.0013 × (TFA -13.9)	Number of days in month (Table 1a)	Average = Sum(40) _{1 12} /12= 1.27	(40)
4. Water heating energy requirement: Assumed occupancy, N If TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA -13.9)2)] + 0.0013 × (TFA -13.9)	Jan Feb Mar Apr May Jun Jul Aug	Sep Oct Nov Dec	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)			(41)
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)			
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	1 Water heating energy requirement:	kWh/year:	
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	4. Water reading energy requirement.	KWII/year.	_
Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd, m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.001		(42)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)		26	(42)
Hot water usage in litres per day for each month $Vd,m = factor from Table 1c \times (43)$ (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	Redu <mark>ce the annual average</mark> hot water usage by 5% if the dwelling is designed to achieve a w		(43)
Hot water usage in litres per day for each month $Vd,m = factor from Table 1c \times (43)$ (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	Jan Feb Mar Apr May Jun Jul Aug	Sen Oct Nov Dec	
Total = Sum(44) _{1 12} = 1248.56 (44) Energy content of hot water used - calculated monthly = $4.190 \times Vd$, $m \times nm \times DTm / 3600 \times Wh/month$ (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) _{1 12} = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)		Sep Oct 140V Dec	
Total = Sum(44) _{1 12} = 1248.56 (44) Energy content of hot water used - calculated monthly = $4.190 \times Vd$, $m \times nm \times DTm / 3600 \times Wh/month$ (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) _{1 12} = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	(44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 10	01.97 106.13 110.29 114.45	
Energy content of hot water used - calculated monthly = $4.190 \times Vd$, $m \times nm \times DTm / 3600 \times Wh/month$ (see Tables 1b, 1c, 1d) (45)m= 169.73	(11)11-		6 (44)
Total = Sum(45) _{1 12} = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46) _m = $\begin{bmatrix} 25.46 & 22.27 & 22.98 & 20.03 & 19.22 & 16.59 & 15.37 & 17.64 & 17.85 & 20.8 & 22.7 & 24.66 & (46) &$	Energy content of hot water used - calculated monthly = $4.190 \times Vd$, $m \times nm \times DTm / 3600 \times Vd$	· /	
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	(45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 11	18.99 138.67 151.37 164.37	
(46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	If instantaneous water heating at point of use (no hot water storage), enter 0 in hoves (46) to	. ,	(45)
		· ·	(40)
Traitor otorago roco.		7.85 20.8 22.7 24.66	(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)	5	e vessel 0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)		<u> </u>	(11)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)) enter '0' in (47)	
Water storage loss:	Water storage loss:		
a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)	a) If manufacturer's declared loss factor is known (kWh/day):	0	(48)
Temperature factor from Table 2b 0 (49)	Temperature factor from Table 2b	0	(49)
Energy lost from water storage, kWh/year $(48) \times (49) = 0$ (50)		0	(50)
b) If manufacturer's declared cylinder loss factor is not known:	b) If manufacturer's declared cylinder loss factor is not known:		

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51))
If community heating see section 4.3	
Volume factor from Table 2a 0 (52) Temperature factor from Table 2b 0 (53)	
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ (54) Enter (50) or (54) in (55)	
	,
Water storage loss calculated for each month ((56)m = (55) × (41)m	
(56) m =	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 =	
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 (59)	١
	'
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 50.96 46.03 50.96 49.32 49.84 46.18 47.72 49.84 49.32 50.96 49.32 50.96 (61))
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(62)m= 220.69 194.47 204.14 182.86 177.98 156.76 150.19 167.42 168.3 189.63 200.68 215.33 (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 =)
Output from water heater	
(64)m= 220.69 194.47 204.14 182.86 177.98 156.76 150.19 167.42 168.3 189.63 200.68 215.33	
Output from water heater (annual) _{1 12} 2228.45 (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= 69.17 60.86 63.67 56.73 55.07 48.31 46 51.56 51.89 58.85 62.66 67.39 (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= 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 (66))
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 29 25.76 20.95 15.86 11.86 10.01 10.81 14.06 18.87 23.96 27.96 29.81 (67))
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 325.31 328.69 320.18 302.07 279.21 257.73 243.37 240 248.5 266.61 289.47 310.96 (68))
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 37.7 37.7 37.7 37.7 37.7 37.7 37.7 37.	١
	'
Pumps and fans gains (Table 5a)	
(70) m =	1
Losses e.g. evaporation (negative values) (Table 5)	
(71) m =	1
Water heating gains (Table 5)	
(72)m= 92.98 90.57 85.58 78.8 74.02 67.1 61.83 69.3 72.07 79.09 87.02 90.58 (72)	1

Total internal g	ains =					(66)	m + (67)m	+ (68	3)m +	(69)m + (70)m +	(71)m + (72)	m		
(73)m= 517.4 5	515.13	496.82	466.84	435.19	40)4.95	386.13	393	.46	409.56	439.78	3 474.57	501.46		(73)
6. Solar gains:															
Solar gains are cal	culated ı	using sola	r flux from	Table 6a	and			tions	to coi	nvert to the	e applic		ion.		
Orientation: Ac	cess F ble 6d	actor	Area m²			Flu	x ole 6a		т,	g_ able 6b		FF		Gains	
	Die ou				-	rai	ле ба 			abie ob	_	Table 6c		(W)	_
Southeast 0.9x	0.77	X	8.4	16	x	3	6.79	X		0.55	X	0.8	=	94.91	(77)
Southeast 0.9x	0.77	X	9.6	64	x	3	6.79	X		0.55	X	0.8	=	108.15	(77)
Southeast _{0.9x}	0.77	X	8.4	16	x	6	2.67	X		0.55	X	0.8	=	161.67	(77)
Southeast _{0.9x}	0.77	X	9.6	64	x	6	2.67	X		0.55	X	0.8	=	184.22	(77)
Southeast 0.9x	0.77	х	8.4	16	x [8	5.75	X		0.55	X	0.8	=	221.21	(77)
Southeast 0.9x	0.77	X	9.6	64	x [8	5.75	X		0.55	X	0.8	=	252.06	(77)
Southeast 0.9x	0.77	X	8.4	16	x [10	06.25	X		0.55	X	0.8	=	274.09	(77)
Southeast _{0.9x}	0.77	X	9.6	64	x [10	06.25	x		0.55	X	0.8	=	312.32	(77)
Southeast 0.9x	0.77	X	8.4	16	x [1	19.01	x		0.55	X	0.8	=	307	(77)
Southeast 0.9x	0.77	Х	9.6	64	x [1	19.01	x		0.55	x	0.8	=	349.82	(77)
Southeast 0.9x	0.77	X	8.4	16	x [1	18.15	Х		0.55	X	0.8	=	304.78	(77)
Southeast _{0.9x}	0.77	x	9.6	64	х	1	18.15	х		0.55	x	0.8		347.29	(77)
Southeast 0.9x	0.77	x	8.4	16	х	1	13.91	×		0.55	x	0.8	_ =	293.84	(77)
Southeast 0.9x	0.77	x	9.6	64	x	1	13.91	X		0.55	х	0.8	=	334.83	(77)
Southeast 0.9x	0.77	x	8.4	16	x	10	04.39	X		0.55	х	0.8	=	269.29	(77)
Southeast _{0.9x}	0.77	x	9.6	64	x	10	04.39	Х		0.55	х	0.8	=	306.85	(77)
Southeast 0.9x	0.77	x	8.4	16	х	9	2.85	х		0.55	x	0.8		239.52	(77)
Southeast 0.9x	0.77	Х	9.6	64	x	9	2.85	x		0.55	X	0.8		272.93	(77)
Southeast 0.9x	0.77	X	8.4	16	x [6	9.27	x		0.55	×	0.8		178.68	(77)
Southeast 0.9x	0.77	X	9.6	64	x [6	9.27	x		0.55	×	0.8	_ =	203.61	(77)
Southeast 0.9x	0.77	X	8.4	16	x [4	4.07	х		0.55	x	0.8	- -	113.69	(77)
Southeast 0.9x	0.77	X	9.6	64	×	4	4.07	х		0.55	x	0.8	=	129.54	(77)
Southeast 0.9x	0.77	x	8.4	16	×	3	1.49	х		0.55	x	0.8	╡ -	81.23	(77)
Southeast 0.9x	0.77	x	9.6	64	x		1.49	x		0.55	×	0.8	-	92.56	(77)
Southwest _{0.9x}	0.77	x	4.5		x [6.79			0.55	x	0.8	_ =	51.38	(79)
Southwest _{0.9x}	0.77	x	4.9	==	x [6.79			0.55	×	0.8		55.42	(79)
Southwest _{0.9x}	0.77	X	4.5		x [2.67			0.55	×	0.8	╡ -	87.53	(79)
Southwest _{0.9x}	0.77	X	4.9		x [2.67			0.55	×	0.8	╡ -	94.41	(79)
Southwest _{0.9x}	0.77	X	4.5		x [5.75			0.55	×	0.8	╡ -	119.76	(79)
Southwest _{0.9x}	0.77	x	4.9		~ _L		5.75			0.55	X	0.8	╡ -	129.17	(79)
Southwest _{0.9x}	0.77	x	4.5		~ L х [06.25			0.55	X	0.8	╡ -	148.38	(79)
Southwest _{0.9x}	0.77	x	4.9		^ L x [06.25			0.55	^ x	0.8	╡ -	160.05	(79)
Southwest _{0.9x}	0.77	_ ^	4.5		^		19.01	 		0.55	- ^ x	0.8	╡ -	166.2	(79)
Southwest _{0.9x}		×			^						-		╡ -		(79)
	0.77	^	4.9	7 -1	^ L		19.01			0.55	^	0.8		179.27	(13)

Southwest _{0.9x}		1	1.50	1 .,	140.45	1	0.55	۱.,		l	405	7(70)
Southwest _{0.9x}	0.77	X	4.58	X	118.15] 1	0.55	X	0.8	= 	165	(79)
<u> </u>	0.77	X	4.94	X	118.15] 1	0.55	X	0.8	= 	177.97	(79)
Southwesto s	0.77	X	4.58	X	113.91] 1	0.55	X	0.8	= 	159.08	(79)
Southwest _{0.9x}	0.77	X	4.94	X	113.91] 1	0.55	X	0.8	= 	171.58	(79)
Southwest _{0.9x}	0.77	X	4.58	X	104.39	<u> </u>	0.55	X	0.8	=	145.78	(79)
Southwest _{0.9x}	0.77	X	4.94	X	104.39	<u> </u>	0.55	X	0.8	=	157.24	(79)
Southwest _{0.9x}	0.77	X	4.58	X	92.85		0.55	X	0.8	=	129.67	(79)
Southwest _{0.9x}	0.77	X	4.94	X	92.85	<u> </u>	0.55	X	0.8	=	139.86	(79)
Southwest _{0.9x}	0.77	X	4.58	X	69.27	<u> </u>	0.55	X	0.8	=	96.73	(79)
Southwest _{0.9x}	0.77	X	4.94	X	69.27	<u> </u>	0.55	X	0.8	=	104.34	(79)
Southwest _{0.9x}	0.77	X	4.58	X	44.07	[0.55	X	0.8	=	61.55	(79)
Southwest _{0.9x}	0.77	X	4.94	X	44.07	_	0.55	X	0.8	=	66.38	(79)
Southwest _{0.9x}	0.77	X	4.58	X	31.49	<u> </u>	0.55	X	0.8	=	43.97	(79)
Southwest _{0.9x}	0.77	X	4.94	X	31.49	<u> </u>	0.55	X	0.8	=	47.43	(79)
Northwest _{0.9x}	0.77	X	0.71	X	11.28	x	0.55	X	0.8	=	2.44	(81)
Northwest 0.9x	0.77	X	5.29	X	11.28	X	0.55	X	0.8	=	18.2	(81)
Northwest 0.9x	0.77	x	0.71	X	22.97	x	0.55	x	0.8	=	4.97	(81)
Northwest 0.9x	0.77	x	5.29	X	22.97	Х	0.55	X	0.8	=	37.05	(81)
Northwest 0.9x	0.77	x	0.71	х	41.38] x	0.55	x	0.8	=	8.96	(81)
Northwest 0.9x	0.77	x	5.29	х	41.38		0.55	x	0.8	=	66.75	(81)
Northwest 0.9x	0.77	x	0.71	X	67.96	x	0.55	x	0.8	=	14.71	(81)
Northwest 0.9x	0.77	x	5.29	x	67.96	Х	0.55	x	0.8	=	109.61	(81)
Northwest 0.9x	0.77	x	0.71	x	91.35	x	0.55	x	0.8	=	19.78	(81)
Northwest 0.9x	0.77	X	5.29	х	91.35	x	0.55	x	0.8	=	147.34	(81)
Northwest 0.9x	0.77	X	0.71	x	97.38	x	0.55	x	0.8	=	21.08	(81)
Northwest 0.9x	0.77	X	5.29	X	97.38	x	0.55	x	0.8	=	157.08	(81)
Northwest _{0.9x}	0.77	x	0.71	X	91.1	x	0.55	x	0.8	=	19.72	(81)
Northwest _{0.9x}	0.77	x	5.29	x	91.1	x	0.55	x	0.8	=	146.95	(81)
Northwest _{0.9x}	0.77	x	0.71	X	72.63	x	0.55	x	0.8	=	15.72	(81)
Northwest 0.9x	0.77	x	5.29	X	72.63	x	0.55	x	0.8	=	117.15	(81)
Northwest _{0.9x}	0.77	x	0.71	x	50.42	x	0.55	x	0.8	=	10.92	(81)
Northwest _{0.9x}	0.77	x	5.29	x	50.42	x	0.55	X	0.8	=	81.33	(81)
Northwest 0.9x	0.77	x	0.71	x	28.07	x	0.55	x	0.8	=	6.08	(81)
Northwest _{0.9x}	0.77	x	5.29	x	28.07	x	0.55	x	0.8	=	45.27	(81)
Northwest _{0.9x}	0.77	x	0.71	x	14.2	x	0.55	x	0.8	=	3.07	(81)
Northwest _{0.9x}	0.77	x	5.29	x	14.2	x	0.55	X	0.8	j =	22.9	(81)
Northwest _{0.9x}	0.77	x	0.71	x	9.21	x	0.55	x	0.8	=	1.99	(81)
Northwest _{0.9x}	0.77	x	5.29	x	9.21	x	0.55	x	0.8	j =	14.86	(81)
Rooflights _{0.9x}	1	x	2.5	x	26	x	0.55	x	0.8	j =	25.74	(82)
Rooflights _{0.9x}	1	x	2.5	x	26	x	0.55	x	0.8	j =	25.74	(82)
Rooflights _{0.9x}	1	×	3.61	x	26	x	0.55	x	0.8	=	74.34	(82)
								ı		•		_

Rooflights 0.9x				1		1 1		пг		_		— (00)
D = efficients		X	2.5	X	54	X	0.55	_	0.8	=	53.46	(82)
Do officials to		X	2.5	X	54	X	0.55	_ ×	0.8	=	53.46	(82)
Rooflights 0.9x 1		X	3.61	X	54	X	0.55	_ ×	0.8	=	154.39	(82)
Rooflights 0.9x 1		X	2.5	X	96	X 1	0.55	_ X L	0.8	=	95.04	(82)
Rooflights 0.9x 1		X	2.5	X	96	X	0.55	_	0.8	_ =	95.04	(82)
Rooflights 0.9x 1		X	3.61	X	96	X	0.55	_ X	0.8	_ =	274.48	(82)
Rooflights 0.9x 1		X	2.5	X	150	X	0.55	_ x	0.8	_ =	148.5	(82)
Rooflights 0.9x 1		X	2.5	X	150	X	0.55	X	0.8	=	148.5	(82)
Rooflights 0.9x 1		X	3.61	X	150	X	0.55	×	0.8	=	428.87	(82)
Rooflights 0.9x 1		X	2.5	X	192	X	0.55	×	0.8	=	190.08	(82)
Rooflights _{0.9x} 1		X	2.5	X	192	X	0.55	x	0.8	=	190.08	(82)
Rooflights _{0.9x} 1		X	3.61	x	192	X	0.55	X	0.8	=	548.95	(82)
Rooflights 0.9x 1		X	2.5	X	200	X	0.55	X	0.8	=	198	(82)
Rooflights 0.9x 1		X	2.5	X	200	X	0.55	x [0.8	=	198	(82)
Rooflights 0.9x 1		X	3.61	X	200	X	0.55	x	0.8	=	571.82	(82)
Rooflights _{0.9x} 1		X	2.5	x	189	X	0.55	x [0.8	=	187.11	(82)
Rooflights 0.9x 1		X	2.5	X	189	X	0.55	x	0.8	=	187.11	(82)
Rooflights 0.9x		X	3.61	X	189	Х	0.55	X	0.8	=	540.37	(82)
Rooflights 0.9x 1		x	2.5	x	157] x	0.55	х	0.8	=	155.43	(82)
Rooflights 0.9x 1		x	2.5	х	157	x	0.55	х	0.8	=	155.43	(82)
Rooflights 0.9x 1		x	3.61	X	157	X	0.55	х	0.8	=	448.88	(82)
Rooflights 0.9x 1		x	2.5	x	115	Х	0.55	х	0.8	=	113.85	(82)
Rooflights 0.9x 1		x	2.5	х	115	Х	0.55	х	0.8	=	113.85	(82)
Rooflights 0.9x		x	3.61	х	115	x	0.55	х	0.8	=	328.8	(82)
Rooflights 0.9x 1		x	2.5	х	66	х	0.55	x	0.8	=	65.34	(82)
Rooflights 0.9x 1		x	2.5	х	66	х	0.55	_ x [0.8	=	65.34	(82)
Rooflights 0.9x 1		x	3.61	х	66	x	0.55	_ x [0.8	=	188.7	(82)
Rooflights 0.9x 1		x	2.5	x	33	x	0.55	x	0.8	_ =	32.67	(82)
Rooflights 0.9x 1		x	2.5	x	33	x	0.55	×	0.8	_	32.67	(82)
Rooflights 0.9x 1		x	3.61	x	33	x	0.55		0.8	=	94.35	(82)
Rooflights 0.9x 1		x	2.5	х	21	X	0.55	וֹ x וֹ	0.8	=	20.79	(82)
Rooflights 0.9x 1		x	2.5	X	21	X	0.55	x	0.8	=	20.79	(82)
Rooflights 0.9x 1		x	3.61	x	21) x	0.55		0.8	= =	60.04	(82)
			0.01	l]	0.00		0.0		00.01	 _` ′
Solar gains in watts,	calcula	ated	for each mon	th		(83)m	ı = Sum(74)m	(82)m				
(83)m= 456.33 831.16			1745.03 2098.5		41.04 2040.6	1771	1.78 1430.73	954.1	556.82	383.67		(83)
Total gains – internal	and so	olar	(84)m = (73) n	า + (83)m , watts						ı	
(84)m= 973.74 1346.29	9 1759	.28	2211.87 2533.7	2 25	545.98 2426.72	2165	5.24 1840.29	1393.87	7 1031.39	885.13		(84)
7. Mean internal tem	nperati	ur <u>e</u> (heating seaso	on)								
Temperature during	•	•			area from Tab	ole 9.	Th1 (°C)				21	(85)
Utilisation factor for		•		_		- 1	· - /				<u> </u>	
Jan Feb	-	_	Apr May	Ť	Jun Jul	A	ug Sep	Oct	Nov	Dec		
	•		<u> </u>		ı		<u>· · · · · · · · · · · · · · · · · · · </u>		<u> </u>			

(86)m=	1	0.99	0.96	0.85	0.67	0.48	0.35	0.41	0.68	0.94	0.99	1		(86)
Mean	internal	temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)					
(87)m=	19.6	19.88	20.29	20.7	20.92	20.99	21	21	20.94	20.56	19.98	19.55		(87)
Temn	erature	during h	neating p	ariade ir	rest of	dwelling	from Ta	hla 0 Ti	h2 (°C)					
(88)m=	19.84	19.85	19.85	19.86	19.86	19.87	19.87	19.88	19.87	19.86	19.86	19.85		(88)
			l											, ,
			ains for i	r		<u> </u>			0.50	0.04	0.00			(90)
(89)m=	1	0.99	0.94	0.81	0.6	0.4	0.26	0.31	0.59	0.91	0.99	1	I	(89)
Mean	interna	temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	ps 3 to	7 in Tabl	e 9c)		-	1	
(90)m=	17.99	18.41	18.98	19.55	19.8	19.87	19.87	19.88	19.83	19.39	18.56	17.92		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.26	(91)
Mean	internal	temper	ature (fo	r the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	18.41	18.8	19.32	19.85	20.09	20.16	20.17	20.17	20.12	19.69	18.93	18.35		(92)
Apply	adjustn	nent to t	he mean	interna	temper	ature fro	m Table	4e, whe	re appro	priate				
(93)m=	18.26	18.65	19.17	19.7	19.94	20.01	20.02	20.02	19.97	19.54	18.78	18.2		(93)
8. Sp	ace hea	ting requ	uirement											
Set T	i to the r	nean int	ernal ter	mperatu	e obtain	ed at ste	ep 11 of	Table 9	o, so tha	t Ti <u>,</u> m=(76)m an	d re-calc	:ulate	
the ut	ilisation	factor fo	or gains	using Ta	ble 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	ation fac	_	ains, hm											
(94)m=	0.99	0.98	0.93	0.81	0.61	0.41	0.27	0.32	0.59	0.9	0.99	1	J	(94)
	_		, W = (94	<u> </u>										
(95)m=	<mark>9</mark> 68.6	1319.53	1642.03	1782.31	1539.29	1040.49	662.5	698.47	1094.23	1258.9	1017.4	882.01	J	(95)
			rnal tem	_								1		
(96)m =	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat			an intern	1		1		x [(93)m				1	1	
(97)m=	2793.08	2743.92	2524.16	2126.08	1618.73	1050.32	663.61	700.86	1144.92	1756.88	2304.65	2775.31		(97)
Space			ement fo	r		Wh/mont	th = 0.02	24 x [(97))m – (95				1	
(98)m=	1357.41	957.19	656.3	247.52	59.1	0	0	0	0	370.5	926.82	1408.62		
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	5983.46	(98)
Space	e heating	g require	ement in	kWh/m²	/year								38.74	(99)
8c Si	nace cod	olina rec	quiremen	nt										
		Ĭ	July and		See Tal	ole 10h								
Outou	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rate		lculated	<u> </u>			l				l	l		
(100)m=		0	0	0	0		1436.44		0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm	<u> </u>							<u> </u>	<u>I</u>		
(101)m=		0	0	0	0	0.96	0.98	0.96	0	0	0	0		(101)
Usefu	ıl loss, h	mLm (V	/atts) = ((100)m x	(101)m									
(102)m=	0	0	O	0	0		1404.91	1420.25	0	0	0	0		(102)
	s (solar d	gains ca	lculated	for appli	cable we	eather re	egion, se	e Table	10)	<u> </u>	ı	ı		
(103)m=	rì	0	0	0	0	2930.3		2519.69	0	0	0	0		(103)
Spac	e coolina	g require	ement fo	r month.	whole c	lwelling.	continu	ous (kW	h' = 0.02	24 x [(1()3)m – (102)m 1	x (41)m	
			104)m <					,	, -	21	, \	, ,	. /	
(104)m=	0	0	0	0	0	853.89	1035.87	817.98	0	0	0	0		
									Total	= Sum(104)	=	2707.74	(104)
	-0 4 B 00 4		40405/	(CAD 0 02)										

Cooled fraction	2							f C -	acalad .	oroo : (a) [0.00	(105)
Intermittency factor		able 10b)					10=	cooled	area - (4	+) = [0.66	(103)
(106)m= 0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	ı	
		<u> </u>						Tota	l = Sum(′1 <u>04)</u>	=	0	(106)
Space cooling	requirer	ment for	month =	(104)m	× (105)	× (106)r	n	_		_			
(107)m= 0	0	0	0	0	141.84	172.08	135.88	0	0	0	0		
								Total	= Sum(107)	= [449.8	(107)
Space cooling	requirer	ment in k	:Wh/m²/y	/ear				(107)) ÷ (4) =			2.91	(108)
9a. Energy red	quiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heating Fraction of sp	•	at from se	econdar	v/supple	mentary	svstem					ĺ	0	(201)
Fraction of sp					momary	•	(202) = 1 -	- (201) =			 	1	(202)
Fraction of to			-				(204) = (204)	, ,	(203)] =		l I		(204)
		Ü	•				(204) - (2	02) ~ [1	(200)] =		ļ	1	╡ `
Efficiency of r						0.4					ļ	93.3	(206)
Efficiency of s					g systen	า, %					ļ	0	(208)
Cooling Syste	em Ener	gy Efficie	ency Rat	tio								4.32	(209)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heatin		·											
1357.41	957.19	656.3	247.52	59.1	0	0	0	0	370.5	926.82	1408.62		
$(211)m = {[(98)$	<u> </u>			_									(211)
1454.89	1025.93	703.43	265.29	63.35	0	0	0	0	397.1	993.38	1509.77		_
							Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	2=	6413.14	(211)
Space heatin	-			month									
$= \{[(98)m \times (200)] $	0	00 + (20	0	0	0	0	0	0	0	0	0		
(210)		Ŭ	· ·	ŭ		Ŭ		l (kWh/yea	-			0	(215)
Water heating	•								, ,	715,10. 12			(=,
Output from wa		ter (calc	ulated al	bove)									
220.69	194.47	204.14	182.86	177.98	156.76	150.19	167.42	168.3	189.63	200.68	215.33	ı	
Efficiency of w	ater hea	iter										81	(216)
(217)m= 88.87	88.58	87.91	86.1	83.13	81	81	81	81	86.92	88.49	88.95		(217)
Fuel for water	•				-	-	_	-	-	-			
(219)m = (64) (219)m = 248.32	m x 100 219.54) ÷ (217) 232.23	m 212.39	214.09	193.53	185.41	206.69	207.78	218.16	226.78	242.09	ı	
(219)111- 240.32	219.54	232.23	212.33	214.03	190.00	100.41		I = Sum(2	<u> </u>	220.70	242.09	2607	(219)
Space cooling	n fual k	Wh/mor	nth					. • • • • • • • • • • • • • • • • • • •	7 - 7112		I		(219)
(221)m = (107)													
(221)m= 0	0	0	0	0	32.83	39.83	31.45	0	0	0	0	ı	
							Tota	I = Sum(2	21) ₆₈ =			104.12	(221)
Annual totals									k\	Wh/yeaı	,	kWh/yea	 r
Space heating	fuel use	ed, main	system	1						-		6413.14	
Water heating	fuel use	ed										2607	
Space cooling	fuel use	ed										104.12	\neg
											·		_

Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside 346.16 (230a) central heating pump: (230c)30 sum of (230a) (230g) = Total electricity for the above, kWh/year (231) 376.16 Electricity for lighting 512.18 (232)12a. CO2 emissions – Individual heating systems including micro-CHP **Emission factor Emissions Energy** kWh/year kg CO2/kWh kg CO2/year Space heating (main system 1) (211) x (261) 1385.24 0.216 Space heating (secondary) (215) x (263)0.519 (219) x Water heating 0.216 563.11 (264)(261) + (262) + (263) + (264) =Space and water heating (265)1948.35 (221) x Space cooling 0.519 54.04 (266)(231) x Electricity for pumps, fans and electric keep-hot (267)0.519 195.23 (232) x Electricity for lighting (268)0.519 265.82 sum of (265) (271) = Total CO2, kg/year (272)2463.44 $(272) \div (4) =$ **Dwelling CO2 Emission Rate** (273)15.95 El rating (section 14) (274)83

eight associates

Appendix Energy Assessment Ellerdale Road

GREEN Scenario

				User D	etails:						
Assessor Name: Software Name:	Stroma FS	SAP 201			Strom Softwa	are Vei	rsion:		Versio	n: 1.0.1.25	
A 11	4 Ellendala	Daad	Р	roperty .	Address	: House	1-GREE	N			
Address: 1. Overall dwelling dime	1 Ellerdale	Road									
1. Overall dwelling diffle	11510115.			Area	a(m²)		Av. Hei	iaht(m)		Volume(m³)	
Basement				7		(1a) x		2.6	(2a) =	174.2	(3a)
Ground floor				8	37.44	(1b) x		3	(2b) =	262.32] (3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+	·(1d)+(1e	e)+(1r	n)	54.44	(4)			j l		J
Dwelling volume	, , , , , ,		, ,	´ L)+(3c)+(3d)+(3e)+	.(3n) =	436.52	(5)
2. Ventilation rate:											J
	main heating		econdar leating	у	other		total			m³ per hour	
Number of chimneys	0	+ [0	+	0	_ = [0	x 4	40 =	0	(6a)
Number of open flues	0	+	0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ns						0	x 1	10 =	0	(7a)
Number of passive vents						Ē	0	x 1	10 =	0	(7b)
Number of flueless gas fi	res					Ì	0	x 4	40 =	0	(7c)
									Air ch	anges per hou	ır
Infiltration due to chimne	vs. flues and t	fans = (6	a)+(6b)+(7	'a)+(7b)+(7c) =	Г	0	Η.	÷ (5) =	0	(8)
If a pressurisation test has b						continue fr			. (0) –	0](0)
Number of storeys in the	ne dw <mark>elling</mark> (n	s)								0	(9)
Additional infiltration	0.7							[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0 if both types of wall are pi						•	uction			0	(11)
deducting areas of openir	ngs); if equal use	r 0.35		ŭ		`					_
If suspended wooden f		`	ed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	•									0	(13)
Percentage of windows	s and doors d	raught st	ripped		0.25 [0.2) v (1.4) · 1	1001 -			0	(14)
Window infiltration					0.25 - [0.2		100] = 12) + (13) +	(15) _		0	(15)
Infiltration rate	aEO avaraca	مرانم مناهم	io motro	o nor be					oroo	0	(16)
Air permeability value, If based on air permeabil				•	•	•	elle ol e	rivelope	area	3](17)] ₍₄₀₎
Air permeability value applie	-						is beina us	sed		0.15	(18)
Number of sides sheltere					, ,	,	3			2	(19)
Shelter factor					(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporat	ing shelter fa	ctor			(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified f	or monthly wi	nd speed	1	•							
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Tab							•		ı	
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
			·					(0.4.)	(22.)				ı	
Adjuste T	0.16	ation rat	e (allowi	ng for sr 0.14	o.14	d wind s	peed) = 0.12	(21a) x	(22a)m 0.13	0.14	0.14	0.15	1	
L Calcula				rate for t	_	_	· ·	0.12	0.13	0.14	0.14	0.13	J	
		al ventila											0.9	5 (2
			0 11	, ,	, (, ,	, ,	N5)) , othe	`) = (23a)			0.9	5 (2
			-	•	_			n Table 4h					76	.5 (2
Ĺ							- ` ` 	, 	i `	, 	` 	1 – (23c)	i ÷ 100] I	(0
24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27]	(2
· F							- 	MV) (24b	í `	r ´ `	- 	Ι ,	1	(2
24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(2
•					•	-		on from (·c) = (22b		.5 × (23b	o)			
4c)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(2
d) If r	natural v	ventilatio	on or wh	ole hous	e positiv	re input	ventilatio	on from l	loft	<u>!</u>	!	!	J	
								0.5 + [(2		0.5]			-	
24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(2
Effoc	tive oir				10.41				(0.5)					
LIIEC	live all	change	rate - er	nter (24a) or (2 <mark>4</mark> k	o) or (24	c) or (24	ld) in box	x (25)					
г	0.28	0.28	rate - er 0.27	o.26	0.25	0.24	c) or (24 0.24	ld) in box	0.24	0.25	0.26	0.27		(2
25)m= [0.28	0.28	0.27		0.25		· `		· /	0.25	0.26	0.27		(2
25)m= [3. Hea	0.28	0.28 s and he	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar	0.24 ea	U-val	0.24 ue	AXU		k-value	-	AXk
25)m= [3. Hea LEM	0.28	0.28	0.27	0.26	0.25 er:	0.24 Net Ar A ,r	0.24 ea m²	U-vali W/m2	0.24 ue 2K	A X U	K)		-	A X k kJ/K
3. Hea ELEM	0.28 at losses	0.28 s and he Gros area	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar	0.24 ea m²	U-vali W/m2	0.24 ue eK	AXU	K)	k-value	-	A X k kJ/K
25)m= [3. Hea ELEM Doors Vindov	0.28 at losses ENT	0.28 s and he Gros	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r	0.24 ea m² x1	U-valu W/m2 1.2 /[1/(1.2)+	0.24 ue 2K = 0.04] = [A X U	K)	k-value	-	A X k kJ/K
3. Head Selection (25)m= [25)m= [25]m= [25]m	0.28 ENT vs Type vs Type	0.28 s and he Gros area	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r	0.24 ea m² x1 x1	U-vali W/m2 1.2 /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [A X U (W/) 2.112	K)	k-value	-	A X k kJ/K (2
3. Head Section 19 Sec	0.28 ENT vs Type vs Type vs Type	0.28 s and he Gros area	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76	0.24 ea m² x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [A X U (W// 2.112 0.81	K)	k-value	-	A X k kJ/K (2 (2 (2
25)m= [3. Head Doors Vindov Vindov Vindov Vindov	o.28 It osses ENT vs Type vs Type vs Type vs Type	0.28 S and he Gros area	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29	0.24 ea m² x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [A X U (W/) 2.112 0.81 6.06	K)	k-value	-	A X k kJ/K (2 (2 (2
3. Head Selection (25)m= [3. Head Selection (25	o.28 IENT INT INT INT INT INT INT IN	0.28 s and he Gros area 1 2 3 4 4 5	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46	0.24 ea m² x1 x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [A X U (W// 2.112 0.81 6.06 9.69	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2
3. Head Section 1. Sec	o.28 It osses ENT vs Type vs Type vs Type vs Type	0.28 s and he Gros area 1 2 3 4 4 5	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64	0.24 ea m² x1 x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [A X U (W/) 2.112 0.81 6.06 9.69 11.04	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Section 1985 1985 1985 1985 1985 1985 1985 1985	o.28 IENT INT INT INT INT INT INT IN	0.28 s and he Gros area 1 2 3 4 5 6 6	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58	0.24 ea m² x1 x1 x1 x1 x1 x1	U-value W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Selection (1997) 4. Head Selection (19	o.28 It osses IENT IVS Type	0.28 S and he Gros area 1 1 2 2 3 4 4 5 5 6 6 6 6 6 1	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58	0.24 ea m² x1 x1 x1 x1 x1 x1 x1	U-value W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Selection (1997) 4. Head Selection (19	o.28 It ossesses to see the control of the control	0.28 S and he Gros area 1 1 2 2 2 3 4 4 4 5 5 6 6 6 6 1 6 2	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head SELEM Doors Vindov Vindov Vindov Vindov Vindov Vindov Vindov Roofligh	o.28 IENT IVS Type	0.28 S and he Gros area 1 1 2 2 2 3 4 4 4 5 5 6 6 6 6 1 6 2	0.27	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1 x1	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.24 0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [A X U (W/) 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3	K)	k-value	-	
3. Head Selection of the control of	o.28 IENT IVS Type	0.28 S and he Gros area 1 1 2 2 2 3 4 4 4 5 5 6 6 6 6 1 6 2	0.27 eat loss es (m²)	0.26 paramete Openin	0.25 er:	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5 3.61	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-value W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2) + /[1/(1.2) +	0.24 0.24 0.24 0.24 0.04] = [0.	A X U (W/) 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3 4.332	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Section 19 19 19 19 19 19 19 19 19 19 19 19 19	o.28 It ossesses IENT IVS Type IVS T	0.28 s and he Gros area 41 42 43 44 45 66 e 1 e 2 e 3	0.27 eat loss ss (m²)	0.26 paramete Openin	0.25 er: gs ₁ ²	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5 3.61 87.44	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-value W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2) + /[1/(1.2) + /[1/(1.2) +	0.24 0.24 0.24 0.24 0.24 0.04] = [0.04]	A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3 4.332 9.61840	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Sellen S	o.28 It ossesses IENT IVS Type IVS T	0.28 s and he Gros area 4 1 4 2 4 3 4 4 5 6 6 e 1 6 e 2 6 3	0.27 eat loss ss (m²)	0.26 Openin m	0.25 er: gs ₁ 2	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5 3.61 87.44 81.4	0.24 ea m² x1 x1 x1 x1 x1 x1 x1 x1 x1 x	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.24 0.04] = [0.04] =	A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3 4.332 9.61840 14.65	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2
3. Head Selection (25)m = [3.	vs Type hts Type hts Type hts Type	0.28 s and he Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 1 e 2 e 3	0.27 pat loss (m²)	0.26 Openin m	0.25 er: gs ₁ 2	0.24 Net Ar A ,r 1.76 0.71 5.29 8.46 9.64 4.58 4.94 2.5 2.5 3.61 87.44 81.4	0.24 ea	U-vali W/m2 1.2 /[1/(1.2)+ /[1/(1.2)+	0.24 0.24 0.24 0.24 0.24 0.04] = [0.04]	A X U (W// 2.112 0.81 6.06 9.69 11.04 5.24 5.66 3 4.332 9.61840 14.65 15.73	K)	k-value	-	A X k kJ/K (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2

(26) (30) + (32) =

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

Fabric heat loss, $W/K = S (A \times U)$

102.88

(33)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²k	Heat capacity Cm = S(A x k)	((28) (30) + (32) + (32a) (32e) = 44603.08	(34)
For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 11 can be used instead of a detailed calculation. Thermal bridges: S (L × Y) calculated using Appendix K if details of thermal bridging are not known (36) = 0.15 x (31) Total fabric heat loss calculated monthly Ventilation heat loss calculated monthly Ventilation heat loss calculated monthly Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (39)m = 0.33 × (25)m × (5) Heat transfer coefficient, W/K (39)m = (30)m = (37) + (38)m (39)m = (37) + (38)m (40)m = (39)m + (4) (40)m = (30)m + (4) (40)m = (30)m + (4) (40)m = (30)m + (4) (Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium 250	(35)
Total fabric heat loss	, ,	dicative values of TMP in Table 1f	` ′
Total fabric heat loss calculated monthly (38)m = 0.33 * (25)m × (5)	Thermal bridges : S (L x Y) calculated using Appendix K	56.86	(36)
Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	if details of thermal bridging are not known (36) = $0.15 \times (31)$		
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Total fabric heat loss	(33) + (36) = 159.74	(37)
(38) me	Ventilation heat loss calculated monthly	(38) m = $0.33 \times (25)$ m x (5)	
Heat transfer coefficient, W/K (39)m= 200.08 199.62 199.16 196.87 196.41 194.11 194.11 193.65 195.03 196.41 197.33 198.25 Average = Sum(39), v, /12= 196.75 (39) Heat loss parameter (HLP), W/m²K (40)m= 1.3 1.29 1.29 1.27 1.27 1.26 1.26 1.25 1.26 1.27 1.28 1.28 Average = Sum(40), v, /12= 1.27 (40) Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (41)m= 31 28 31 30 31 30 31 31 30 31 30 31 30 31 (41) 4. Water heating energy requirement: Assumed occupancy, N if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9) if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9)9 if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9)9 if TFA ≥ 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA +13.9)2)] + 0.0013 × (TFA -13.9)9 if TFA ≥ 13.9,	Jan Feb Mar Apr May Jun Jul Aug	Sep Oct Nov Dec	
(39)ma	(38)m= 40.34 39.88 39.43 37.13 36.67 34.37 34.37 33.92 3	5.29 36.67 37.59 38.51	(38)
Average = Sum(39), 12 / 12 = 196.75 (39) Heat loss parameter (HLP), W/m²K (40)m = (39)m + (4) (40)m = 1.3	Heat transfer coefficient, W/K	(39)m = (37) + (38)m	
Heat loss parameter (HLP), W/m²K (40)m= 1.3	(39)m= 200.08 199.62 199.16 196.87 196.41 194.11 194.11 193.65 19	95.03 196.41 197.33 198.25	
Average = Sum(40), 12 / 12 1.27 (40)	Heat loss parameter (HLP), W/m²K		(39)
Number of days in month (Table 1a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (41)m= 31 28 31 30 31 30 31 30 31 31 30 31 30 31 30 31 (41) 4. Water heating energy requirement: **Reduce the annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Energy content of hot water used - calculated monthly = 4.190 x Vd, m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45), 12 = 1637.06 (45) It instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	(40)m= 1.3 1.29 1.29 1.27 1.27 1.26 1.26 1.25	1.26 1.27 1.28 1.28	
4. Water heating energy requirement: Assumed occupancy, N If TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA -13.9)2)] + 0.0013 × (TFA -13.9)	Number of days in month (Table 1a)	Average = Sum(40) _{1 12} /12= 1.27	(40)
4. Water heating energy requirement: Assumed occupancy, N If TFA > 13.9, N = 1 + 1.76 × [1 - exp(-0.000349 × (TFA -13.9)2)] + 0.0013 × (TFA -13.9)	Jan Feb Mar Apr May Jun Jul Aug	Sep Oct Nov Dec	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)			(41)
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)			
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	1 Water heating energy requirement:	kWh/year:	
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1 Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	4. Water reading energy requirement.	Kwiiiyeai.	
Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target or not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd, m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd, m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)	if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.001		(42)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)			(40)
Hot water usage in litres per day for each month $Vd,m = factor from Table 1c \times (43)$ (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	Redu <mark>ce the annual average</mark> hot water usage by 5% if the dwelling is designed to achieve a w		(43)
Hot water usage in litres per day for each month $Vd,m = factor from Table 1c \times (43)$ (44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 101.97 106.13 110.29 114.45 Total = Sum(44) ₁₋₁₂ = 1248.56 (44) Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) ₁₋₁₂ = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	Jan Feb Mar Apr May Jun Jul Aug	Sen Oct New Dec	
Total = Sum(44) _{1 12} = 1248.56 (44) Energy content of hot water used - calculated monthly = $4.190 \times Vd$, $m \times nm \times DTm / 3600 \times Wh/month$ (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) _{1 12} = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)		Sep Oct Nov Dec	
Total = Sum(44) _{1 12} = 1248.56 (44) Energy content of hot water used - calculated monthly = $4.190 \times Vd$, $m \times nm \times DTm / 3600 \times Wh/month$ (see Tables 1b, 1c, 1d) (45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 118.99 138.67 151.37 164.37 Total = Sum(45) _{1 12} = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	(44)m= 114.45 110.29 106.13 101.97 97.8 93.64 93.64 97.8 10	01.97 106.13 110.29 114.45	
Energy content of hot water used - calculated monthly = $4.190 \times Vd$, $m \times nm \times DTm / 3600 \times Wh/month$ (see Tables 1b, 1c, 1d) (45)m= 169.73	(11)11-		(44)
Total = Sum(45) _{1 12} = 1637.06 (45) If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46) _m = $\begin{bmatrix} 25.46 & 22.27 & 22.98 & 20.03 & 19.22 & 16.59 & 15.37 & 17.64 & 17.85 & 20.8 & 22.7 & 24.66 & (46) &$	Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kW	` '	` ′
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	(45)m= 169.73 148.45 153.18 133.55 128.14 110.58 102.47 117.58 12	18.99 138.67 151.37 164.37	
(46)m= 25.46 22.27 22.98 20.03 19.22 16.59 15.37 17.64 17.85 20.8 22.7 24.66 (46)	If instantaneous water heating at point of use (no hot water storage), enter 0 in hoves (46) to	· · ·	(45)
		· ·	(40)
		7.85 20.8 22.7 24.66	(46)
Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)	5	e vessel n	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)		<u> </u>	()
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)		e) enter '0' in (47)	
Water storage loss:	Water storage loss:		
a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)	a) If manufacturer's declared loss factor is known (kWh/day):	0	(48)
Temperature factor from Table 2b 0 (49)	Temperature factor from Table 2b	0	(49)
Energy lost from water storage, kWh/year $(48) \times (49) = 0$ (50)		0	(50)
b) If manufacturer's declared cylinder loss factor is not known:	b) If manufacturer's declared cylinder loss factor is not known:		

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)
If community heating see section 4.3
Volume factor from Table 2a 0 (52) Temperature factor from Table 2b 0 (53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ (54) Enter (50) or (54) in (55)
Water storage loss calculated for each month ((56)m = (55) × (41)m
(56) m =
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H
(57)m =
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 (59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m
(61)m= 50.96 46.03 50.96 49.32 49.84 46.18 47.72 49.84 49.32 50.96 49.32 50.96 (61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$
(62)m= 220.69 194.47 204.14 182.86 177.98 156.76 150.19 167.42 168.3 189.63 200.68 215.33 (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 =
Output from water heater
(64)m= 220.69 194.47 204.14 182.86 177.98 156.76 150.19 167.42 168.3 189.63 200.68 215.33
Output from water heater (annual) _{1 12} 2228.45 (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= 69.17 60.86 63.67 56.73 55.07 48.31 46 51.56 51.89 58.85 62.66 67.39 (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= 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 147.05 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
(67)m= 29 25.76 20.95 15.86 11.86 10.01 10.81 14.06 18.87 23.96 27.96 29.81 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m= 325.31 328.69 320.18 302.07 279.21 257.73 243.37 240 248.5 266.61 289.47 310.96 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 37.7 37.7 37.7 37.7 37.7 37.7 37.7 37.
Pumps and fans gains (Table 5a)
(70) m =
Losses e.g. evaporation (negative values) (Table 5)
(71) m =
Water heating gains (Table 5)
(72)m= 92.98 90.57 85.58 78.8 74.02 67.1 61.83 69.3 72.07 79.09 87.02 90.58 (72)

Total internal gain	s =					(66)	m + (67)m	+ (68	8)m +	(69)m + (70)m +	(71)m + (72)	m		
(73)m= 517.4 515.	13 4	96.82	466.84	435.19	40	4.95	386.13	393	.46	409.56	439.78	3 474.57	501.46		(73)
6. Solar gains:															
Solar gains are calcula	ted usii	ng solai	r flux from	Table 6a	and			tions	to cor	nvert to the	e applic		ion.		
Orientation: Acces		ctor	Area m²			Flu	x ole 6a		т,	g_ able 6b		FF		Gains	
	b u	_			_	rat	ле ба ———		1 6	abie ob	_	Table 6c		(W)	
	.77	X	8.4	16	x	3	6.79	X		0.55	X	0.8	=	94.91	(77)
Southeast 0.9x	.77	X	9.6	64	x	3	6.79	X		0.55	X	0.8	=	108.15	(77)
	.77	X	8.4	16	x	6	2.67	X		0.55	X	0.8	=	161.67	(77)
Southeast 0.9x	.77	X	9.6	64	X	6	2.67	X		0.55	X	0.8	=	184.22	(77)
Southeast 0.9x	.77	X	8.4	16	x	8	5.75	X		0.55	X	0.8	=	221.21	(77)
Southeast 0.9x	.77	X	9.6	64	x	8	5.75	X		0.55	X	0.8	=	252.06	(77)
Southeast 0.9x	.77	X	8.4	16	x	10	06.25	X		0.55	X	0.8	=	274.09	(77)
Southeast 0.9x	.77	X	9.6	64	x	10	06.25	x		0.55	X	0.8	=	312.32	(77)
Southeast 0.9x	.77	X	8.4	16	x	11	19.01	x		0.55	X	0.8	=	307	(77)
Southeast 0.9x	.77	X	9.6	64	x [11	19.01	x		0.55	X	0.8	=	349.82	(77)
Southeast 0.9x	.77	X	8.4	16	x [11	18.15	X		0.55	X	0.8		304.78	(77)
Southeast 0.9x	.77	x	9.6	64	x	11	18.15	х		0.55	x	0.8		347.29	(77)
Southeast 0.9x	.77	X	8.4	16	х	11	13.91	x		0.55	x	0.8	=	293.84	(77)
Southeast 0.9x	.77	x	9.6	64	×	11	13.91	x		0.55	x	0.8	=	334.83	(77)
Southeast 0.9x	.77	x	8.4	16	x	10	04.39	X		0.55	x	0.8	-	269.29	(77)
Southeast 0.9x	.77	x	9.6	64	×	10	04.39	х		0.55	x	0.8	=	306.85	(77)
Southeast 0.9x	.77	×	8.4	16	х	9	2.85	х		0.55	x	0.8	=	239.52	(77)
Southeast 0.9x	.77	x	9.6	64	х	9	2.85	x		0.55	X	0.8	=	272.93	(77)
Southeast 0.9x	.77	x	8.4	16	x	6	9.27	х		0.55	x	0.8	=	178.68	(77)
Southeast 0.9x	.77	x	9.6	64	x	6	9.27	х		0.55	×	0.8	=	203.61	(77)
Southeast 0.9x	.77	x	8.4	16	x [4	4.07	x		0.55	x	0.8		113.69	(77)
Southeast 0.9x	.77	x	9.6	64	x [4	4.07	x		0.55	×	0.8		129.54	(77)
Southeast 0.9x	.77	x	8.4	16	x	3	1.49	x		0.55	×	0.8	╡ =	81.23	(77)
Southeast 0.9x	.77	x	9.6	64	x	3	1.49	х		0.55	x	0.8	╡ -	92.56	(77)
Southwest _{0.9x}	.77	×	4.5	58	x [3	6.79			0.55	×	0.8	╡ -	51.38	(79)
=	.77	×	4.9	94	x		6.79			0.55	×	0.8	= =	55.42	(79)
Courtlement	.77	x	4.5		x [2.67			0.55	x	0.8		87.53	(79)
	.77	x	4.9		x		2.67			0.55	x	0.8	_ =	94.41	(79)
Otht	.77	x	4.5		x [5.75			0.55	x	0.8		119.76	(79)
Otht	.77	×	4.9		x [5.75			0.55	×	0.8		129.17	(79)
	.77	×	4.5		x [06.25			0.55	×	0.8	╡ -	148.38	(79)
0	.77	×	4.9		x [06.25			0.55	ا ×	0.8	╡ -	160.05	(79)
Couthweater	.77	X	4.5		^ L		19.01			0.55	X	0.8	= =	166.2	(79)
	.77		4.9		^ L x [19.01			0.55	^_ x	0.8	= =	179.27	(79)
0.01	.,,			· ·	~ L	1	10.01	l		3.00	^_	0.0		110.21	

Southwest _{0.9x}	0.77	1	1.50	1 .,	140.45	1	0.55	۱.,		l	405	7(70)
Southwest _{0.9x}	0.77	X	4.58	X	118.15] 1	0.55	X	0.8	= 	165	(79)
<u> </u>	0.77	X	4.94	X	118.15] 1	0.55	X	0.8	= 	177.97	(79)
Southwesto a	0.77	X	4.58	X	113.91] 1	0.55	X	0.8	= 	159.08	(79)
Southwest _{0.9x}	0.77	X	4.94	X	113.91] 1	0.55	X	0.8	= 	171.58	(79)
Southwest _{0.9x}	0.77	X	4.58	X	104.39	<u> </u>	0.55	X	0.8	=	145.78	(79)
Southwest _{0.9x}	0.77	X	4.94	X	104.39	<u> </u>	0.55	X	0.8	=	157.24	(79)
Southwest _{0.9x}	0.77	X	4.58	X	92.85		0.55	X	0.8	=	129.67	(79)
Southwest _{0.9x}	0.77	X	4.94	X	92.85	<u> </u>	0.55	X	0.8	=	139.86	(79)
Southwest _{0.9x}	0.77	X	4.58	X	69.27	<u> </u>	0.55	X	0.8	=	96.73	(79)
Southwest _{0.9x}	0.77	X	4.94	X	69.27	<u> </u>	0.55	X	0.8	=	104.34	(79)
Southwest _{0.9x}	0.77	X	4.58	X	44.07	[0.55	X	0.8	=	61.55	(79)
Southwest _{0.9x}	0.77	X	4.94	X	44.07	_	0.55	X	0.8	=	66.38	(79)
Southwest _{0.9x}	0.77	X	4.58	X	31.49	<u> </u>	0.55	X	0.8	=	43.97	(79)
Southwest _{0.9x}	0.77	X	4.94	X	31.49	<u> </u>	0.55	X	0.8	=	47.43	(79)
Northwest _{0.9x}	0.77	X	0.71	X	11.28	X	0.55	X	0.8	=	2.44	(81)
Northwest _{0.9x}	0.77	X	5.29	X	11.28	x	0.55	x	0.8	=	18.2	(81)
Northwest 0.9x	0.77	X	0.71	X	22.97	X	0.55	X	0.8	=	4.97	(81)
Northwest 0.9x	0.77	X	5.29	X	22.97	X	0.55	X	0.8	=	37.05	(81)
Northwest 0.9x	0.77	X	0.71	х	41.38	x	0.55	x	0.8	=	8.96	(81)
Northwest 0.9x	0.77	x	5.29	х	41.38	x	0.55	x	0.8	=	66.75	(81)
Northwest 0.9x	0.77	X	0.71	X	67.96	x	0.55	x	0.8	=	14.71	(81)
Northwest 0.9x	0.77	x	5.29	x	67.96	Х	0.55	x	0.8	=	109.61	(81)
Northwest _{0.9x}	0.77	x	0.71	x	91.35	X	0.55	x	0.8	=	19.78	(81)
Northwest _{0.9x}	0.77	X	5.29	х	91.35	X	0.55	x	0.8	=	147.34	(81)
Northwest _{0.9x}	0.77	x	0.71	x	97.38	x	0.55	x	0.8	=	21.08	(81)
Northwest _{0.9x}	0.77	X	5.29	X	97.38	x	0.55	x	0.8	=	157.08	(81)
Northwest _{0.9x}	0.77	x	0.71	X	91.1	x	0.55	x	0.8	=	19.72	(81)
Northwest _{0.9x}	0.77	X	5.29	x	91.1	x	0.55	x	0.8	=	146.95	(81)
Northwest _{0.9x}	0.77	x	0.71	X	72.63	x	0.55	x	0.8	=	15.72	(81)
Northwest 0.9x	0.77	X	5.29	x	72.63	x	0.55	x	0.8	=	117.15	(81)
Northwest _{0.9x}	0.77	X	0.71	x	50.42	x	0.55	x	0.8	=	10.92	(81)
Northwest _{0.9x}	0.77	X	5.29	x	50.42	x	0.55	X	0.8	=	81.33	(81)
Northwest 0.9x	0.77	X	0.71	x	28.07	x	0.55	x	0.8	=	6.08	(81)
Northwest _{0.9x}	0.77	x	5.29	x	28.07	x	0.55	x	0.8	=	45.27	(81)
Northwest _{0.9x}	0.77	x	0.71	x	14.2	x	0.55	x	0.8	=	3.07	(81)
Northwest _{0.9x}	0.77	x	5.29	x	14.2	x	0.55	x	0.8	j =	22.9	(81)
Northwest _{0.9x}	0.77	x	0.71	x	9.21	x	0.55	x	0.8	j =	1.99	(81)
Northwest _{0.9x}	0.77	×	5.29	x	9.21	x	0.55	x	0.8	=	14.86	(81)
Rooflights _{0.9x}	1	×	2.5	×	26	×	0.55	x	0.8	=	25.74	(82)
Rooflights _{0.9x}	1	×	2.5	×	26	x	0.55	x	0.8	=	25.74	(82)
Rooflights _{0.9x}	1	X	3.61	X	26	X	0.55	x	0.8	 =	74.34	(82)
L _								l		ı		

Rooflights 0.9s	Rooflights 0.9x 1	1		1		1		¬ г		_		7(00)
Rooflights 0.9x	D = 40 mb 4 =] 1		! !		1		╡		=		=
Rooflights 0.9x	Do-district-]]		!]		1		╡		=		╡`′
Rooflights 0.9x]]]]]]		╡		=		╡`′
Rooflights 0.0x	D flis-late]]		X		1		_		=		╡`′
Rooflights 0.9x		X		X	96	X	0.55	X	0.8	_ =	95.04	╡
Rooflights 0.9x		X		X	96	X	0.55	X		_ =		╡`′
Rooflights 0.9x		X		X	150	X	0.55	x [0.8	_ =	148.5	╡`′
Rooflights 0.9x		X	2.5	X	150	X	0.55	X	0.8	=	148.5	(82)
Rooflights 0.9x		X	3.61	X	150	X	0.55	X	0.8	=	428.87	(82)
Rooflights 0.9x		X	2.5	X	192	X	0.55	X	0.8	=	190.08	(82)
Rooflights 0.9x		X	2.5	X	192	X	0.55	x	0.8	=	190.08	(82)
Rooflights 0.9x		X	3.61	x	192	X	0.55	X	0.8	=	548.95	(82)
Rooflights 0.9x		X	2.5	X	200	Х	0.55	X	0.8	=	198	(82)
Rooflights 0.9x		X	2.5	X	200	X	0.55	x [0.8	=	198	(82)
Rooflights 0.9x	Rooflights 0.9x 1	X	3.61	X	200	X	0.55	X	0.8	=	571.82	(82)
Rooflights 0.9x	Rooflights 0.9x 1	X	2.5	x	189	X	0.55	x [0.8	=	187.11	(82)
Rooflights 0.9x	Rooflights 0.9x 1	X	2.5	X	189	X	0.55	x	0.8	=	187.11	(82)
Rooflights 0.9x	Rooflights 0.9x	X	3.61	X	189	Х	0.55	X	0.8	=	540.37	(82)
Rooflights 0.9x	Rooflights 0.9x 1	x	2.5	x	157] x	0.55	x	0.8	=	155.43	(82)
Rooflights 0.9x	Rooflights _{0.9x} 1	x	2.5	х	157	_ x	0.55	х	0.8	=	155.43	(82)
Rooflights 0.9x	Rooflights _{0.9x} 1	x	3.61	X	157	x	0.55	х	0.8	=	448.88	(82)
Rooflights 0.9x	Rooflights 0.9x 1	x	2.5	x	115	Х	0.55	х	0.8	=	113.85	(82)
Rooflights 0.9x	Rooflights 0.9x 1	x	2.5	х	115	Х	0.55	х	0.8	=	113.85	(82)
Rooflights 0.9x	Rooflights 0.9x	x	3.61	х	115	х	0.55	х	0.8	=	328.8	(82)
Rooflights 0.9x	Rooflights 0.9x 1	x	2.5	х	66	x	0.55	x	0.8	=	65.34	(82)
Rooflights $0.9x$	Rooflights 0.9x 1	x	2.5	х	66	х	0.55	_ x [0.8	=	65.34	(82)
Rooflights 0.9x	Rooflights 0.9x 1	x	3.61	x	66	x	0.55	×	0.8	=	188.7	(82)
Rooflights 0.9x	Rooflights 0.9x 1	x	2.5	x	33	x	0.55		0.8	=	32.67	(82)
Rooflights 0.9x 1	Rooflights 0.9x 1	X	2.5	х	33	х	0.55	_ x [0.8	=	32.67	(82)
Rooflights 0.9x	Rooflights 0.9x 1	X	3.61	х	33	X	0.55	- x	0.8	=	94.35	(82)
Rooflights 0.9x 1	D (1) 1 (X		ı X) x		x		= =		=
Rooflights 0.9x 1 x 3.61 x 21 x 0.55 x 0.8 = 60.04 (82) Solar gains in watts, calculated for each month (83)m = Sum(74)m (82)m (83)m = 456.33 831.16 1262.46 1745.03 2098.53 2141.04 2040.6 1771.78 1430.73 954.1 556.82 383.67 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m = 973.74 1346.29 1759.28 2211.87 2533.72 2545.98 2426.72 2165.24 1840.29 1393.87 1031.39 885.13 (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)	D flis-late] 1		!]) X		╡		= =		=
Solar gains in watts, calculated for each month (83)m = Sum(74)m (82)m (83)m= 456.33 831.16 1262.46 1745.03 2098.53 2141.04 2040.6 1771.78 1430.73 954.1 556.82 383.67 (83) Total gains – internal and solar (84)m = (73)m + (83)m, watts (84)m= 973.74 1346.29 1759.28 2211.87 2533.72 2545.98 2426.72 2165.24 1840.29 1393.87 1031.39 885.13 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	D (1) 11] 1		! 1] 1		╡		= =		=
(83)m= 456.33 831.16 1262.46 1745.03 2098.53 2141.04 2040.6 1771.78 1430.73 954.1 556.82 383.67 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 973.74 1346.29 1759.28 2211.87 2533.72 2545.98 2426.72 2165.24 1840.29 1393.87 1031.39 885.13 (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)	J]	0.01	l	21]	0.00		0.0		00.04	(\/
(83)m= 456.33 831.16 1262.46 1745.03 2098.53 2141.04 2040.6 1771.78 1430.73 954.1 556.82 383.67 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 973.74 1346.29 1759.28 2211.87 2533.72 2545.98 2426.72 2165.24 1840.29 1393.87 1031.39 885.13 (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)	Solar gains in watts, calcula	ated	for each mon	th		(83)m	ı = Sum(74)m	(82)m				
(84)m= 973.74 1346.29 1759.28 2211.87 2533.72 2545.98 2426.72 2165.24 1840.29 1393.87 1031.39 885.13 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	<u> </u>		i			`			556.82	383.67		(83)
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Total gains – internal and s	olar	(84)m = (73) n	า + (33)m , watts		!!.		-!!-		l	
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	(84)m= 973.74 1346.29 1759	9.28	2211.87 2533.7	2 25	545.98 2426.72	2165	5.24 1840.29	1393.87	7 1031.39	885.13		(84)
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	7. Mean internal temperat	ure (heating seaso	on)					•			
Utilisation factor for gains for living area, h1,m (see Table 9a)	· ·				area from Tah	ole 9	Th1 (°C)				21	(85)
		• .		_		0	(),					
		_		Ť	<u> </u>	Α	ug Sep	Oct	Nov	Dec		
			1 1	<u></u>	1 3 3		<u> </u>		1 1		ı	

(86)m=	1	0.99	0.96	0.85	0.67	0.48	0.35	0.41	0.68	0.94	0.99	1		(86)
Mean	internal	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)					
(87)m=	19.6	19.88	20.29	20.7	20.92	20.99	21	21	20.94	20.56	19.98	19.55		(87)
Tomn		durina h	neating p	ariade ir	rest of	dwelling	from Ta	hla 0 Ti	h2 (°C)					
(88)m=	19.84	19.85	19.85	19.86	19.86	19.87	19.87	19.88	19.87	19.86	19.86	19.85		(88)
			l								10.00		l	,
			ains for i			<u> </u>			0.50	0.04	0.00	4	1	(90)
(89)m=	1	0.99	0.94	0.81	0.6	0.4	0.26	0.31	0.59	0.91	0.99	1		(89)
Mean	interna	temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	ps 3 to	7 in Tabl	e 9c)			ı	
(90)m=	17.99	18.41	18.98	19.55	19.8	19.87	19.87	19.88	19.83	19.39	18.56	17.92		(90)
									f	fLA = Livin	g area ÷ (4	4) =	0.26	(91)
Mean	internal	l temper	ature (fo	r the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	18.41	18.8	19.32	19.85	20.09	20.16	20.17	20.17	20.12	19.69	18.93	18.35		(92)
Apply	/ adjustn	nent to t	he mean	internal	temper	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	18.26	18.65	19.17	19.7	19.94	20.01	20.02	20.02	19.97	19.54	18.78	18.2		(93)
8. Sp	ace hea	ting requ	uirement											
Set T	i to the r	mean int	ernal ter	mperatui	re obtain	ed at ste	ep 11 of	Table 9	o, so tha	t Ti <u>,</u> m=(76)m an	d re-calc	:ulate	
the ut	tilisation	factor fo	or gains	using Ta	ble 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	ation fac	_	ains, hm											
(94)m=	0.99	0.98	0.93	0.81	0.61	0.41	0.27	0.32	0.59	0.9	0.99	1		(94)
			, W = (94	<u> </u>										
(95)m=	968.6	1319.53	1642.03	1782.31	1539.29	1040.49	662.5	698.47	1094.23	1258.9	1017.4	882.01		(95)
	$\overline{}$	age exte	rnal tem	perature	from Ta	able 8								
(96)m =		4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat			an intern			1		x [(93)m					Í	
(97)m=	2793.08	2743.92	2524.16	2126.08	1618.73	1050.32	663.61	700.86	1144.92	1756.88	2304.65	2775.31		(97)
Space			ement fo			Wh/mont	th = 0.02	24 x [(97))m – (95				ı	
(98)m=	1357.41	957.19	656.3	247.52	59.1	0	0	0	0	370.5	926.82	1408.62		
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	5983.46	(98)
Space	e heating	g require	ement in	kWh/m²	² /year								38.74	(99)
8c S	pace cod	olina rea	quiremen	nt										
		Ĭ	July and		See Tal	ole 10h								
Jaiou	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rate		lculated	•			l		<u> </u>	l			i ·	
(100)m=		0	0	0	0		1436.44		0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm										ı	
(101)m=	0	0	0	0	0	0.96	0.98	0.96	0	0	0	0		(101)
Usefu	ىـــــــا I loss, h ا	mLm (V	Vatts) = ((100)m x	(101)m								i	
(102)m=		0	0	0	0		1404.91	1420.25	0	0	0	0		(102)
Gains	s (solar o	gains ca	lculated	for appli	cable we	eather re	egion, se	e Table	10)	1				
(103)m=	r `	0	0	0	0	2930.3		2519.69	0	0	0	0		(103)
Spac	e cooling	g require	ement fo	r month,	whole d	lwelling,	continu	ous (kW	h' = 0.0	24 x [(1(03)m – (102)m] :	x (41)m	
			(104)m <					,	,	- '			. ,	
(104)m=	0	0	0	0	0	853.89	1035.87	817.98	0	0	0	0		
									Total	= Sum(104)	=	2707.74	(104)
0.	ECAD 204	2 Varaion	. 1 0 1 05 /	(CAD 0 02)	http://w	uu otromo	oom					'	Do	an 9 of 10

Cooled freeties	2							f C -	analad .	oroo : (4) [0.00	(105)
Cooled fraction Intermittency for		able 10h)					10=	cooled	area - (4	+) =	0.66	(100)
(106)m= 0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
L	<u> </u>	<u> </u>			ļ	<u> </u>		Tota	ı I = Sum('1 <u>04</u>)	=	0	(106)
Space cooling	requirer	ment for	month =	(104)m	× (105)	× (106)r	m			,			
(107)m= 0	0	0	0	0	141.84	172.08	135.88	0	0	0	0		
								Total	l = Sum(107)	= [449.8	(107)
Space cooling	requirer	ment in k	:Wh/m²/y	/ear				(107)) ÷ (4) =			2.91	(108)
9a. Energy red	quiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heating	•			./							ſ		7(004)
Fraction of sp			,		mentary	•		(004)			ļ	0	(201)
Fraction of sp			-				(202) = 1 -	, ,	,		ļ	1	(202)
Fraction of to	tal heati	ng from	main sys	stem 1			(204) = (204)	02) × [1 –	(203)] =		ļ	1	(204)
Efficiency of I	main spa	ace heat	ing syste	em 1								93.3	(206)
Efficiency of	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
Cooling Syste	em Ener	gy Efficie	ency Ra	tio								4.32	(209)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heatin	g require	ement (c	alculate	d above))								
1357.41	957.19	656.3	247.52	59.1	0	0	0	0	370.5	926.82	1408.62		
(211 <mark>)m = {[(98</mark>)m x (20	(4)] } x 1	00 ÷ (20	(6)									(211)
14 <mark>54.89</mark>	1025.93	703.43	265.29	63.35	0	0	0	0	397.1	993.38	15 <mark>09.77</mark>		
							Tota	ıl (kWh/yea	ar) =Sum(2	211)	_=	6413.14	(211)
Sp <mark>ace h</mark> eatin				month									
$= \{[(98)m \times (20)]$													
(215)m= 0	0	0	0	0	0	0	0 Tota	0	0	0	0	_	7(045)
							Tota	ıl (kWh/yea	ar) =Surri(2	213) _{15,10. 12}	2=	0	(215)
Water heating Output from w		tor (colo	ulated a	001(0)									
220.69	194.47	204.14	182.86	177.98	156.76	150.19	167.42	168.3	189.63	200.68	215.33		
Efficiency of w	ater hea	ıter					ļ.	l	l			81	(216)
(217)m= 88.87	88.58	87.91	86.1	83.13	81	81	81	81	86.92	88.49	88.95		(217)
Fuel for water	heating,	kWh/mo	onth			Į.		!	!	Į.			
(219)m = (64)					Γ	Ι	ı	ı	ı	I			
(219)m= 248.32	219.54	232.23	212.39	214.09	193.53	185.41	206.69	207.78	218.16	226.78	242.09		_
_							Tota	I = Sum(2	19a) ₁₁₂ =		l	2607	(219)
Space cooling (221)m = (107			nth.										
(221)m = 0	0	0	0	0	32.83	39.83	31.45	0	0	0	0		
	<u> </u>	<u> </u>			<u> </u>	<u> </u>	Tota	l = Sum(2:	21) ₆₈ =	<u>I</u>		104.12	(221)
Annual totals									k.	Wh/yeaı	ا ر	kWh/yea	
Space heating		ed, main	system	1					r.	y cai	· [6413.14	
Water heating	fuel use	d									l [2607	Ħ
Space cooling											[104.12	╡
Spass sooming		. •									l	104.12	

Electricity for pumps, fans and electric keep-hot mechanical ventilation - balanced, extract or positive input from outside 346.16 (230a) central heating pump: (230c)30 sum of (230a) (230g) = Total electricity for the above, kWh/year (231) 376.16 Electricity for lighting 512.18 (232)Electricity generated by PVs (233)-1977.28 12a. CO2 emissions – Individual heating systems including micro-CHP **Energy Emission factor Emissions** kWh/year kg CO2/kWh kg CO2/year (211) x Space heating (main system 1) (261)0.216 1385.24 (215) x Space heating (secondary) 0.519 0 (263)(219) x Water heating (264)0.216 563.11 (261) + (262) + (263) + (264) =Space and water heating 1948.35 (265)Space cooling (221) x 0.519 (266)54.04 Electricity for pumps, fans and electric keep-hot (231) x (267)0.519 195.23 (232) x **Electricity for lighting** 265.82 (268)0.519 Energy saving/generation technologies Item 1 0.519 -1026.21 (269)Total CO2, kg/year sum of (265) (271) (272)1437.23

 $(272) \div (4) =$

Dwelling CO2 Emission Rate

El rating (section 14)

9.31

90

(273)

(274)