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Planning Statement Energy Assessment 34A-36 Kilburn High Road

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Executive Summary

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About the Scheme:

The project consists of the construction of a new 5th floor level on top of an existing building, to create 5 new residential units. The development is located in in the London Borough of Camden area and it has a total net internal area of 328 m^2 .

Planning Policy

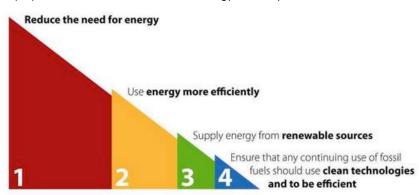
In accordance with the Sustainable, Design and Construction SPG, the scheme is required to achieve a 35% carbon reduction target (beyond Part L 2013) as set out in The London Plan Policy 5.2.

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 dwelling 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)	6.72	6.32	-	4.19	
CO ₂ emissions saving (Tonnes CO ₂ /yr)	-	0.40	-	2.13	
Saving from each stage (%)	-	6.0	-	31.7	
Total CO ₂ emissions saving (Tonnes CO ₂ /yr)	2.53				

37.7% Total carbon emissions savings over Part L of the Building Regulations 2013 achieved

Executive Summary

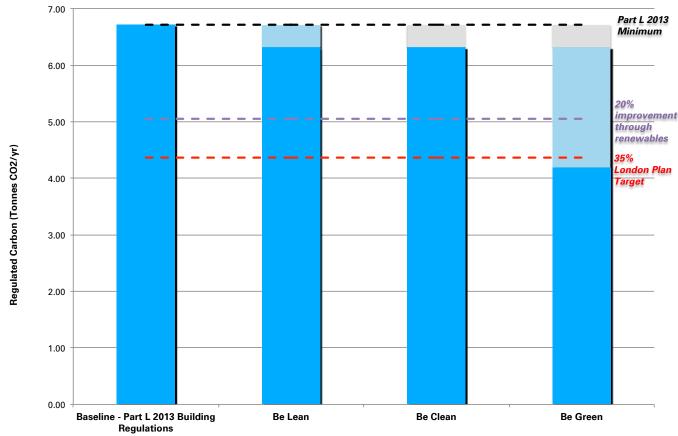
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GLA's Energy Hierarchy – Regulated Carbon Emissions:

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 6.0% from the fabric energy efficiency measures described in the 'Be Lean' section, and will reduce total carbon emissions by 37.7% over Building Regulations with the further inclusion of low and zero carbon technologies (PV panel system).

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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 offset 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	0.40	6.0%					
Savings from 'Be Clean'-After CHP	0.00	0.0%					
Savings from 'Be Green'-After renewable energy	2.13	31.7%					
Total Cumulative Savings	2.53	37.7%					
Total Target Savings	2.35	35%					
Annual Surplus	0.18						

Total Carbon Emissions:

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

Carbon Dioxide Emissions – Regulated and Unregulated (Tonnes CO ₂ /yr)							
	Regulated Emissions	Unregulated Emissions	Total Emissions				
Baseline: Part L 2013	6.72	4.94	11.66				
Be Lean: After demand reduction	6.32	4.94	11.26				
Be Clean: After CHP	-	-	-				
Be Green: After Renewable energy	4.19	4.94	9.13				

Introduction Energy Assessment 34A-36 Kilburn High 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 followed in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the document "ENERGY PLANNING: Greater London Authority guidance on preparing energy assessments (March 2016)"

Under the GLA's guidance, applications for major developments should be accompanied by an energy statement. The energy statement should provide information demonstrating how the energy hierarchy has been followed i.e. 'Lean, Clean, Green', including consideration of passive design and decentralised energy options such CHP/Community CHP.

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

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

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Building Regulations Part L 2013 Minimum Compliance:

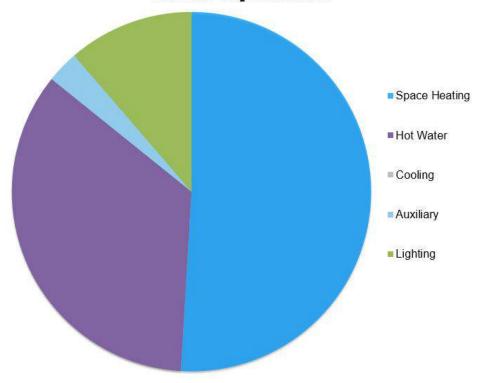
The 'baseline' carbon emissions for the development are 6.72 Tonnes $\rm CO_2/yr.$

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 CO₂/yr

Heating	Hot Water	Cooling	Auxiliary	Lighting
3.42	2.34	0.00	0.19	0.76





Overview:

The chart above shows that heating is the primary source of carbon emissions, and hot water is the second largest, across the scheme as a whole.

'Be Lean': Demand Reduction Measures Energy Assessment 34A-36 Kilburn High Road

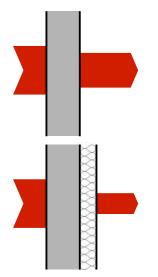
Be Lean - Summary:

Demand reduction measures have reduced the scheme's carbon emissions by 6.0% over the minimum Part L 2013 Building Regulations baseline.

Glazing Percentage:

The proposed scheme has an average of 28.83% glazing area (glazed area/façade area \times 100).

Building Fabric Passive Design measures:



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

U Values:

Element	Minimum Building Regulations U value	Proposed U value
	W/m²K	W/m²K
External Walls	0.30	0.15
Corridor Walls	0.30	0.15
Party Walls	0.20	0.00
Roofs	0.20	0.10
Windows	2.00	1.30
Rooflights	2.00	1.60
Doors	2.00	1.30

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 caused by poor perpends in blockwork inner leafs. Structural leakage is hard to remedy retrospectively therefore good detailing at the design stage is essential.

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

Thermal Bridging:

The linear lengths of the thermal bridging junctions have been measured for the scheme. The scheme has been indicatively modelled with the accredited thermal bridge Psi-values for lintel (E2), sill (E3), jamb (E4), corner (E16), inverted corner (E17) and party wall (E18). In addition, a bespoke calculation should be performed for balcony detail (E23) to target a psi-value of 0.3 W/mK and for inverted eave (E24) to target a psi-value of 0.15 W/mK.

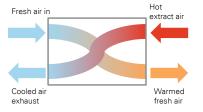
Thermal Mass:

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

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'Be Lean': Demand Reduction Measures Energy Assessment 34A-36 Kilburn High 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 programmer, room thermostats and TRVs. The heat will be distributed via radiators with fully insulated pipework. The gas boiler will have a minimum efficiency of 89.5%.

Ventilation:

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

- Dwellings with 1 wet room, a specific fan power of 0.53W/l/s and a heat recovery of 89%
- Dwellings with 2 wet room, a specific fan power of 0.60W/l/s and a heat recovery of 88%.

Air Conditioning:

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

Lighting:

High efficiency lighting has been specified for the development with a lumen efficacy of more than 70 lm/W.

'Be Clean': Heating Infrastructure & CHP

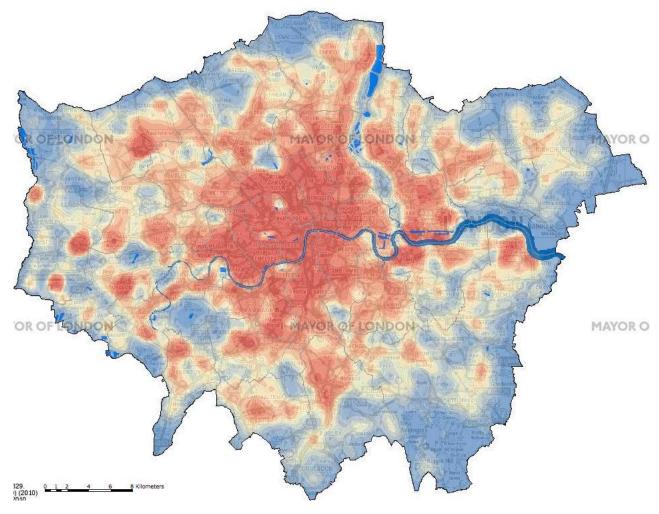
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Heating Infrastructure including CHP:

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

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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.

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'Be Clean': Site Wide Networks and CHP Energy Assessment 34A-36 Kilburn High 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 local conditions due to the existing building 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.

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'Be Clean': Cooling

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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
- Reduce the amount of heat entering the building in summer (e.g. shading and fenestration)
- 3) Manage the heat within the building through thermal mass, room height and green roofs
- 4) Passive ventilation
- 5) Mechanical ventilation
- 6) Active cooling systems (ensuring the lowest carbon option)

Avoiding Overheating



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:

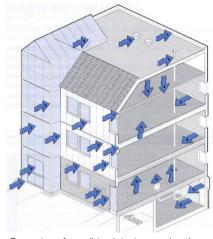
1) Minimise internal heat generation through energy efficient design

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 (>70 lumens per circuit watt).

'Be Clean': Cooling Energy Assessment 34A-36 Kilburn High Road

Avoiding Overheating Measures taken:



Examples of possible air leakage points in a building

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:

- Orientation of building the scheme is an extension of an existing building, it has not been possible to orient the extension to control solar gains, however openable windows have been specified to facilitate natural ventilation.
- 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 q-value of 0.55 have been specified.
- Light-coloured curtain/roller blinds will be specified to limit solar gain. The shading has also been optimised to avoid substantially reducing daylighting or increasing the requirement for electric lighting.

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

- Insulation levels have been maximised and the resulting U-values are lower than required by Building Regulations. The build-ups therefore prevent the penetration of heat as much as practically possible. See the 'Be Lean' section of this report for target U-values.
- A reduced air permeability rate of 3 m³/(hr.m²) @ 50 pa has been targeted 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.



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

'Be Clean': Cooling Energy Assessment 34A-36 Kilburn High 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 2.7m. As the roof will be well insulated to achieve a U-value of 0.10 W/m²K, there will be minimal penetration of heat through the roof.
- Green roofs A green roof has been considered to be unpractical by the
 design team. Consequently, a roof covering with a high albedo (reflective)
 surface has been specified in order to minimise the heat absorbed by the
 roof, and significant thermal insulation has been specified to prevent any
 heat absorbed being transferred into the building.

4) Passive ventilation

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

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

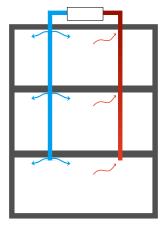


Typical building section demonstrating passive cross ventilation.

'Be Clean': Cooling

Energy Assessment 34A-36 Kilburn High Road

Avoiding Overheating Measures taken:



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

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.
- Fan powered ventilation: A balanced mechanical ventilation system with supply and extract fans will be specified. Heat recovery 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:
 - Dwellings with 1 wet room, a specific fan power of 0.53W/l/s and a heat recovery of 89%.
 - Dwellings with 2 wet room, a specific fan power of 0.60W/l/s and a heat recovery of 88%.

Overheating Risk:

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

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

According to the GLA guidance on preparing energy assessments (March 2016), 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 34A-36 Kilburn High Road

Efficiency Measures taken:	5)	Active cooling systems (ensuring the lowest carbon option)
		Air conditioning has not been specified for the scheme, since the overheating analysis demonstrates the there is no significant risk of overheating and the passive design measures are enough to guarantee the occupant's comfort.

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'Be Green': Renewable Energy

Energy Assessment 34A-36 Kilburn High 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 has also been provided for renewable energy technologies considered feasible.

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 = ✓ ✓
 - Building orientation suitability =
 - Buildability of installation =
- Economic viability: (Maximum score of 5)
 - o Capital cost of all components = ✔ ✔
 - ⊙ 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 = ✓ ✓ ✓ ✓
 - o Impact of future grid decarbonisation (gas vs. electric) = 🗸 🗸
 - 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 34A-36 Kilburn High 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 £50,000. 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	///	VVVV	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

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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.

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

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

The most suitable location for mounting photovoltaic panels is on roofs as they usually have the greatest exposure to the sun. The proposed site has a potential useable flat roof area of approximately 320 m^2 .

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO₂ and sustainability
Photovoltaic	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 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 34A-36 Kilburn High 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 flat roof area of approximately 320 m^2 .

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 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

Energy Assessment 34A-36 Kilburn High 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 CO_2 emissions reduction target approximately 1 turbine would be required as a standalone solution. The indicative cost of a smaller roof mounted turbine is £2,000/kW so achieving the required CO_2 emissions reduction would cost approximately £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.

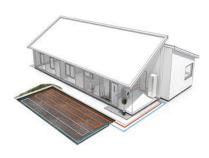
Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO₂ and sustainability
Wind Energy	No local air quality impacts, use of unutilised roof space, conservation officer will have concerns for the site, minor noise issues.	Can be added 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 34A-36 Kilburn High 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 £100,000 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.	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 34A-36 Kilburn High 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 £30,000-50,000 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	CO ₂ and sustainability
ASHP	No local air quality impacts, use of unutilised roof space, conservation officer may have minor concerns over visual impact, no noise issues.	Can be added to the roof, good 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 34A-36 Kilburn High 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 V	V V V V	<i>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</i>	V V V	V V V V V	17 out of 26
Solar Thermal	VVV	V V V V	<i>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</i>	VVV	VVVVV	16 out of 26
Wind Energy	V V V V	VV V	<i>\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\</i>	VVV	V V V V V	17 out of 26
GSHP	VVVV	V V V V	V V V V V	V V V	VVVVV VVVVV	15 out of 26
ASHP	V V V V	V V V V	V V V V	V V V	V V V V V	16 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 and that the local residents would raise concerns over potential noise and turbulence. Therefore, photovoltaic panels have been considered to be the optimum balance of sustainable and economic objectives.

'Be Green': Photovoltaic

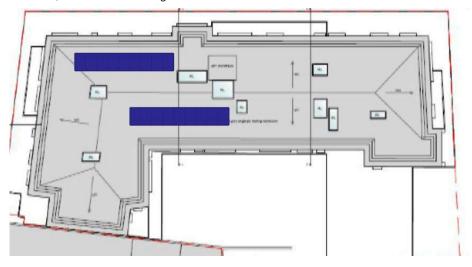
Energy Assessment 34A-36 Kilburn High Road

Summary:

A photovoltaic panel system of 5.4 kWp (approximately 18PV panels of 300W each) has been specified for the development and detailed summary of the lifecycle cost, revenue and payback for the photovoltaic panels is presented in this section.

Location:

The following drawing shows that there are approximately 320 m^2 of available roof that could be used to install photovoltaic modules and lack of shading. PV panels will be oriented Southeast, with 10° tilt covering 28.8 m^2 of the roof.



'Be Green': Photovoltaic

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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 = £7,600
- Maintenance Cost = £1,800
- Operation Cost = £2,500 (replacement inverters etc.)
- Total Costs = £11,900

Revenue and Payback Parameters:

- The cost of electricity to be displaced is 14p/kWh.
- The 5.4 kWp system is estimated to generate 4,107 kWh/yr. Based on the assumption that 50% of the electricity will be used on site, an offset saving of £287/yr will be achieved.
- With the current Feed in Tariff, a tariff of 4.32/kWh will be received for generation, and 4.91p/kWh will be received for export, which gives an additional saving of £278.

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)	4,107
Annual Carbon Emissions Reductions (kg CO ₂ /year)	2,131
CO ₂ Emissions Reduction (%)	31.7

Cost Performance Criteria	Value
Total Cost Over Life Cycle (£)	11,900
Predicted Annual Savings (£)	566
Payback Period (yeas)	21.0

Conclusion Energy Assessment 34A-36 Kilburn High Road

Summary

The baseline carbon emissions for the scheme are 6.72 Tonnes CO₂/yr.

As demonstrated, the development will reduce carbon emissions by 6.0% from the fabric energy efficiency measures described in the "Be Lean" section, and will reduce total carbon emissions by 37.7% 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)	6.72	6.32	-	4.19	
CO ₂ emissions saving (Tonnes CO ₂ /yr)	-	0.40	-	2.13	
Saving from each stage (%)	-	6.0	-	31.7	
Total CO ₂ emissions saving (Tonnes CO ₂ /yr)		2.	53		

37.7% Total carbon emissions savings over Part L of the Building Regulations 2013 achieved

Appendix Energy Assessment 34A-36 Kilburn High 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 Green – DER from the Green SAP DER Worksheets

Appendix Energy Assessment 34A-36 Kilburn High Road

Baseline Scenario

Assessor Name: Chris Hocknell Stroma Number: STRO016363 Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.12 Address: Noverall dwelling dimensions:			l Isar E)etails: _							
Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.12	Assessor Name	Chris Hocknell			a Num	ber:		STRO	016363		
Address: 1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 51.3 (4) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 138.51 (5) 2. Ventilation rate: main heating Number of chimneys 0											
Area(m²)		F	Property	Address	Apartm	ent 1					
Area(m²) Av. Height(m) Volume(m³)											
Ground floor 51.3 (1a) x 2.7 (2a) = 138.51 (3a)	1. Overall dwelling dime	nsions:	Δre	a(m²)		Δv He	eiaht(m)		Volume(m ³	3)	
Dwelling volume	Ground floor				(1a) x			(2a) =	·	<u>^</u>	
2. Ventilation rate: Main heating heating heating heating heating	Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	51.3	(4)			J			
2. Ventilation rate: main heating	Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	138.51	(5)	
Number of chimneys Number of chimneys										`	
Number of chimneys 0 + 0 + 0 + 0 = 0 $\times 40$ = 0 $\times 60$ $\times 20$ = 0 = 0 $\times 20$ = 0	2. Ventuation rate.		ry	other		total			m³ per hou	ır	
Number of intermittent fans 2	Number of chimneys		+ [0] = [0	X 4	40 =	0	(6a)	
Number of passive vents Number of flueless gas fires 0	Number of open flues	0 + 0		0	j - L	0	x	20 =	0	(6b)	
Number of flueless gas fires Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20	Number of intermittent far	ns			, L	2	x ·	10 =	20	(7a)	
Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20	Number of passive vents				Ē	0	x ·	10 =	0	(7b)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20	Number of flueless gas fir	res			Ē	0	x	40 =	0	(7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20					L						
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0		6 16 (0.) (0.)	-	(7 .)	_				nanges per ho	_	
Number of storeys in the dwelling (ns) Additional infiltration Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0	•				continue fr			÷ (5) =	0.14	(8)	
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0			(),			o (o) to	(10)		0	(9)	
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0							[(9)	-1]x0.1 =	0	(10)	
deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12) If no draught lobby, enter 0.05, else enter 0 0 (13)					•	ruction			0	(11)	
If no draught lobby, enter 0.05, else enter 0	• • • • • • • • • • • • • • • • • • • •	· · · · · · · · · · · · · · · · · · ·	o ine grea	lei wali ale	a (ailei						
	•	,	.1 (seale	ed), else	enter 0				0	=	
Develope of windows and deeps drawabt stripped	• •									=	
Percentage of windows and doors draught stripped $0.25 - [0.2 \times (14) \div 100] = 0 \tag{14}$ Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0 \tag{15}$	•	and doors draught stripped		0.25 - [0.2	x (14) ÷ 1	1001 =				= ' '	
Infiltration rate $ (8) + (10) + (11) + (12) + (13) + (15) = 0 $ (16)						_	+ (15) =			=	
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)	Air permeability value,	q50, expressed in cubic metro	es per ho	our per s	quare m	etre of e	envelope	area	5	(17)	
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	•	•							0.39	(18)	
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered 1 (19)			ne or a de	gree air pe	rmeability	is being u	sed			7(40)	
Number of sides sheltered $1 mtext{(19)}$ Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.92 mtext{(20)}$		u		(20) = 1 -	[0.0 75 x (1	19)] =			-	→ ' ' '	
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.36$ (21)	Infiltration rate incorporati	ng shelter factor		(21) = (18) x (20) =					=	
Infiltration rate modified for monthly wind speed	Infiltration rate modified for	or monthly wind speed								_	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind speed from Table 7	Monthly average wind spe	eed from Table 7	_								
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7			
Wind Factor (22a)m = (22)m ÷ 4	Wind Factor (22a)m = (22	?)m ÷ 4									
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18			0.95	0.92	1	1.08	1.12	1.18			

Adjusted infiltra	ation rate ((allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.36	0.39	0.41	0.43]	
Calculate effect		•	rate for t	he appli	cable ca	se						0	(23a)
If exhaust air he			endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If balanced with	heat recove	ery: effici	iency in %	allowing t	or in-use f	actor (fron	n Table 4h) =				0	(23c)
a) If balance	d mechani	ical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	``
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If balance	d mechan	ical ve	ntilation	without	heat red	covery (N	ЛV) (24b	o)m = (22	2b)m + (2	23b)		_	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h				•	•				E (00l-				
	$1 < 0.5 \times (2)$	23b), ti	nen (24)	c) = (23t)	o); other	wise (24	c) = (22t)	o) m + 0.	.5 × (23b) ₀	Ι ,	1	(24c)
(- /											0	J	(240)
d) If natural if (22b)n	ventilation n = 1, then			•	•				0.5]				
(24d)m= 0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(24d)
Effective air	change ra	ite - en	iter (24a) or (24l	o) or (24	c) or (24	d) in box	x (25)				-	
(25)m= 0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59]	(25)
3. Heat losse	s and heat	t loss p	paramet	er:									
ELEMENT	Gross area (m		Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/F		k-value kJ/m²·		A X k kJ/K
Doors					2	x	1	-	2				(26)
Windows Type	: 1				4.08	x1	/[1/(1.4)+	0.04] =	5.41				(27)
Windows Type	2				1.97	x1	/[1/(1.4)+	0.04] =	2.61				(27)
Windows Type	3				1.78	x1	/[1/(1.4)+	0.04] =	2.36				(27)
Rooflights Typ	e 1				0.44819	959 x1	/[1/(1.7) +	0.04] =	0.761933	31			(27b)
Rooflights Typ	e 2				0.76406	674 x1	/[1/(1.7) +	0.04] =	1.29891	5			(27b)
Walls Type1	35.48		9.61		25.87	7 X	0.18	= i	4.66				(29)
Walls Type2	30.48		2		28.48	3 x	0.18	-	5.13				(29)
Roof	51.3		1.21		50.09) x	0.13	-	6.51				(30)
Total area of e	lements, n	n²			117.2	6							(31)
* for windows and						ated using	formula 1	/[(1/U-valu	ue)+0.04] a	as given in	paragrapl	n 3.2	
** include the area Fabric heat los				s ana par	แนดกร		(26) (30)) + (32) =				22.00	(33)
Heat capacity		•	0)				(==) (==,	((28)	(30) + (32	2) + (32a)	(32e) =	32.96 10777.	
Thermal mass	•	,	P = Cm +	- TFA) ir	n kJ/m²K			***	itive Value:	, , ,	(0=0)	250	(35)
For design assess	•	`		,			ecisely the				able 1f		(00)
can be used inste													
Thermal bridge	,	•			•	<						8.84	(36)
if details of thermater Total fabric he		e not kn	own (36) =	= U.15 X (3	1)			(33) +	(36) =			41.8	1 (37)
Ventilation hea		culated	l monthl	/					= 0.33 × (25)m x (5))	71.0	(0.)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
			'					<u> </u>				1	

											•	•	
(38)m= 27.8	27.61	27.42	26.53	26.37	25.6	25.6	25.46	25.9	26.37	26.7	27.05		(38)
Heat transfer of	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m= 69.61	69.41	69.22	68.34	68.18	67.41	67.41	67.26	67.7	68.18	68.51	68.86		_
Heat loss para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷	Sum(39) ₁ (4)	₁₂ /12=	68.34	(39)
(40)m= 1.36	1.35	1.35	1.33	1.33	1.31	1.31	1.31	1.32	1.33	1.34	1.34		
				-		-	-	,	Average =	Sum(40) ₁	12 /12=	1.33	(40)
Number of day	i	`	– ´–				l .					l	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9			[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (⁻	ΓFA -13.		.73		(42)
if TFA £ 13.9				`	`		, ,.	`					
Annual average Reduce the annual									e taraet o		5.25		(43)
not more that 125	•		0 ,		•	·	io acriicve	a water us	ic larger o	ı			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i				<u></u>				000					
(44)m= 82.77	79.76	76.75	73.74	70.73	67.72	67.72	70.73	73.74	76.75	79.76	82.77		
		<u> </u>					l .	-	Γotal = Su	l m(44) _{1 12} =	 =	903	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x C	OTm / 3600	kWh/mon	th (see Ta	ables 1b, 1	c, 1d)		_
(45)m= 122.75	107.36	110.79	96.59	92.68	79.97	74.11	85.04	86.05	100.29	109.47	118.88		
									Γotal = Su	m(45) _{1 12} =	=	1183.97	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46,) to (61)		1	1		
(46)m= 18.41 Water storage	16.1	16.62	14.49	13.9	12	11.12	12.76	12.91	15.04	16.42	17.83		(46)
Storage volum		includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	` ,		0 ,			Ū		11110 VOO	301		U		(47)
Otherwise if no	•			•			` ,	ers) ente	er '0' in (47)			
Water storage	loss:		,					,	·	•			
a) If manufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro		_	-				(48) x (49)) =			0		(50)
b) If manufactHot water store			•								0		(51)
If community h	_			C Z (KVV	iiiiii Ciuc	iy <i>)</i>					0		(51)
Volume factor	_										0		(52)
Temperature f	actor fro	m Table	2b								0		(53)
Energy lost fro	m water	· storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	(54) in (5	55)									0		(55)
Water storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit lo	oss (annual) fr	om Table	3							0		(58)
Primary circuit lo			•	•	. ,	. ,						
· -	actor from Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)	1		
(59)m= 0	0 0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calc	ulated for each	n month (61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 42.18	36.71 39.11	36.37	36.05	33.4	34.51	36.05	36.37	39.11	39.34	42.18		(61)
Total heat requi	red for water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	1
(62)m= 164.93	144.07 149.9	132.95	128.72	113.37	108.62	121.08	122.42	139.4	148.81	161.06		(62)
Solar DHW input ca	lculated using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)												
(63)m= 0	0 0	0	0	0	0	0	0	0	0	0		(63)
Output from wat	ter heater					•	•					
(64)m= 164.93	144.07 149.9	132.95	128.72	113.37	108.62	121.08	122.42	139.4	148.81	161.06		
	!					Outp	out from wa	ater heate	r (annual)₁	12	1635.35	(64)
Heat gains from	water heating	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	א 0.8 + [ר	((46)m	+ (57)m	+ (59)m]	_
(65)m= 51.36	44.88 46.61	41.21	39.83	34.94	33.27	37.29	37.7	43.12	46.23	50.07		(65)
include (57)m	in calculation	of (65)m	only if c	vlinder i	s in the o	dwellina	or hot w	ater is fr	om com	munity h	eating	
5. Internal gair		. ,	-	,								
	·		,.									
Metabolic gains Jan	Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 86.42	86.42 86.42	86.42	86.42	86.42	86.42	86.42	86.42	86.42	86.42	86.42		(66)
Lighting gains (c	ļ				<u> </u>	<u> </u>	ļ					,
	11.94 9.71	7.35	5.49	4.64	5.01	6.52	8.74	11.1	12.96	13.82		(67)
` '					<u> </u>	l			12.00	10.02		(0.)
Appliances gain (68)m= 150.61	152.17 148.23	139.85	129.27	119.32	112.67	3a), aisc	115.05	123.43	134.02	143.96		(68)
` ′	!	<u> </u>			<u> </u>	<u> </u>			134.02	143.90		(00)
Cooking gains (-	· ·							04.04	04.04		(60)
(69)m= 31.64	31.64 31.64	31.64	31.64	31.64	31.64	31.64	31.64	31.64	31.64	31.64		(69)
Pumps and fans		· ·	_				_		_	_		(70)
(70)m= 3	3 3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. eva	<u> </u>	1	, ,									
(71)m= -69.14	-69.14 -69.14	-69.14	-69.14	-69.14	-69.14	-69.14	-69.14	-69.14	-69.14	-69.14		(71)
Water heating g	ains (Table 5)								•	•		
(72)m= 69.03	66.78 62.65	57.23	53.53	48.53	44.72	50.12	52.37	57.96	64.21	67.3		(72)
Total internal g	jains =			(66)	m + (67)m	n + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m= 285.01	282.82 272.52	256.36	240.22	224.41	214.33	219.67	228.09	244.43	263.12	277.01		(73)
6. Solar gains:												
Solar gains are cal	lculated using sola	ar flux from	Table 6a	and assoc	iated equa	itions to co	onvert to th	e applicab		ion.		
Orientation: Ac		Area		Flu		т	g_ chla Ch	т.	FF		Gains	
	able 6d	m²		ı al	ble 6a	, -	able 6b		able 6c		(W)	_
Northeast _{0.9x}	0.77 ×	4.0	8	X 1	1.28	X	0.63	X	0.7	=	14.07	(75)
Northeast _{0.9x}	0.77 ×	1.9	7	X 1	1.28	x	0.63	X	0.7	=	6.79	(75)

Northeast _{0.9x}	0.77	٦ ,	4.00	1 .	22.07	1 ,	0.02	l	0.7	1 =	20.04	(75)
Northeast 0.9x	0.77] X]	4.08] X] .,	22.97] X] .,	0.63	X	0.7] 1	28.64	=
Northeast 0.9x	0.77] X]	1.97	X 1	22.97] X]	0.63	X	0.7] = 1 _	13.83	(75)
Northeast 0.9x	0.77] X]	4.08] X] .,	41.38] X] .,	0.63	X	0.7] = 1 _	51.6	(75)
Northeast 0.9x	0.77	」 × ¬	1.97	J X	41.38] X]	0.63	X	0.7] = 1	24.91	(75)
Northeast 0.9x	0.77	X	4.08	X	67.96] X]	0.63	X	0.7] = 1	84.73	(75)
<u> </u>	0.77	」 X ¬	1.97	X	67.96] X]	0.63	X	0.7] = 1	40.91	(75)
Northeast 0.9x	0.77	X	4.08	X	91.35] X]	0.63	X	0.7] = 1	113.9	(75)
Northeast 0.9x	0.77	」 X ¬	1.97	X	91.35] X]	0.63	X	0.7] = 1	55	(75)
Northeast 0.9x	0.77	」 ^X ¬	4.08	X	97.38] X]	0.63	X	0.7] = 1	121.43	(75)
Northeast 0.9x	0.77	X	1.97	X	97.38] X]	0.63	X	0.7] = 1	58.63	(75)
Northeast 0.9x	0.77	X	4.08	X	91.1	X	0.63	X	0.7] =	113.59	(75)
Northeast 0.9x	0.77	X	1.97	X	91.1	X	0.63	X	0.7] =	54.85	(75)
Northeast 0.9x	0.77	X	4.08	X	72.63	X	0.63	X	0.7	=	90.56	(75)
Northeast _{0.9x}	0.77	X	1.97	X	72.63	X	0.63	X	0.7	=	43.73	(75)
Northeast _{0.9x}	0.77	X	4.08	X	50.42	X	0.63	X	0.7	=	62.87	(75)
Northeast _{0.9x}	0.77	X	1.97	X	50.42	X	0.63	X	0.7	=	30.36	(75)
Northeast _{0.9x}	0.77	X	4.08	X	28.07	X	0.63	X	0.7	=	35	(75)
Northeast _{0.9x}	0.77	X	1.97	X	28.07	X	0.63	X	0.7	=	16.9	(75)
Northeast _{0.9x}	0.77	X	4.08	X	14.2	X	0.63	X	0.7	=	17.7	(75)
Northeast _{0.9x}	0.77	X	1.97	X	14.2	X	0.63	X	0.7	=	8.55	(75)
Northeast _{0.9x}	0.77	X	4.08	X	9.21	X	0.63	X	0.7	=	11.49	(75)
Northeast _{0.9x}	0.77	X	1.97	X	9.21	X	0.63	X	0.7	=	5.55	(75)
Northwest _{0.9x}	0.77	X	1.78	X	11.28	X	0.63	X	0.7	=	12.28	(81)
Northwest _{0.9x}	0.77	X	1.78	x	22.97	X	0.63	X	0.7	=	24.99	(81)
Northwest _{0.9x}	0.77	X	1.78	X	41.38	X	0.63	X	0.7	=	45.02	(81)
Northwest _{0.9x}	0.77	X	1.78	X	67.96	X	0.63	X	0.7	=	73.93	(81)
Northwest _{0.9x}	0.77	X	1.78	x	91.35	X	0.63	X	0.7	=	99.38	(81)
Northwest _{0.9x}	0.77	X	1.78	x	97.38	X	0.63	x	0.7	=	105.95	(81)
Northwest _{0.9x}	0.77	x	1.78	x	91.1	x	0.63	x	0.7	=	99.12	(81)
Northwest 0.9x	0.77	x	1.78	x	72.63	x	0.63	x	0.7	=	79.02	(81)
Northwest _{0.9x}	0.77	x	1.78	x	50.42	X	0.63	x	0.7	=	54.86	(81)
Northwest _{0.9x}	0.77	x	1.78	x	28.07	X	0.63	X	0.7	=	30.54	(81)
Northwest 0.9x	0.77	x	1.78	x	14.2	x	0.63	x	0.7	=	15.45	(81)
Northwest _{0.9x}	0.77	x	1.78	x	9.21	x	0.63	x	0.7	=	10.02	(81)
Rooflights 0.9x	1	x	0.45	x	26	X	0.63	x	0.7	=	4.63	(82)
Rooflights 0.9x	1	x	0.76	x	26	x	0.63	x	0.7] =	7.88	(82)
Rooflights 0.9x	1	x	0.45	x	54	x	0.63	x	0.7] =	9.61	(82)
Rooflights 0.9x	1	x	0.76	x	54	x	0.63	x	0.7	j =	16.38	(82)
Rooflights 0.9x	1	x	0.45	x	96	x	0.63	x	0.7	j =	17.08	(82)
Rooflights 0.9x	1	x	0.76	x	96	x	0.63	x	0.7] =	29.11	(82)
Rooflights _{0.9x}	1	X	0.45	x	150	x	0.63	x	0.7	=	26.68	(82)

Roofligh	nts _{0.9x}	1	X	0.7	76	x	1	50	X	0.63	x	0.7	=	45.49	(82)
Roofligh	nts _{0.9x}	1	X	0.45		x	1	92	x	0.63	x	0.7	=	34.15	(82)
Roofligh	nts _{0.9x}	1	X	0.76		x	1	92	x	0.63	x	0.7	=	58.23	(82)
Roofligh	nts _{0.9x}	1	x	0.45		x	2	00	X	0.63	x	0.7	=	35.58	(82)
Roofligh	nts _{0.9x}	1	X	0.76		x	2	00	x	0.63	x	0.7	=	60.65	(82)
Roofligh	nts _{0.9x}	1	x	0.45		x	1	89	x	0.63	×	0.7	=	33.62	(82)
Roofligh	nts 0.9x	1	x	0.76		x	1	89	x	0.63	x	0.7	=	57.32	(82)
Roofligh	nts _{0.9x}	1	X	0.45		x	1	57	x	0.63	x	0.7	=	27.93	(82)
Roofligh	nts _{0.9x}	1	x	0.76		x	1	57	x	0.63	x	0.7	=	47.61	(82)
Roofligh	nts 0.9x	1	X	0.45		x	1	15	x	0.63	x	0.7	=	20.46	(82)
Roofligh	its _{0.9x}	1	X	0.76		x	1	15	x	0.63	x	0.7	=	34.87	(82)
Roofligh	its _{0.9x}	1	X	0.45		x	(66	x	0.63	x	0.7	=	11.74	(82)
Roofligh	its _{0.9x}	1	X	0.76		x	(36	x	0.63	x	0.7	=	20.02	(82)
Roofligh	its _{0.9x}	1	X	0.45		x	(33	x	0.63	x	0.7	=	5.87	(82)
Roofligh	nts _{0.9x}	1	X	0.7	' 6	x		33	X	0.63	X	0.7	=	10.01	(82)
Roofligh	its _{0.9x}	1	X	0.4	0.45			21	x	0.63	x	0.7	=	3.74	(82)
Roofligh	nts _{0.9x}	1	X	0.7	' 6	x	2	21	X	0.63	X	0.7	=	6.37	(82)
Solar gains in watts, calculated for each month (83)m = Sum(74)m (82)m															
(83)m=	45.65	93.43	167.72	271.75	360.66	3	82.24	358.5	288	.84 203.41	114.1	9 57.57	37.17		(83)
Total g	ains – iı	nternal a	nd solar	(84)m =	= (73)m	า + (83)m ,	watts						_	
(0.4)	330.66	270 25		E00 44		\Box								1	(0.4)
(84)m=	330.00	376.25	440.24	528.11	600.88	6	06.65	572.82	508	.51 431.5	358.6	1 320.69	314.17		(84)
L		L			<u> </u>		06.65	572.82	508	.51 431.5	358.6	1 320.69	314.17		(84)
7. Mea	an inter	nal temp	erature	(heating	seaso	n)				.51 431.5 Th1 (°C)	358.6	1 320.69	314.17	21	(84)
7. Mea	an inter erature	nal temp	erature eating p	(heating eriods ir	season the liv	n) /ing	area fr	om Tal			358.6	1 320.69	314.17	21	
7. Mea	an inter erature	nal tempo during he	erature eating p	(heating eriods ir	season the liv	n) /ing m (s	area fr	om Tal	ole 9		358.6 Oct		314.17	21	
7. Mea	an inter erature tion fac	nal tempo during heater	erature eating p ains for I	(heating eriods ir iving are	season the lives	n) ving m (s	area fr	om Tal ole 9a)	ole 9	Th1 (°C)				21	
7. Med Tempo Utilisa (86)m=	an inter erature tion fac Jan	nal temp during he etor for ga Feb	erature eating p ains for I Mar 0.99	(heating eriods ir iving are Apr 0.95	season the lives, h1,r May	n) ving m (s	area fr ee Tab Jun	om Tal ble 9a) Jul ^{0.5}	ole 9,	Th1 (°C) ug Sep 8 0.85	Oct	Nov	Dec	21	(85)
7. Med Tempo Utilisa (86)m=	an inter erature tion fac Jan	nal temp during he tor for ga	erature eating p ains for I Mar 0.99	(heating eriods ir iving are Apr 0.95	season the lives, h1,r May	n) /ing m (s	area fr ee Tab Jun	om Tal ble 9a) Jul ^{0.5}	ole 9,	Th1 (°C) ug Sep 8 0.85 Table 9c)	Oct	Nov 0.99	Dec	21	(85)
7. Mean (86)m= Mean (87)m=	an interestant interna	nal temp during he stor for ga Feb 0.99 I tempera	erature eating p ains for I Mar 0.99 ature in	(heating eriods ir iving are Apr 0.95 living are 20.42	season the livea, h1,1 May 0.84 ea T1 (m (s	area free Tab	om Tal ole 9a) Jul 0.5 s 3 to 7	ole 9, 0.5 7 in T	Th1 (°C) ug Sep i8 0.85 Table 9c) 98 20.82	Oct 0.98	Nov 0.99	Dec 1	21	(85)
7. Mez Tempe Utilisa (86)m= Mean (87)m= Tempe	an interesture tion factor Jan 1 interna 19.53 erature	nal temp during he stor for ga Feb 0.99 I tempera 19.69 during he	erature eating p ains for I Mar 0.99 ature in 19.99 eating p	(heating eriods ir iving are 0.95) living are 20.42	season the livea, h1,r May 0.84 ea T1 (20.77	in) ving m (s	area free Tab Jun 0.66 www.step	om Tal ole 9a) Jul 0.5 s 3 to 7 20.99	ole 9, 0.5 7 in T 20.	Th1 (°C) ug Sep 8 0.85 able 9c) 98 20.82 9, Th2 (°C)	Oct 0.98	Nov 0.99	Dec 1	21	(85)
7. Mea Tempo Utilisa (86)m= Mean (87)m= Tempo (88)m=	an interestion factoring Jan 1 interna 19.53 erature 19.8	nal temp during he stor for ga Feb 0.99 I tempera 19.69 during he	erature eating p ains for I Mar 0.99 ature in 19.99 eating p	(heating eriods ir iving are 0.95 living are 20.42 eriods ir 19.82	season the livea, h1,r May 0.84 ea T1 (20.77 n rest o	n) ving m (s follo	area free Tab Jun 0.66 www.step 20.94 velling 19.83	om Tal ble 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83	Ole 9 Al 0.5 7 in T 20. able 9	Th1 (°C) ug Sep 8 0.85 able 9c) 98 20.82 9, Th2 (°C)	Oct 0.98	Nov 0.99	Dec 1	21	(85) (86) (87)
7. Mean (86)m= Mean (87)m= Tempe (88)m= Utilisa	an interestion factoring tion factor	nal temp during he tor for ga Feb 0.99 I tempera 19.69 during he 19.8	erature eating p ains for I Mar 0.99 ature in 19.99 eating p 19.8	crest of d	season the livea, h1,1 May 0.84 ea T1 (20.77 n rest o 19.82 welling	n) ving (see following) following fo	area free Tab	om Tal ple 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table	ole 9 A 0.5 7 in T 20. able 9	Th1 (°C) ug Sep i8 0.85 Table 9c) 98 20.82 0, Th2 (°C) 83 19.83	Oct 0.98 20.36	Nov 0.99 19.88	Dec 1 19.51 19.81		(85) (86) (87) (88)
7. Mean Utilisa (86)m= Mean (87)m= Tempe (88)m= Utilisa (89)m=	an interestion factoring tion factoring factor	nal temp during he stor for ga Feb 0.99 I tempera 19.69 during he 19.8	erature eating p ains for I Mar 0.99 ature in 19.99 eating p 19.8 ains for I 0.98	criest of do	season the livea, h1,1 May 0.84 ea T1 (20.77 n rest o 19.82 welling 0.78	m (s follo	area free Tab	om Tal ple 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38	ole 9 0.5 7 in T 20. able 9 19.	Th1 (°C) ug Sep 88 0.85 Table 9c) 98 20.82 9, Th2 (°C) 83 19.83	Oct 0.98 20.36 19.82 0.96	Nov 0.99	Dec 1	21	(85) (86) (87)
7. Mean Tempo Utilisa (86)m= Mean (87)m= Tempo (88)m= Utilisa (89)m= Mean	an interestion factoring tion factoring factor	nal temp during he tor for ga Feb 0.99 I tempera 19.69 during he 19.8 tor for ga 0.99 I tempera	erature eating p ains for I Mar 0.99 eature in 19.99 eating p 19.8 ains for I 0.98 eature in	criods ir 19.82 eriods ir 19.82 the rest	season the livea, h1,r May 0.84 ea T1 (20.77 rest of 19.82 welling 0.78 of dwe	m (s follo	area free Tab Jun 0.66 www.step 20.94 velling 19.83 mm (see 0.56 T2 (fo	om Tal ple 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38	Ole 9 Al 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3	Th1 (°C) ug Sep 88 0.85 able 9c) 98 20.82 9, Th2 (°C) 83 19.83 5 0.77 to 7 in Table	Oct 0.98 20.36 19.82 0.96 e 9c)	Nov 0.99 19.88 19.81	Dec 1 19.51 19.81	21	(85) (86) (87) (88) (89)
7. Mean Utilisa (86)m= Mean (87)m= Tempe (88)m= Utilisa (89)m=	an interestion factoring tion factoring factor	nal temp during he stor for ga Feb 0.99 I tempera 19.69 during he 19.8	erature eating p ains for I Mar 0.99 ature in 19.99 eating p 19.8 ains for I 0.98	criest of do	season the livea, h1,1 May 0.84 ea T1 (20.77 n rest o 19.82 welling 0.78	m (s follo	area free Tab	om Tal ple 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38	ole 9 0.5 7 in T 20. able 9 19.	Th1 (°C) ug Sep 88 0.85 Table 9c) 98 20.82 0, Th2 (°C) 83 19.83 5 0.77 to 7 in Table 82 19.68	Oct 0.98 20.36 19.82 0.96 e 9c) 19.08	Nov 0.99 19.88 2 19.81 0.99	Dec 1 19.51 19.81 1		(85) (86) (87) (88) (89) (90)
7. Mean Tempo Utilisa (86)m= Mean (87)m= Tempo (88)m= Utilisa (89)m= Mean	an interestion factoring tion factoring factor	nal temp during he tor for ga Feb 0.99 I tempera 19.69 during he 19.8 tor for ga 0.99 I tempera	erature eating p ains for I Mar 0.99 eature in 19.99 eating p 19.8 ains for I 0.98 eature in	criods ir 19.82 eriods ir 19.82 the rest	season the livea, h1,r May 0.84 ea T1 (20.77 rest of 19.82 welling 0.78 of dwe	m (s follo	area free Tab Jun 0.66 www.step 20.94 velling 19.83 mm (see 0.56 T2 (fo	om Tal ple 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38	Ole 9 Al 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3	Th1 (°C) ug Sep 88 0.85 Table 9c) 98 20.82 0, Th2 (°C) 83 19.83 5 0.77 to 7 in Table 82 19.68	Oct 0.98 20.36 19.82 0.96 e 9c) 19.08	Nov 0.99 19.88 19.81	Dec 1 19.51 19.81 1	21	(85) (86) (87) (88) (89)
7. Mean (86)m= Mean (87)m= Tempe (88)m= Utilisa (89)m= Mean (90)m=	an interestion factoring tion factoring factor	nal temp during he stor for ga Feb 0.99 I tempera 19.69 during he 19.8 stor for ga 0.99 I tempera	erature eating p ains for I Mar 0.99 ature in 19.99 eating p 19.8 ains for I 0.98 ature in 18.54	criods ir iving are 0.95 living are 20.42 eriods ir 19.82 rest of do 0.93 the rest 19.15	season the livea, h1,1 May 0.84 ea T1 (20.77 n rest of 19.82 welling 0.78 of dwe 19.6	m (s / follo	area free Tab Jun 0.66 w step 20.94 velling free 9.83 m (see 0.56 T2 (fo	om Tal ole 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38 llow ste 19.83	ole 9 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3 19.	Th1 (°C) ug Sep 88 0.85 Table 9c) 98 20.82 0, Th2 (°C) 83 19.83 5 0.77 to 7 in Table 82 19.68	Oct 0.98 20.36 19.82 0.96 e 9c) 19.08	Nov 0.99 19.88 2 19.81 0.99	Dec 1 19.51 19.81 1		(85) (86) (87) (88) (89) (90)
7. Mean (86)m= (86)m= Mean (87)m= Tempe (88)m= Utilisa (89)m= Mean (90)m=	an interestion factoring tion factoring factor	nal temp during he stor for ga Feb 0.99 I tempera 19.69 during he 19.8 stor for ga 0.99 I tempera	erature eating p ains for I Mar 0.99 ature in 19.99 eating p 19.8 ains for I 0.98 ature in 18.54	criods ir iving are 0.95 living are 20.42 eriods ir 19.82 rest of do 0.93 the rest 19.15	season the livea, h1,1 May 0.84 ea T1 (20.77 n rest of 19.82 welling 0.78 of dwe 19.6	m (s // follo 2 of dw 1 1 llling	area free Tab Jun 0.66 w step 20.94 velling free 9.83 m (see 0.56 T2 (fo	om Tal ole 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38 llow ste 19.83	ole 9 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3 19.	Th1 (°C) ug Sep 88 0.85 Table 9c) 98 20.82 9, Th2 (°C) 83 19.83 15 0.77 to 7 in Table 19.68 — fLA) × T2	Oct 0.98 20.36 19.82 0.96 e 9c) 19.08	Nov 0.99 19.88 19.81 0.99 18.38 ving area ÷ (-	Dec 1 19.51 19.81 1		(85) (86) (87) (88) (89) (90)
7. Mean (86)m= (86)m= Mean (87)m= Tempo (88)m= Utilisa (89)m= Mean (90)m= Mean (92)m= Apply	an interestion factoring tion factoring factor	nal temp during he tor for ga Feb 0.99 I tempera 19.69 during he 19.8 ctor for ga 0.99 I tempera 18.09 I tempera 19.09 I tempera	erature eating p ains for I Mar 0.99 ature in 19.99 eating p 19.8 ains for I 0.98 ature in 18.54 ature (fo 19.36 ne mean	crest of dro.93 the rest 19.15 r the whose in the rest internal	season the livea, h1,1 May 0.84 ea T1 (20.77 n rest of 19.82 welling 0.78 of dwe 19.6 ole dw 20.26 temper	m (s follo 2 f dw 1 llling ellin	area free Tab Jun 0.66 w step 0.94 velling free 0.56 T2 (for 19.8 g) = fL 0.45 ure from	om Tal ple 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38 llow ste 19.83 A × T1 20.48 n Table	Al 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3 19. + (1 20. 24e,	Th1 (°C) ug Sep i8 0.85 Table 9c) 98 20.82 0, Th2 (°C) 83 19.83 15 0.77 to 7 in Table 82 19.68 — fLA) × T2 48 20.33 where appre	Oct 0.98 20.36 19.82 0.96 e 9c) 19.08 fLA = Livitate private	Nov 0.99 19.88 19.81 0.99 18.38 ving area ÷ (-	Dec 1 19.51 19.81 1 17.84 4) =		(85) (86) (87) (88) (89) (90) (91) (92)
7. Mean (86)m= Mean (87)m= Tempo (88)m= Utilisa (89)m= Mean (90)m= Mean (92)m=	an interestion factor Jan 1 interna 19.53 erature 19.8 tion factor 1 interna 17.86 interna 18.81	nal temporal temporal temperal 19.69 during he 19.8 etor for gas 18.09 ltemperal 19.09 ltemperal 18.09 ltemperal 19.00 ltemper	erature eating p ains for I Mar 0.99 ature in 19.99 eating p 19.8 ains for I 0.98 ature in 18.54	cheating eriods ir iving are 0.95 living are 20.42 eriods ir 19.82 rest of do 0.93 the rest 19.15 rest who 19.87	season the livea, h1,1 May 0.84 ea T1 (20.77 n rest of 19.82 welling 0.78 of dwe 19.6 ole dw 20.26	m (s follo 2 f dw 1 llling ellin	area free Tab Jun 0.66 w step 20.94 yelling free (see (see (see (see (see (see (see (om Tal ole 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38 llow ste 19.83 A × T1 20.48	All 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3 19. + (1 20.	Th1 (°C) ug Sep 88 0.85 Table 9c) 98 20.82 0, Th2 (°C) 83 19.83 5 0.77 to 7 in Table 82 19.68 — fLA) × T2 48 20.33 where appre	Oct 0.98 20.36 19.82 0.96 e 9c) 19.08 LA = Liv 19.81	Nov 0.99 19.88 19.81 0.99 18.38 ving area ÷ (-	Dec 1 19.51 19.81 1 17.84 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [Mean (90)m= [Mean (92)m= [Apply (93)m=	an interestion factor Jan 1 interna 19.53 erature 19.8 tion factor 1 interna 17.86 interna 18.81 adjustna 18.81	nal temp during he tor for ga Feb 0.99 I tempera 19.69 during he 19.8 ctor for ga 0.99 I tempera 18.09 I tempera 19.09 I tempera	erature eating p ains for I Mar 0.99 ature in 19.99 eating p 19.8 ains for I 0.98 ature in 18.54 ature (fo 19.36 ne mean 19.36	crest of dro.93 the rest 19.15 r the whose in the rest internal	season the livea, h1,1 May 0.84 ea T1 (20.77 n rest of 19.82 welling 0.78 of dwe 19.6 ole dw 20.26 temper	m (s follo 2 f dw 1 llling ellin	area free Tab Jun 0.66 w step 0.94 velling free 0.56 T2 (for 19.8 g) = fL 0.45 ure from	om Tal ple 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38 llow ste 19.83 A × T1 20.48 n Table	Al 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3 19. + (1 20. 24e,	Th1 (°C) ug Sep i8 0.85 Table 9c) 98 20.82 0, Th2 (°C) 83 19.83 15 0.77 to 7 in Table 82 19.68 — fLA) × T2 48 20.33 where appre	Oct 0.98 20.36 19.82 0.96 e 9c) 19.08 fLA = Livitate private	Nov 0.99 19.88 19.81 0.99 18.38 ving area ÷ (-	Dec 1 19.51 19.81 1 17.84 4) =		(85) (86) (87) (88) (89) (90) (91) (92)
7. Mean (86)m= [Mean (87)m= [Tempo (88)m= [Utilisa (89)m= [Mean (90)m= [Mean (92)m= [Apply (93)m= [8. Spa	an interestion factoring f	nal temp during heter for ga Feb 0.99 I tempera 19.69 during heter for ga 0.99 I tempera 18.09 I tempera 18.09 I tempera 19 nent to the 19 ting requires	erature eating pains for I Mar 0.99 eature in 19.99 eating p 19.8 eature for I 0.98 eature in 18.54 eature (for I) 19.36 eature mean 19.36 emean	crest of do 19.82 r the who 19.87 internal 19.87	season the livea, h1,1 May 0.84 ea T1 (20.77 n rest of 19.82 welling 0.78 of dwe 19.6 ed temper 20.26 temper 20.26 re obta	ring wing m (s follo follo g f	area free Tab Jun 0.66 w step 0.94 relling free 0.56 T2 (for 19.8 g) = fL 0.45 ure from 0.45	om Tal ple 9a) Jul 0.5 s 3 to 7 20.99 from Ta 19.83 e Table 0.38 llow ste 19.83 A × T1 20.48 n Table 20.48	Al 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3 19. + (1 20. e 4e, 20.	Th1 (°C) ug Sep i8 0.85 Table 9c) 98 20.82 0, Th2 (°C) 83 19.83 15 0.77 to 7 in Table 82 19.68 — fLA) × T2 48 20.33 where appre	Oct 0.98 20.36 19.82 0.96 e 9c) 19.08 19.81	Nov 0.99 19.88 19.81 0.99 18.38 ving area ÷ (ving area ÷ (ving area + (ving area))	Dec 1 19.51 19.81 1 17.84 4) = 18.78	0.57	(85) (86) (87) (88) (89) (90) (91) (92)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisa	ation fac	tor for a	ains. hm	1:										
(94)m=	1	0.99	0.98	0.93	0.81	0.61	0.45	0.52	0.81	0.96	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	(95)m= 329.04 372.85 430.2 489.98 484.14 372.49 257.64 266.26 349.06 345.52 317.87 312.94												(95)	
Monthly average external temperature from Table 8											1			
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m–(96)m]												ı	(0-)
	(97)m= 1009.84 978.5 890.4 749.75 583.88 394.12 261.82 274.22 421.72 627.88 831.03 1004.27													(97)
-	Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m= 506.51 407 342.39 187.04 74.21 0 0 0 0 210.07 369.47 514.34											0044.00	7(00)		
	Total per year (kWh/year) = Sum(98) _{15,912} =												2611.03	<u> </u> (98)
Space	e heating	g require	ement in	kWh/m²	² /year								50.9	(99)
9a. En	ergy red	uiremer	nts – Ind	ividual h	eating s	ystems i	ncluding	micro-C	CHP)					
•	e heatir	_										ı		_
	•			econdar		mentary	•						0	(201)
Fracti	ion of sp	ace hea	it from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	ո, %						0	(208)
	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												kWh/yea	ar
Space	Space heating requirement (calculated above)													
	506.51	407	342.39	187.04	74.21	0	0	0	0	210.07	369.47	514.34		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20	06)								_	(211)
	542.31	435.76	366.58	200.25	79.45	0	0	0	0	224.91	395.58	550.69		
								Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	2795.53	(211)
•		`		y), kWh/	month									
•= ·)m x (20												ı	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		٦
								1018	ıl (kWh/yea	ar) =Sum(2	215) _{15,10. 12}		0	(215)
	heating		4 /I-		h \									
Output	164.93	144.07	149.9	ulated a	128.72	113.37	108.62	121.08	122.42	139.4	148.81	161.06		
Efficie	ncy of w		ļ						<u> </u>				80.3	(216)
(217)m=		87.52	87.07	85.91	83.72	80.3	80.3	80.3	80.3	86.08	87.25	87.77		」` (217)
	r water	heating.	<u> </u>	nth	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	l	I	
	1 = (64)	•											•	
(219)m=	188.09	164.61	172.17	154.76	153.75	141.19	135.27	150.79	152.46	161.94	170.56	183.51		_
	Total = Sum(219a) ₁₁₂ =												1929.08	(219)
Annual totals kWh/year											kWh/year	٦		
Space heating fuel used, main system 1											2795.53	_		
Water heating fuel used											1929.08			
Electricity for pumps, fans and electric keep-hot														

central heating pump: boiler with a fan-assisted flue				30 45		(230c) (230e)
Total electricity for the above, kWh/year	sum	of (230a) (230g)	=	45	75	(231)
Electricity for lighting					237.39	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP					
	Energy kWh/year	_	sion fac t D2/kWh	tor	Emissions kg CO2/ye	
Space heating (main system 1)	(211) x	0.	216	=	603.84	(261)
Space heating (secondary)	(215) x	0.	519	=	0	(263)
Water heating	(219) x	0.	216	=	416.68	(264)
Space and water heating	(261) + (262) + (263) + (2	264) =			1020.52	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.	519	=	38.93	(267)
Electricity for lighting	(232) x	0.	519	=	123.21	(268)
Total CO2, kg/year		sum of (265)	(271) =		1182.65	(272)

TER =

(273)

23.05

Stroma Number: STRO016363 Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.12
Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.12
Address: 1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³) Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 61.1 (4) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 164.97 (5) 2. Ventilation rate: Number of chimneys 0 + 0 + 0 = 0 x40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x20 = 0 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.12 (8)
Area(m²)
Area(m²)
Ground floor Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 164.97 (5) 2. Ventilation rate: Main heating heating heating heating heating + 0 + 0 = 0 x 40 = 0 (6a) Number of chimneys 0 + 0 + 0 = 0 x 20 = 0 (6b) Number of intermittent fans 2 x 10 = 20 (7a) Number of passive vents 0 x 40 = 0 (7b) Number of flueless gas fires 0 x 40 = 0 (7c) Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.12 (8)
Dwelling volume $ (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 164.97 $
2. Ventilation rate: Main Secondary Other Heating Heating
2. Ventilation rate: main heating secondary heating other heating total m³ per hour Number of chimneys 0 + 0 + 0 = 0 x 40 = 0 (6a) Number of open flues 0 + 0 + 0 x 20 = 0 (6b) Number of intermittent fans 2 x 10 = 20 (7a) Number of passive vents 0 x 40 = 0 (7b) Number of flueless gas fires 0 x 40 = 0 (7c) Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.12 (8)
Number of chimneys 0 + 0 + 0 = 0 $\times 40$ = 0 (6a) Number of open flues 0 + 0 + 0 = 0 $\times 20$ = 0 (6b) Number of intermittent fans Number of passive vents Number of flueless gas fires Air changes per hour Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c)$ = 20 $\div (5)$ = 0.12 (8)
Number of chimneys 0 + 0 + 0 = 0 $\times 40$ = 0 $(6a)$ Number of open flues 0 + 0 + 0 = 0 $\times 20$ = 0 $(6b)$ Number of intermittent fans 2 $\times 10$ = 20 $(7a)$ Number of passive vents 0 $\times 10$ = 0 $(7b)$ Number of flueless gas fires 0 $\times 40$ = 0 $(7c)$ Air changes per hour Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c)$ = 20 $\div (5)$ = 0.12 (8)
Number of intermittent fans Number of passive vents Number of flueless gas fires $ \begin{array}{cccccccccccccccccccccccccccccccccc$
Number of passive vents 0
Number of flueless gas fires $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Air changes per hour Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ 20 $\div (5) =$ 0.12 (8)
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ 20 $\div (5) =$ 0.12 (8)
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) =$ 20 $\div (5) =$ 0.12 (8)
Number of storeys in the dwelling (ns)
Additional infiltration $[(9)-1] \times 0.1 = 0 $ (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11) if both types of wall are present, use the value corresponding to the greater wall area (after
deducting areas of openings); if equal user 0.35
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0
If no draught lobby, enter 0.05, else enter 0
Percentage of windows and doors draught stripped $0.25 - [0.2 \times (14) \div 100] = 0 \tag{14}$ Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0 \tag{15}$
Vindow infiltration $0.25 - [0.2 \times (14) + 100] = 0$ (15) Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ 0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used
Number of sides sheltered 3 (19) Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ (20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.29$ (21)
Infiltration rate modified for monthly wind speed
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly average wind speed from Table 7
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7
Wind Factor (22a)m = (22)m ÷ 4
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18

Calculate effective air change rate for the applicable case If mechanical ventilation: If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	djusted infiltra					1	` 	`	`		<u> </u>		1	
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 24a)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.37	0.36	0.35	0.32	0.31 he annli	0.27	0.27	0.27	0.29	0.31	0.32	0.34		
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 24a)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				ale for t	пс аррп	cabic ca	.50						0	(23
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 24a)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 b) If balanced mechanical ventilation without heat recovery (MVH) (24b)m = (22b)m + (23b) 24b)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b)m + 0.5 × (23b) 24e)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	If exhaust air he	eat pump us	ing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23
24a)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	If balanced with	heat recove	ery: effic	iency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				0	(23
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) 24b)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a) If balance	d mechar	nical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	4a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) 24dom = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	b) If balance	d mechar	nical ve	ntilation	without	heat red	covery (N	ЛV) (24b)m = (22	2b)m + (2	23b)		_	
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) Atom= 0	4b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² × 0.5] 22dd)m = 0.57	•				•	•				.5 × (23b))			
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5] 24d)m = 0.57	4c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) 25m= 0.57 0.56 0.56 0.55 0.55 0.54 0.54 0.54 0.54 0.55 0.55	,				•	•				0.5]			_	
3. Heat losses and heat loss parameter: ELEMENT Gross Openings area (m²)	4d)m= 0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(24
3. Heat losses and heat loss parameter: ELEMENT Gross	Effective air	change ra	ate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)					
Net Area area (m²) Openings area (m²) Openins area (m²) Openings area (m²) Openings area (m²) Openings	5)m= 0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(2
area (m²) m² A ,m² W/m2K (W/K) kJ/m²·K k loors 2	B. Heat losses	s and hea	it loss p	paramete	er:									
Sindows Type 1	LEMENT			•	Ξ						〈)			A X k kJ/K
	oors					2	х	1	=	2				(2
Indows Type 3 Indows Type 4 Indows Type 1 Indows Type 4 Indows Type 1 Indow	indows Type	: 1				5.06	x1.	/[1/(1.4)+	0.04] =	6.71				(2
2.68	indows Type	2				2.58	x1.	/[1/(1.4)+	0.04] =	3.42				(2
cooflights 0.9867381 $\times 1/[1/(1.7) + 0.04] = 1.677455$	indows Type	3				1.97	x1.	/[1/(1.4)+	0.04] =	2.61				(2
Valls Type 1 38.95 12.29 26.66 x 0.18 = 4.8	indows Type	4				2.68	x1.	/[1/(1.4)+	0.04] =	3.55				(2
Valls Type2 45.47 2 43.47 \times 0.18 $=$ 7.82 0.18 $=$ $=$ 0.18 $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$ $=$	ooflights					0.98673	381 x1	/[1/(1.7) +	0.04] =	1.67745	5			(2
coof 61.1 0.99 60.11 x 0.13 = 7.81 cotal area of elements, m² 145.52 for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 include the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) (26) (30) + (32) = 40.3 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 deat capacity Cm = S	alls Type1	38.95		12.29	9	26.66	3 x	0.18	= İ	4.8	= [(2
otal area of elements, m² 145.52 for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2 include the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) (26) (30) + (32) = 40.3 leat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 hermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f an be used instead of a detailed calculation. hermal bridges: S (L x Y) calculated using Appendix K details of thermal bridging are not known (36) = 0.15 x (31) otal fabric heat loss (33) + (36) = 49.74	alls Type2	45.47		2		43.47	7 X	0.18	<u> </u>	7.82	= i		i i	(2
for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U-value)+0.04]$ as given in paragraph 3.2 include the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) (26) (30) + (32) = 40.3 leat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 13865.72 lhermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 lor design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 11 land be used instead of a detailed calculation. Thermal bridges: S (L x Y) calculated using Appendix K 9.43 lotal fabric heat loss $(33) + (36) = 49.74$	oof	61.1	一	0.99	_	60.1	x	0.13	= = i	7.81	₹ i		7 F	(3
Tinclude the areas on both sides of internal walls and partitions abric heat loss, W/K = S (A x U) (26) $(30) + (32) =$ 40.3 leat capacity Cm = S(A x k) ((28) $(30) + (32) + (32a)$ (32e) = 13865.72 thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 for design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f and be used instead of a detailed calculation. Thermal bridges: S (L x Y) calculated using Appendix K 9.43 details of thermal bridging are not known (36) = 0.15 x (31) footal fabric heat loss (33) + (36) = 49.74	otal area of e	lements, i	m²			145.5	2							(3
abric heat loss, W/K = S (A x U) (26) $(30) + (32) =$ 40.3 leat capacity Cm = S(A x k) ((28) $(30) + (32) + (32a)$ (32e) = 13865.72 hermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f an be used instead of a detailed calculation. hermal bridges: S (L x Y) calculated using Appendix K 9.43 details of thermal bridging are not known (36) = 0.15 x (31) otal fabric heat loss (33) + (36) = 49.74	or windows and	roof window	vs, use e	ffective wi	ndow U-va	alue calcui	ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	ıs given in	paragraph	3.2	
leat capacity Cm = S(A x k) ((28) $(30) + (32) + (32a)$ $(32e) = 13865.72$ hermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f an be used instead of a detailed calculation. hermal bridges: S (L x Y) calculated using Appendix K details of thermal bridging are not known (36) = 0.15 x (31) otal fabric heat loss (33) + (36) = 49.74					ls and par	titions		(00) (00)) . (OO)					
hermal mass parameter (TMP = Cm \div TFA) in kJ/m²K Indicative Value: Medium 250 or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f an be used instead of a detailed calculation. hermal bridges: S (L x Y) calculated using Appendix K details of thermal bridging are not known (36) = 0.15 x (31) otal fabric heat loss (33) + (36) = 49.74			•	U)				(26) (30)		(00) - (00	a) . (00)	(00.)		(3
or design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f an be used instead of a detailed calculation. hermal bridges: S (L x Y) calculated using Appendix K details of thermal bridging are not known (36) = 0.15 x (31) otal fabric heat loss (33) + (36) = 49.74	, ,	•	,) — O	TEA\:-	- I. I/21/					, , ,	(32e) =	13865.	
an be used instead of a detailed calculation. hermal bridges: S (L x Y) calculated using Appendix K details of thermal bridging are not known (36) = 0.15 x (31) otal fabric heat loss (33) + (36) = 49.74		•	•		,			ooisaly the				able 1f	250	(3
details of thermal bridging are not known (36) = $0.15 \times (31)$ otal fabric heat loss (33) + (36) = 49.74	· ·				oorion ucl	ion ale 110	. AHOWH PI	ooia o iy ii le	muicalive	, vaiues Ul	rivii III l	abic II		
otal fabric heat loss $(33) + (36) = 49.74$	nermal bridge	es : S (L x	Y) cal	culated ı	using Ap	pendix l	<						9.43	(3
			re not kn	own (36) =	= 0.15 x (3	31)								
antilation hast loss calculated monthly				_									49.74	(3
entilation heat loss calculated monthly (38)m = 0.33 × (25)m × (5) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec						1				<u> </u>		<u> </u>	1	

(00)							l					I	(00)
(38)m= 30.88		30.6	29.95	29.82	29.25	29.25	29.15	29.47	29.82	30.07	30.33		(38)
Heat transfe (39)m= 80.62		nt, W/K 80.34	79.68	79.56	78.99	78.99	78.88	(39)m 79.21	79.56	38)m 79.81	80.07		
(39)111- [80.02	2 00.48	00.34	79.00	79.50	70.99	70.99	70.00			Sum(39) ₁		79.68	(39)
Heat loss pa	rameter (l	HLP), W	/m²K						= (39)m ÷		127.2		` ′
(40)m= 1.32	1.32	1.31	1.3	1.3	1.29	1.29	1.29	1.3	1.3	1.31	1.31		_
Number of d	ave in mo	nth (Tah	la 1a)					,	Average =	Sum(40) ₁	₁₂ /12=	1.3	(40)
Jar	-i	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)
,		ļ	ļ		ļ		ļ			ļ			
4. Water he	eating ene	rav reau	irement [.]								kWh/ye	ear.	
14. Water ne	Janny Che	igy icqu	ir Ciriciit.								IXVVIII YX	Jui .	
Assumed oc if TFA > 1			·[1 avn	(0 0003	2/0 v /TE	-N 130)2)1 ± 0 (1013 v /	Γ Ε Λ 13		.01		(42)
if TFA £ 1		T 1.70 X	. [ı - exp	(-0.0003	949 X (11	-A -13.9)Z)] + U.() X C1 UC	IFA - 13.	.9)			
Annual aver											82		(43
Reduce the ani not more that 1	_				_	_	to achieve	a water us	se target o	f		'	
			<u> </u>				Ι Δσ.	0.00	0-4	Na.	D.,		
Jar Hot water usag		Mar day for ea	Apr ach month	May Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
		<u> </u>	ı	,	ı	1	· <i>′</i>	00.26	02.64	86.92	1 00 2		
14)m= 90.2	86.92	83.64	80.36	77.08	73.8	73.8	77.08	80.36	83.64	m(44) _{1 12} :	90.2	983.98	(44
Energy content	of hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			· /		903.90	(
45)m= 133.7	6 116.99	120.72	105.25	100.99	87.14	80.75	92.66	93.77	109.28	119.29	129.54		
	ı	l .	l		l		l		Γotal = Su	m(45) _{1 12} :	=	1290.15	(45
f instantaneous	s water heati	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46)) to (61)			!		
46)m= 20.06	1	18.11	15.79	15.15	13.07	12.11	13.9	14.07	16.39	17.89	19.43		(46
Vater storaç					/\/\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	-1			1			· !	
Storage volu	` '	•				Ū		ame ves	sei		0		(47
f community Otherwise if	_			•			, ,	are) ante	ar '∩' in <i>(</i>	47)			
Vater storag		not wate) (tillo li	ioidaes i	Hotaritai	icous cc	ATTION DOIL	Cio, Cill) III (71)			
a) If manufa		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48
emperature	e factor fro	m Table	2b								0		(49
Energy lost t	from water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50
b) If manufa			-										
Hot water st	•			e 2 (kW	h/litre/da	ıy)					0		(51
f community olume factor	_		011 4.3								0		(52
emperature			2b							-	0		(53
nergy lost f				ear			(47) x (51)) x (52) x (53) =		0		(54
Enter (50) o		_	,	Jui			() // (0.)	/		-	0		(55
Nater storag	. , .	,	for each	month			((56)m = (55) × (41):	m			I	•
56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56
f cylinder conta			-				-				-	l ix H	, - 0
		r		1		ı	· · · · ·	· · · ·					(57
57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(3)

Primary circuit	loss (an	nual) fro	m Table	e 3							0		(58)
Primary circuit					•	. ,	. ,						
(modified by	tactor tr	om rabi	e H5 IT t		solar wa	ter neatii	ng and a		r tnermo	<u> </u>	0		(59)
(11)				0	<u> </u>	<u> </u>		U	U	0	0		(59)
Combi loss cal				<u>` </u>	` 	<u> </u>			i	i	i -		
(61)m= 45.96	40.01	42.62	39.63	39.28	36.39	37.61	39.28	39.63	42.62	42.86	45.96		(61)
Total heat requ							r `		<u> </u>	ì	(57)m +	(59)m + (61)m	
(62)m= 179.73	156.99	163.34	144.88	140.27	123.54	118.36	131.94	133.4	151.9	162.15	175.5		(62)
Solar DHW input c									r contribut	ion to wate	er heating)		
(add additional								<u> </u>		_			(00)
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from wa	r				l								
(64)m= 179.73	156.99	163.34	144.88	140.27	123.54	118.36	131.94	133.4	151.9	162.15	175.5	4=00.04	٦,,,,
								out from wa				1782.01	(64)
Heat gains fron						r i	<u> </u>	<u> </u>	- 	<u> </u>	<u> </u>]	
(65)m= 55.97	48.9	50.8	44.9	43.4	38.07	36.25	40.63	41.09	46.99	50.38	54.56		(65)
include (57)n	n in calc	ulation o	of (65)m	only if o	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal ga	ins (see	Table 5	and 5a):									
Metabolic gains	s (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 100.63	100.63	100.63	100.63	100.63	100.63	100.63	100.63	100.63	100.63	100.63	100.63		(66)
Lighting gains ((calculat	ed in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m= 15.67	13.92	11.32	8.57	6.41	5.41	5.84	7.59	10.19	12.94	15.11	16.1		(67)
Appliances gain	ns (calcı	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5				
(68)m= 175.71	177.54	172.94	163.16	150.81	139.21	131.45	129.63	134.23	144.01	156.35	167.96		(68)
Cooking gains	(calcula	ted in Ap	pendix	L, equat	tion L15	or L15a), also se	ee Table	5	-	=		
(69)m= 33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06	33.06		(69)
Pumps and fan	ns gains	(Table 5	 ба)	•	•	•	•	•	•	•			
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. eva	aporatio	n (negat	ive valu	es) (Tab	le 5)				<u>.</u>				
(71)m= -80.5	-80.5	-80.5	-80.5	-80.5	-80.5	-80.5	-80.5	-80.5	-80.5	-80.5	-80.5		(71)
Water heating	gains (T	able 5)		!		!	ı						
(72)m= 75.22	72.77	68.27	62.36	58.33	52.88	48.73	54.61	57.06	63.16	69.97	73.34		(72)
Total internal	gains =			<u> </u>	(66)	ı m + (67)m	ı + (68)m -	L + (69)m + ((70)m + (7	1)m + (72)	m		
(73)m= 322.79	320.41	308.72	290.28	271.74	253.68	242.21	248.02	257.67	276.3	297.62	313.59		(73)
6. Solar gains													
Solar gains are ca		using solai	r flux from	Table 6a	and assoc	iated equa	tions to co	nvert to th	e applicab	le orientat	ion.		
Orientation: A	ccess F	actor	Area		Flu	X		g_		FF		Gains	
Т	able 6d		m²		Ta	ble 6a	Т	able 6b	Ta	able 6c		(W)	
Northeast _{0.9x}	0.77	x	2.5	58	x 1	1.28	x	0.63	x	0.7	=	8.9	(75)
Northeast _{0.9x}	0.77	x	2.5	58	x 2	22.97	x	0.63	x	0.7	=	18.11	(75)
_													_

Northeast _{0.9x}	0.77	l v	0.50	l	44.20	1 ,	0.00	l v	0.7	1 =	22.02	(75)
Northeast 0.9x	0.77	X	2.58	X	41.38	X 	0.63	X	0.7] 1	32.63	╡ `
Northeast 0.9x	0.77	X	2.58	X	67.96	X 1	0.63	X	0.7] = 1 _	53.58	(75)
Northeast 0.9x	0.77	X	2.58	X	91.35] X]	0.63	X	0.7] =] =	72.02	(75)
Northeast 0.9x	0.77	X I	2.58	X	97.38] X]	0.63	X	0.7] 1	76.79	(75)
Northeast 0.9x	0.77	X	2.58	X	91.1	X 1	0.63	X	0.7] = 1 _	71.83	(75)
Northeast 0.9x	0.77	X	2.58	X	72.63] X]	0.63	X	0.7] = 1 _	57.26	(75)
Northeast 0.9x	0.77	X	2.58	X	50.42	X	0.63	X	0.7	=	39.76	(75)
Northeast 0.9x	0.77	X	2.58	X	28.07	X	0.63	X	0.7] = 1	22.13	(75)
Northeast 0.9x	0.77	X	2.58	X	14.2] X]	0.63	X	0.7] = 1	11.19	(75)
<u></u>	0.77	X	2.58	X	9.21	J X I	0.63	X	0.7] = 1	7.27	(75)
Northwest 0.9x	0.77	X	5.06	X	11.28	X	0.63	X	0.7] = 	17.45	(81)
Northwest 0.9x	0.77	X	1.97	X	11.28	X	0.63	X	0.7] = 1	6.79	(81)
Northwest 0.9x	0.77	X	2.68	X	11.28	X	0.63	X	0.7] = 1	9.24	(81)
Northwest 0.9x	0.77	X	5.06	X	22.97	X	0.63	X	0.7] = 1	35.52	(81)
Northwest 0.9x	0.77	Х	1.97	X	22.97	X	0.63	X	0.7	=	13.83	(81)
Northwest 0.9x	0.77	Х	2.68	X	22.97	X	0.63	X	0.7	=	18.81	(81)
Northwest 0.9x	0.77	Х	5.06	X	41.38	X	0.63	X	0.7	=	63.99	(81)
Northwest 0.9x	0.77	X	1.97	X	41.38	X	0.63	X	0.7	=	24.91	(81)
Northwest _{0.9x}	0.77	Х	2.68	X	41.38	X	0.63	X	0.7	=	33.89	(81)
Northwest _{0.9x}	0.77	Х	5.06	X	67.96	X	0.63	X	0.7	=	105.09	(81)
Northwest _{0.9x}	0.77	Х	1.97	X	67.96	X	0.63	X	0.7	=	40.91	(81)
Northwest _{0.9x}	0.77	X	2.68	X	67.96	X	0.63	X	0.7	<u> </u>	55.66	(81)
Northwest _{0.9x}	0.77	х	5.06	X	91.35	X	0.63	X	0.7	=	141.26	(81)
Northwest _{0.9x}	0.77	X	1.97	X	91.35	X	0.63	X	0.7	=	55	(81)
Northwest _{0.9x}	0.77	X	2.68	X	91.35	X	0.63	X	0.7	=	74.82	(81)
Northwest _{0.9x}	0.77	х	5.06	X	97.38	X	0.63	X	0.7	=	150.6	(81)
Northwest _{0.9x}	0.77	X	1.97	X	97.38	X	0.63	X	0.7	=	58.63	(81)
Northwest _{0.9x}	0.77	X	2.68	X	97.38	X	0.63	X	0.7	=	79.76	(81)
Northwest _{0.9x}	0.77	X	5.06	X	91.1	X	0.63	X	0.7	=	140.88	(81)
Northwest 0.9x	0.77	X	1.97	X	91.1	X	0.63	x	0.7	=	54.85	(81)
Northwest _{0.9x}	0.77	x	2.68	X	91.1	X	0.63	X	0.7	=	74.62	(81)
Northwest _{0.9x}	0.77	X	5.06	X	72.63	X	0.63	X	0.7	=	112.31	(81)
Northwest 0.9x	0.77	x	1.97	X	72.63	x	0.63	x	0.7	=	43.73	(81)
Northwest 0.9x	0.77	X	2.68	X	72.63	X	0.63	X	0.7	=	59.48	(81)
Northwest _{0.9x}	0.77	X	5.06	X	50.42	X	0.63	x	0.7	=	77.97	(81)
Northwest _{0.9x}	0.77	x	1.97	x	50.42	x	0.63	x	0.7	=	30.36	(81)
Northwest _{0.9x}	0.77	x	2.68	x	50.42	x	0.63	x	0.7] =	41.3	(81)
Northwest 0.9x	0.77	x	5.06	x	28.07	x	0.63	x	0.7	=	43.4	(81)
Northwest 0.9x	0.77	x	1.97	x	28.07	x	0.63	x	0.7	=	16.9	(81)
Northwest _{0.9x}	0.77	x	2.68	x	28.07	x	0.63	x	0.7	=	22.99	(81)
Northwest _{0.9x}	0.77	x	5.06	x	14.2	X	0.63	X	0.7	=	21.95	(81)

Northwest 0.9x	0.77	X	1.97		x	14.2	X	0.63	X	0.7	-	8.55	(81)
Northwest 0.9x	0.77	×	2.68		x \lceil	14.2	x	0.63	x	0.7	=	11.63	(81)
Northwest 0.9x	0.77	×	5.06		x \lceil	9.21	x	0.63	x	0.7		14.25	(81)
Northwest 0.9x	0.77	×	1.97		x $ar{ar{\ }}$	9.21	x	0.63	x	0.7	=	5.55	(81)
Northwest 0.9x	0.77	×	2.68		x $lacksquare$	9.21	x	0.63	x	0.7	=	7.55	(81)
Rooflights 0.9x	1	×	0.99		x \lceil	26	x	0.63	x	0.7		10.18	(82)
Rooflights 0.9x	1	X	0.99		x 🗏	54	x	0.63	X	0.7	=	21.15	(82)
Rooflights 0.9x	1	X	0.99		x [96	x	0.63	x	0.7	=	37.6	(82)
Rooflights 0.9x	1	X	0.99		x $lacksquare$	150	x	0.63	x	0.7	=	58.75	(82)
Rooflights 0.9x	1	×	0.99		x	192	X	0.63	x	0.7	-	75.19	(82)
Rooflights 0.9x	1	x	0.99		x	200	X	0.63	x	0.7	-	78.33	(82)
Rooflights 0.9x	1	X	0.99		x	189	X	0.63	X	0.7	_	74.02	(82)
Rooflights 0.9x	1	x	0.99		x	157	X	0.63	x	0.7	=	61.49	(82)
Rooflights 0.9x	1	X	0.99		x	115	X	0.63	x	0.7	_	45.04	(82)
Rooflights 0.9x	1	X	0.99		x	66	x	0.63	X	0.7	=	25.85	(82)
Rooflights 0.9x	1	X	0.99		x	33	x	0.63	X	0.7	=	12.92	(82)
Rooflights 0.9x	1	X	0.99		x	21	X	0.63	X	0.7	=	8.22	(82)
Solar gains in	watts, calcu	lated	for each	month			(83)m	= Sum(74)m	(82)m			_	
(83)m= 52.56		3.02		418.29	444		334	.27 234.42	131.2	7 66.25	42.83		(83)
Total gains –	internal and	solar	(84)m = ((73)m +	+ (83	3)m , watts						_	
(84)m= 375.35	427.82 50	4 7 4	604.27	200 00 I						_			(0.4)
(84)m= 375.35	427.02 50	1.74	004.27	690.02	697	7.78 658.4	582	492.09	407.5	7 363.87	356.42]	(84)
7. Mean inte				!		7.78 658.4	582	3 492.09	407.5	7 363.87	356.42		(84)
` ′	rnal tempera	iture (heating s	season)				407.5	7 363.87	356.42	21	(84)
7. Mean inte	rnal tempera e during heat	iture (heating seriods in t	season) the livir) ng ai	rea from Tab			407.5	7 363.87	356.42	21	
7. Mean inte	rnal tempera e during heat ctor for gains	iture (heating seriods in t	season) the livir	ng ai	rea from Tab	ole 9,		407.5°		356.42	21	
7. Mean inte	rnal tempera during heat ctor for gains	iture (ing pe	heating seriods in the ving area	season) the livir	ng ai	rea from Tab e Table 9a) un Jul	ole 9,	Th1 (°C)				21	
7. Mean intercontrol Temperature Utilisation far Jan (86)m= 1	rnal temperate during heat ctor for gains Feb 1 0	iture (ing pe s for li Mar	heating seriods in the ving area Apr 0.95	season) the livir a, h1,m May) ng ai (see	rea from Tab e Table 9a) un Jul 67 0.51	ole 9,	Th1 (°C) ug Sep 9 0.86	Oct	Nov	Dec	21	(85)
7. Mean interaction of the Temperature Utilisation fa	rnal temperate during heat ctor for gains Feb 1 0 al temperature	iture (ing pe s for li Mar	heating seriods in the ving area Apr 0.95 viving area	season) the livir a, h1,m May) ng ai (see	rea from Table Table 9a) un Jul 67 0.51	ole 9,	Th1 (°C) ug Sep 9 0.86 able 9c)	Oct	Nov 1	Dec	21	(85)
7. Mean interaction for Temperature Utilisation fa Jan (86)m= 1 Mean internation (87)m= 19.55	rnal temperate during heat ctor for gains Feb 1 1 0 al temperature 19.7	iture (ing pe s for li Mar .99	cheating seriods in the ving area Apr 0.95 civing area 20.42	season) the livin a, h1,m May 0.85 a T1 (fo	Ji (see Ji 0.6 ollow	rea from Table Table 9a) un Jul 67 0.51 v steps 3 to 7	ole 9, 0.5 7 in T	Th1 (°C) ug Sep 9 0.86 able 9c) 97 20.82	Oct 0.98	Nov 1	Dec 1	21	(85)
7. Mean intercent Temperature Utilisation far Utilisatio	rnal temperate during heat ctor for gains Feb 1 0 al temperature 19.7 e during heat	iture (ing pe s for li Mar .99	heating seriods in the ving area Apr 0.95 viving area 20.42 eriods in the viving area area area area area area area are	season) the livin a, h1,m May 0.85 a T1 (fo	Ji (see Ji 0.6 ollow	rea from Table Table 9a) un Jul 67 0.51 v steps 3 to 7 94 20.99 Illing from Ta	ole 9, 0.5 7 in T	Th1 (°C) ug Sep 9 0.86 able 9c) 97 20.82 9, Th2 (°C)	Oct 0.98	Nov 1 19.88	Dec 1	21	(85)
7. Mean intercent Temperature Utilisation far Utilisatio	rnal temperate during heat ctor for gains Feb 1 0 al temperature 19.7 e during heat 19.83 19	ture (cing person for ling person ling per	heating seriods in the ving area Apr 0.95 ving area 20.42 eriods in the 19.84	season) the livir a, h1,m May 0.85 a T1 (fo 20.77 rest of 0	Jing an (see Jin 0.6 villow 20.1 dwe 19.1	rea from Table Table 9a) un Jul 67 0.51 v steps 3 to 7 94 20.99 Illing from Ta	Ole 9, O.5 7 in T 20.9 able 9	Th1 (°C) ug Sep 9 0.86 able 9c) 97 20.82 9, Th2 (°C)	Oct 0.98	Nov 1	Dec 1	21	(85)
7. Mean intercent Temperature Utilisation fa Utilisation fa (86)m= 1 Mean interna (87)m= 19.55 Temperature (88)m= 19.83 Utilisation fa	rnal temperate during heat ctor for gains Feb 1 1 0 al temperature 19.7 e during heat 19.83 19.83	iture (ing person for li Mar .99 re in li 20 ing person for re 9.83	cheating seriods in the ving area Apr 0.95 civing area 20.42 ceriods in 19.84 cest of dweeters.	the livir a, h1,m May 0.85 a T1 (fo 20.77 rest of 0 19.84 elling, h	Jung and (see Julion 10.6) Julion 10.6 Jul	rea from Take Table 9a) un Jul 67 0.51 r steps 3 to 7 94 20.99 Illing from Take 85 19.85	Al 0.5 7 in T 20.8 19.0	Th1 (°C) ug Sep 9 0.86 able 9c) 97 20.82 9, Th2 (°C) 85 19.84	Oct 0.98 20.36	Nov 1 19.88	Dec 1 19.52	21	(85) (86) (87) (88)
7. Mean intercent Temperature Utilisation far [86]m= 1 Mean internation [87]m= 19.55 Temperature [88]m= 19.83 Utilisation far [89]m= 1	rnal temperate during heat ctor for gains Feb 1 1 0 al temperature 19.7 e during heat 19.83 19 ctor for gains 0.99 0	iture (ing person for li Mar .99 re in li 20 ing person for re .98	cheating seriods in the ving area Apr 0.95 civing area 20.42 ceriods in 19.84 cest of dwo 0.93	the livir a, h1,m May 0.85 a T1 (fo 20.77 rest of c 19.84 elling, h	0.6 Ji 0.6 0.6 20. dwe 19. 0.8	rea from Table Table 9a) un	Al 0.5 on T 20.5	Th1 (°C) ug Sep 9 0.86 table 9c) 97 20.82 0, Th2 (°C) 85 19.84	Oct 0.98 20.36 19.84 0.97	Nov 1	Dec 1	21	(85)
7. Mean intercent Temperature Utilisation far Utilisation far (86)m= 1 Mean internation (87)m= 19.55 Temperature (88)m= 19.83 Utilisation far (89)m= 1 Mean internation far	rnal temperate during heat temperature 19.7 e during heat 19.83 19.00 to 19.99 0 al temperature 19.99 0 al tempera	iture (ing person for li ing person li ing	heating seriods in the ving area Apr 0.95 viving area 20.42 veriods in the 19.84 vest of dwo 0.93 veriods in the rest of dwo 0	the livir a, h1,m May 0.85 a T1 (fo 20.77 rest of 0 19.84 elling, h	Jung all (see Jung 0.6 Jung 19. Jung 19	rea from Table Table 9a) un Jul 67 0.51 r steps 3 to 7 94 20.99 Illing from Ta 85 19.85 n (see Table 67 0.39	All 0.55 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0	Th1 (°C) ug Sep 9 0.86 fable 9c) 97 20.82 9, Th2 (°C) 85 19.84 6 0.79 to 7 in Tabl	Oct 0.98 20.36 19.84 0.97 e 9c)	Nov 1 19.88 19.84	Dec 1 19.52 19.83	21	(85) (86) (87) (88) (89)
7. Mean intercent Temperature Utilisation far [86]m= 1 Mean internation [87]m= 19.55 Temperature [88]m= 19.83 Utilisation far [89]m= 1	rnal temperate during heat temperature 19.7 e during heat 19.83 19.00 to 19.99 0 al temperature 19.99 0 al tempera	iture (ing person for li Mar .99 re in li 20 ing person for re .98	heating seriods in the ving area Apr 0.95 viving area 20.42 veriods in the 19.84 vest of dwo 0.93 veriods in the rest of dwo 0	the livir a, h1,m May 0.85 a T1 (fo 20.77 rest of c 19.84 elling, h	0.6 Ji 0.6 0.6 20. dwe 19. 0.8	rea from Table Table 9a) un Jul 67 0.51 r steps 3 to 7 94 20.99 Illing from Ta 85 19.85 n (see Table 67 0.39	Al 0.5 on T 20.5	Th1 (°C) ug Sep 9 0.86 Table 9c) 97 20.82 0, Th2 (°C) 85 19.84 6 0.79 to 7 in Tabl 84 19.7	Oct 0.98 20.36 19.84 0.97 e 9c)	Nov 1 19.88 19.84 0.99	Dec 1 19.52 19.83		(85) (86) (87) (88) (89)
7. Mean intercent Temperature Utilisation far Utilisation far (86)m= 1 Mean internation (87)m= 19.55 Temperature (88)m= 19.83 Utilisation far (89)m= 1 Mean internation far	rnal temperate during heat temperature 19.7 e during heat 19.83 19.00 to 19.99 0 al temperature 19.99 0 al tempera	iture (ing person for li ing person li ing	heating seriods in the ving area Apr 0.95 viving area 20.42 veriods in the 19.84 vest of dwo 0.93 veriods in the rest of dwo 0	the livir a, h1,m May 0.85 a T1 (fo 20.77 rest of 0 19.84 elling, h	Jung all (see Jung 0.6 Jung 19. Jung 19	rea from Table Table 9a) un Jul 67 0.51 r steps 3 to 7 94 20.99 Illing from Ta 85 19.85 n (see Table 67 0.39	All 0.55 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0	Th1 (°C) ug Sep 9 0.86 Table 9c) 97 20.82 0, Th2 (°C) 85 19.84 6 0.79 to 7 in Tabl 84 19.7	Oct 0.98 20.36 19.84 0.97 e 9c)	Nov 1 19.88 19.84	Dec 1 19.52 19.83	21	(85) (86) (87) (88) (89)
7. Mean intercent Temperature Utilisation far Utilisation far (86)m= 1 Mean internation (87)m= 19.55 Temperature (88)m= 19.83 Utilisation far (89)m= 1 Mean internation far	rnal temperate during heat ctor for gains Feb 1 1 0 al temperature 19.7 e during heat 19.83 19 ctor for gains 0.99 0 al temperature 18.13 18	ing person of the state of the	cheating seriods in the ving area and proving area and pr	the livir a, h1,m May 0.85 a T1 (for 20.77 rest of c 19.84 elling, h 0.79 f dwelling) ng ai (see Ji 0.6 20. dwe 19. 0.9 19.	rea from Take Table 9a) un Jul 67 0.51 r steps 3 to 7 94 20.99 Illing from Take 19.85 n (see Table 57 0.39 T2 (follow steps 19.84	All 0.5 of 19.0 of 19.	Th1 (°C) ug Sep 9 0.86 able 9c) 97 20.82 9, Th2 (°C) 85 19.84 6 0.79 to 7 in Tabl 84 19.7	Oct 0.98 20.36 19.84 0.97 e 9c)	Nov 1 19.88 19.84 0.99	Dec 1 19.52 19.83		(85) (86) (87) (88) (89)
7. Mean interaction for Temperature Utilisation far [86]m= 1 Mean internation [87]m= 19.55 Temperature [88]m= 19.83 Utilisation far [89]m= 1 Mean internation [90]m= 17.91	rnal temperate during heat ctor for gains Feb	ing person of the state of the	heating seriods in the ving area Apr 0.95 ving area 20.42 veriods in the ving area 20.42 veriod area 20.42 veriods in the ving area 20.42 veriods in the vi	the livir a, h1,m May 0.85 a T1 (for 20.77 rest of c 19.84 elling, h 0.79 f dwelling) ng ai (see Ji 0.6 20. dwe 19. 0.9 19.	rea from Table Table 9a) un	All 0.5 of 19.0 of 19.	Th1 (°C) ug Sep 9 0.86 able 9c) 97 20.82 9, Th2 (°C) 85 19.84 6 0.79 to 7 in Tabl 84 19.7 ft — fLA) × T2	Oct 0.98 20.36 19.84 0.97 e 9c)	Nov 1 19.88 19.84 0.99 18.4 ving area ÷ (4	Dec 1 19.52 19.83		(85) (86) (87) (88) (89)
7. Mean intermodular Temperature Utilisation fa Utilisation fa (86)m= 1 Mean intermodular 19.55 Temperature (88)m= 19.83 Utilisation fa (89)m= 1 Mean intermodular 17.91 Mean intermodular 17.91 Mean intermodular 18.65 Apply adjust	rnal temperate during heat ctor for gains Feb	ing person of the second of th	cheating seriods in the ving area and approximate and approxim	the livir a, h1,m May 0.85 a T1 (for 20.77 rest of c 19.84 elling, h 0.79 f dwelling 19.62	ng an (see Ju 0.6 Ju 0.	rea from Table Table 9a) un Jul 37 0.51 r steps 3 to 7 94 20.99 Illing from Ta 85 19.85 n (see Table 57 0.39 T2 (follow sterm 19.84) = fLA × T1 32 20.36 e from Table	All 0.5 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0	Th1 (°C) ug Sep 9 0.86 able 9c) 97 20.82 9, Th2 (°C) 85 19.84 6 0.79 to 7 in Tabl 84 19.7 f — fLA) × T2 35 20.2	Oct 0.98 20.36 19.84 0.97 e 9c) 19.09 LA = Liv	Nov 1 19.88 19.84 0.99 18.4 ving area ÷ (4	Dec 1 19.52 19.83 1 17.87		(85) (86) (87) (88) (89) (90) (91)
7. Mean interaction of the second of the sec	rnal temperate during heat ctor for gains Feb	ing person of the state of the	cheating seriods in the ving area and approximate and approxim	the livir a, h1,m May 0.85 a T1 (for 20.77 rest of c 19.84 elling, h 0.79 f dwelling 19.62	ng an (see Ji 0.6	rea from Table Table 9a) un Jul 37 0.51 r steps 3 to 7 94 20.99 Illing from Ta 85 19.85 n (see Table 57 0.39 T2 (follow sterm 19.84) = fLA × T1 32 20.36 e from Table	All 0.5 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0	Th1 (°C) ug Sep 9 0.86 fable 9c) 97 20.82 9, Th2 (°C) 85 19.84 6 0.79 to 7 in Tabl 84 19.7 f — fLA) × T2 35 20.2 where approximation of the second o	Oct 0.98 20.36 19.84 0.97 e 9c) 19.09 LA = Liv	Nov 1 19.88 19.84 0.99 18.4 ving area ÷ (4	Dec 1 19.52 19.83 1 17.87		(85) (86) (87) (88) (89) (90) (91)
7. Mean intermodular Temperature Utilisation fa Utilisation fa (86)m= 1 Mean intermodular 19.55 Temperature (88)m= 19.83 Utilisation fa (89)m= 1 Mean intermodular 17.91 Mean intermodular 17.91 Mean intermodular 18.65 Apply adjust (93)m= 18.65 8. Space he	rnal temperate during heat ctor for gains Feb	re in to 3.57 re (for ean	heating seriods in the ving area and approximate and approxima	the livir a, h1,m May 0.85 a T1 (for 20.77 rest of carest of	ng an (see Ju 0.6 Ju 0.	rea from Take Table 9a) un Jul 37 0.51 r steps 3 to 7 94 20.99 Illing from Ta 85 19.85 n (see Table 57 0.39 T2 (follow ste 81 19.84) = fLA × T1 32 20.36 e from Table 32 20.36	9a) 0.4 + (1 20.4 4e, 20.4	Th1 (°C) ug Sep 9 0.86 fable 9c) 97 20.82 9, Th2 (°C) 85 19.84 6 0.79 to 7 in Tabl 84 19.7 f — fLA) × T2 35 20.2 where approximates a second content of the content	Oct 0.98 20.36 19.84 0.97 e 9c) 19.09 LA = Liv	Nov 1 19.88 19.84 0.99 18.4 ving area ÷ (4	Dec 1 19.52 19.83 1 17.87 1) =	0.45	(85) (86) (87) (88) (89) (90) (91)
7. Mean interaction of the control o	rnal temperate during heat ctor for gains Feb	re in ti 3.57 re (for 2.21 mean 2.21 ment al terr	cheating seriods in the ving area and appropriate and appropri	the livir a, h1,m May 0.85 a T1 (fo 20.77 rest of o 19.84 elling, h 0.79 f dwelling 19.62	ng an (see Ju 0.6 Ju 0.	rea from Take Table 9a) un Jul 37 0.51 r steps 3 to 7 94 20.99 Illing from Ta 85 19.85 n (see Table 57 0.39 T2 (follow ste 81 19.84) = fLA × T1 32 20.36 e from Table 32 20.36	9a) 0.4 + (1 20.4 4e, 20.4	Th1 (°C) ug Sep 9 0.86 fable 9c) 97 20.82 9, Th2 (°C) 85 19.84 6 0.79 to 7 in Tabl 84 19.7 f — fLA) × T2 35 20.2 where approximates a second content of the content	Oct 0.98 20.36 19.84 0.97 e 9c) 19.09 LA = Liv	Nov 1 19.88 19.84 0.99 18.4 ving area ÷ (4	Dec 1 19.52 19.83 1 17.87 1) =	0.45	(85) (86) (87) (88) (89) (90) (91)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilis	ation fac	tor for a	ains, hm	·										
(94)m=	1	0.99	0.98	0.93	0.81	0.61	0.44	0.52	0.81	0.97	0.99	1		(94)
	∟——I ıl gains.	hmGm	, W = (94		L 4)m				l					
(95)m=	373.77	424.4	491.27	562.74	557.95	428.12	292.66	303.24	400.1	393.83	361.05	355.22		(95)
Montl	nly avera	age exte	rnal tem	perature	from Ta	able 8		!						
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for me	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=	1157.02	1122.02	1021.48	863.07	671.38	452.03	296.96	311.75	483.33	721.29	955.49	1154.46		(97)
Space	r i					Wh/mont	th = 0.02	24 x [(97)m – (95	- `	r ·			
(98)m=	582.74	468.8	394.48	216.24	84.4	0	0	0	0	243.63	427.99	594.63		,
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	3012.91	(98)
Space	e heating	g require	ement in	kWh/m²	² /year								49.31	(99)
9a. En	ergy red	luiremer	nts – Indi	vidual h	eating s	ystems i	ncluding	micro-C	CHP)					
-	e heatir	•										,		,
Fracti	ion of sp	ace hea	it from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	ace hea	it from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	- ir
Space	e heatin	g require	ement (c	alculate	d above)								
	582.74	468.8	394.48	216.24	84.4	0	0	0	0	243.63	427.99	594.63		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20	06)									(211)
	623.92	501.93	422.35	231.52	90.36	0	0	0	0	260.85	458.24	636.65		_
								Tota	ıl (kWh/yea	ar) =Sum(2	211)	=	3225.81	(211)
Space	e heating	g fuel (s	econdar	y), kWh/	month									
			00 ÷ (20			i	i		·		·			
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		1
								lota	ıl (kWh/yea	ar) =Sum(2	275) _{15,10. 12}	-	0	(215)
	heating		tor (oolo	ام امدادات	hava)									
Output	179.73	156.99	ter (calc 163.34	144.88	140.27	123.54	118.36	131.94	133.4	151.9	162.15	175.5		
Efficie	ncy of w												80.3	(216)
(217)m=		87.63	87.19	86.06	83.82	80.3	80.3	80.3	80.3	86.23	87.38	87.88		」` ´ ´ (217)
			kWh/mo				<u> </u>	<u> </u>	<u> </u>		ļ			
		•	÷ (217)											
(219)m=	204.71	179.15	187.34	168.35	167.35	153.85	147.4	164.31	166.13	176.15	185.57	199.71		,
								Tota	I = Sum(2	19a) ₁₁₂ =			2100	(219)
	l totals	و مناجعة	≕!≂جمسامہ	aa.t = :==	4					k'	Wh/year		kWh/year	1
•	•		ed, main	system	I								3225.81	_
Water	heating	fuel use	d										2100	
Electri	city for p	umps, f	ans and	electric	keep-ho	t								

				1	(220-)
central heating pump:			30	•	(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a	a) (230g) =		75	(231)
Electricity for lighting				276.72	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh		Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	=	696.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	453.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1150.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	143.62	(268)
Total CO2, kg/year	sum	n of (265) (271) =		1332.92	(272)

TER =

(273)

21.82

			loor D	otaila:						
A N	Obrida I I a al va all								040000	
		2								
Software Hame.	Ottoma 1 O/ ti 201							VCISIO	71. 1.0.4.12	
Address :										
1. Overall dwelling dime	ensions:									
Cround floor					(1-)] ₍₀₌₎ =		<u>-</u>
Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.12		(3a)								
	a)+(1b)+(1c)+(1d)+(1e)+(1n)	7	7.3						_
Dwelling volume					(3a)+(3b))+(3c)+(3c	l)+(3e)+	.(3n) =	208.71	(5)
2. Ventilation rate:	main se	econdary		other		total			m³ ner hou	r
North an of all large and	heating h	eating			, ₋ -			40 - 1	-	_
•		0		0	<u> </u>	0			0	= ' '
·		0	† <u>L</u>	0	」 <u> </u>	0			0	(6b)
					L	3	X '	10 =	30	(7a)
Number of passive vents	3				L	0	X ·	10 =	0	(7b)
Number of flueless gas fi	ires					0	X 4	40 =	0	(7c)
								Δir ch	anges per ho	nur
Infiltration due to chimne	vs_flues and fans = (6)	a)+(6b)+(7a)·	+(7b)+(7	7c) =	Г	20		ı		_
	•				ontinue fr			. (5) –	0.14	
Number of storeys in the	he dwelling (ns)								0	(9)
							[(9)	-1]x0.1 =	0	(10)
					•	uction			0	(11)
		oonaing to tri	ie greate	er wall area	a (aner					
If suspended wooden	floor, enter 0.2 (unseal	ed) or 0.1	(seale	d), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0								0	(13)
Percentage of window	s and doors draught st	ripped							0	(14)
									0	(15)
	50			. , . ,	. , , ,	, , ,	, ,			(16)
•	•		•	•	•	etre of e	envelope	area		=
· ·	-					is heina u	sed		0.39	(18)
			o. a aog	,, ee a pe.	v	.c 20g a			3	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =				(20)
Infiltration rate incorporate	ting shelter factor			(21) = (18)	x (20) =				0.31	(21)
Infiltration rate modified f	or monthly wind speed							,		
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7									
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor $(22a)m = (2a)m =$	2)m ÷ 4									
	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
` ''					-		L <u>-</u>		J	

	ation rate (`			1	` 	`	`	I	0.04	T	1	
0.39 Calculate effe		0.37 ange i	0.34 rate for t	0.33 he appli	0.29 cable ca	0.29 ise	0.28	0.31	0.33	0.34	0.36	İ	
If mechanica		_										0	(23
If exhaust air he	eat pump usin	ng Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0	(23
If balanced with	heat recover	ry: effic	iency in %	allowing t	for in-use f	actor (fron	n Table 4h) =				0	(23
a) If balance	d mechani	ical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balance	d mechani	ical ve	ntilation	without	heat red	covery (I	MV) (24b)m = (22	2b)m + (2	23b)	,	,	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	ļ	(24
c) If whole h if (22b)n	ouse extra n < 0.5 × (2			•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)n	ventilation n = 1, then			•	•				0.5]		•	ı	
24d)m= 0.58		0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	1	(24
Effective air	change rat	te - er	iter (24a) or (24l	o) or (24	c) or (24	d) in bo	x (25)	•		•		
25)m= 0.58	0.57 (0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	1	(25
3. Heat losse	s and heat	loss r	naramete	ar.									
LEMENT	Gross area (m	ĺ	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	()	k-value kJ/m²·l		A X k kJ/K
oors	aroa (m	. ,	••		2	 x	1	 =	2		10/111	`	(2)
Vindows Type	: 1				4.54	_{x1}	/[1/(1.4)+	0.04] =	6.02				(2
Vindows Type					6.3	_	/[1/(1.4)+		8.35				(2
Vindows Type					4.78	ऱ .	/[1/(1.4)+		6.34				(2
Vindows Type					0.98	= .	/[1/(1.4)+		1.3				(2
Rooflights					0.7285	_	/[1/(1.7) +	0.04] =	1.238504	4			(2
Valls Type1	40.58		16.6		23.98		0.18	i i	4.32	≒⊓			(2
Valls Type2	56.98		2	=	54.98	=	0.18	= :	9.9	=		룩 늗	(2
Roof	77.3		0.73	=	76.57	=	0.13	-	9.95	=		룩 늗	(3
otal area of e		l ∩²	0.70		174.8	_	0.10		0.00				(3
for windows and			ffective wi	ndow U-va			g formula 1	/[(1/U-valu	ıе)+0.04] а	ıs qiven in	paragraph	1 <i>3.2</i>	(0
* include the area						·		• .	, •	Ū			
abric heat los	s, W/K = S	6 (A x	U)				(26) (30) + (32) =				49.33	3 (3
leat capacity	Cm = S(A)	xk)						((28)	(30) + (32	2) + (32a)	(32e) =	15691.	54 (3
hermal mass	parameter	r (TMF	P = Cm ÷	· TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(3
or design assess an be used inste				construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
hermal bridge	es : S (L x `	Y) cal	culated i	using Ap	pendix l	K						8.33	(3
details of therma		e not kn	own (36) =	= 0.15 x (3	31)			(00)	(20)				
atal falania la	31 1000							(331 +	(KB) =				- 1/2
otal fabric he entilation hea		ا عامل	التحصما						$(36) = 0.33 \times (36)$	OE\=- (E)		57.67	7 (3

(00)	T	22.15						l	a= a.		l		1	(00)
` ′ _	39.65	39.45	39.25	38.32	38.14	37.33	37.33	37.18	37.64	38.14	38.5	38.86		(38)
Heat tran				05.00	05.04	0.5	0.5	04.05	· '	= (37) + (37)	 	00.50	1	
(39)m=	97.32	97.12	96.92	95.99	95.81	95	95	94.85	95.31	95.81	96.16 Sum(39) ₁	96.53	95.99	(39)
Heat loss	s parar	meter (H	HLP), W/	m²K						= (39)m ÷		12 / 12-	95.99	
(40)m=	1.26	1.26	1.25	1.24	1.24	1.23	1.23	1.23	1.23	1.24	1.24	1.25		_
Number	of dove	o in moi	oth (Tab	lo 1a)					,	Average =	Sum(40) ₁	₁₂ /12=	1.24	(40)
Number	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)
` /						ļ		ļ					I	
4 Wate	er heati	na ener	gy requi	rement								kWh/ye	ear.	
				romont.								icvviii y		
Assumed if TFA				[1 - exn	(-0.0003	849 v (TF	-Δ -13 Θ)2)] + 0.0	0013 x (ΓFΔ -13		.41		(42)
	£ 13.9		· 1.70 X	[I - CXP	(-0.000	7-5 X (11	A-10.5	<i>)</i> 2)] · O.() X 010 X (1174-10.	.5)			
Annual a												.43		(43)
Reduce the not more th		_				_	_	to acnieve	a water us	se target o	T			
Г	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ــــ Hot water ı							<u> </u>		СОР	000	1101			
(44)m= 1	100.57	96.91	93.26	89.6	85.94	82.29	82.29	85.94	89.6	93.26	96.91	100.57		
					ļ	ļ	ļ	!	-	Γotal = Su	m(44) _{1 12} =	!	1097.15	(44)
Energy cor	ntent of h	not water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		_
(45)m= 1	149.14	130.44	134.61	117.35	112.6	97.17	90.04	103.32	104.56	121.85	133.01	144.44		
If instantan	neoue wa	ater heati	na at noint	of use (no	hot water	r etoraga)	enter () in	hoves (16		Total = Su	m(45) _{1 12} =	=	1438.53	(45)
_	-		· ,	,	1		1		` ,	40.00	10.05	04.07	1	(46)
(46)m= [2 Water st	22.37 orage I	19.57 OSS :	20.19	17.6	16.89	14.58	13.51	15.5	15.68	18.28	19.95	21.67		(46)
Storage	•		includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If commu	unity he	eating a	nd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwis			hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water sto	-		ا لمصماد	aaa faat	معامات		./do./\					_	1	(40)
a) If mar					JI IS KIIO	wii (Kvvi	i/uay).					0]	(48)
Tempera Energy lo					oor			(40) v (40)				0		(49)
b) If mar			•			or is not		(48) x (49)	, –			0		(50)
Hot wate				-								0		(51)
If commu	-	_		on 4.3										
Volume f				2h							-	0		(52)
Tempera								(43) (54)	(50) (- 0)		0]	(53)
Energy lo Enter (5			_	, KVVN/ye	ear			(47) x (51)) X (52) X (೦૩) =		0		(54) (55)
Water st	, ,	, ,	•	or each	month			((56)m = (55) × (41)ı	m		U	I	(33)
	0	0	0	0			0	0	0	0	0	0		(56)
(56)m=		_			0 m = (56)m	0 x [(50) – (-				-] lix H	(30)
					1		ı	· · · · ·			•	· · ·	1	(57)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) from Table 3													
Primary circuit loss (arrital) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m		(33)											
(modified by factor from Table H5 if there is solar water heating and a cylinder thermos	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) ÷ 365 × (41)m		'											
(61)m= 50.96 44.61 47.52 44.19 43.8 40.58 41.93 43.8 44.19 47.52	47.79 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= 200.1 175.05 182.13 161.54 156.4 137.75 131.97 147.12 148.74 169.37	180.8 195.4	(62)											
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution	on to water heating)	ı											
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)		_											
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													
Output from water heater													
(64)m= 200.1 175.05 182.13 161.54 156.4 137.75 131.97 147.12 148.74 169.37	180.8 195.4												
Output from water heater	(annual) _{1 12}	1986.37 (64)											
Heat gains from water heating, kWh/month 0.25 $^{\circ}$ [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m	+ (57)m + (59)m]											
(65)m= 62.33 54.52 56.64 50.07 48.39 42.45 40.42 45.3 45.81 52.4	56.17 60.77	(65)											
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from	om community h	eating											
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= 120.48 120.48 120.48 120.48 120.48 120.48 120.48 120.48 120.48 120.48 120.48	120.48 120.48	(66)											
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	•	1											
(67)m= 19.05 16.92 13.76 10.42 7.79 6.57 7.1 9.23 12.39 15.74	18.37 19.58	(67)											
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	•	ı											
(68)m= 213.71 215.92 210.33 198.44 183.42 169.31 159.88 157.66 163.25 175.14	190.16 204.28	(68)											
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	•	ı											
(69)m= 35.05 35.05 35.05 35.05 35.05 35.05 35.05 35.05 35.05	35.05 35.05	(69)											
Pumps and fans gains (Table 5a)	<u>'</u>	I											
(70)m= 3 3 3 3 3 3 3 3 3 3 3	3 3	(70)											
Losses e.g. evaporation (negative values) (Table 5)	•	J											
(71)m= -96.39 -96.39 -96.39 -96.39 -96.39 -96.39 -96.39 -96.39 -96.39 -96.39	-96.39 -96.39	(71)											
Water heating gains (Table 5)		I											
(72)m= 83.78 81.14 76.13 69.54 65.04 58.96 54.33 60.89 63.63 70.42	78.02 81.67	(72)											
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m	1)m + (72)m	ı											
(73)m= 378.68 376.12 362.36 340.54 318.39 296.99 283.45 289.93 301.41 323.45	348.69 367.67	(73)											
6. Solar gains:													
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicab	le orientation.												
Orientation: Access Factor Area Flux g_	FF	Gains											
Table 6d m² Table 6a Table 6b Ta	able 6c	(W)											
Northeast 0.9x 0.77 x 0.98 x 11.28 x 0.63 x	0.7	3.38 (75)											
Northeast 0.9x 0.77 x 0.98 x 22.97 x 0.63 x	0.7	6.88 (75)											
													

Northeast _{0.9x}	0.77	٦ ,	0.00	1 🗸	44.20	1 .	0.02	l	0.7	1 =	40.00	(75)
Northeast 0.9x	0.77] X]	0.98] X] .,	41.38	X 	0.63	X	0.7] 1	12.39	≓ `
Northeast 0.9x	0.77] X]	0.98] X]	67.96	X 1	0.63	X	0.7] = 1 _	20.35	(75)
Northeast 0.9x	0.77] X]	0.98] X] .,	91.35] X]	0.63	X	0.7] = 1 _	27.36	(75)
Northeast 0.9x	0.77] X	0.98	X	97.38	X 1	0.63	X	0.7] = 1	29.17	(75)
Northeast 0.9x	0.77	X	0.98	X	91.1	X	0.63	X	0.7] = 1	27.28	(75)
<u> </u>	0.77	」 X □	0.98	X	72.63	X I	0.63	X	0.7] = 1	21.75	(75)
Northeast 0.9x	0.77	X	0.98	X	50.42	X	0.63	X	0.7] = 1	15.1	(75)
Northeast 0.9x	0.77	X	0.98	X	28.07	X	0.63	X	0.7] = 1	8.41	(75)
Northeast 0.9x	0.77	X	0.98	X	14.2	X	0.63	X	0.7] = 1	4.25	(75)
Northeast 0.9x	0.77	X	0.98	X	9.21	X	0.63	X	0.7] =	2.76	(75)
Southeast 0.9x	0.77	X	4.54	X	36.79	X	0.63	X	0.7	=	51.05	(77)
Southeast 0.9x	0.77	X	6.3	X	36.79	X	0.63	X	0.7] =	70.84	(77)
Southeast 0.9x	0.77	X	4.78	X	36.79	X	0.63	X	0.7] =	53.75	(77)
Southeast _{0.9x}	0.77	X	4.54	X	62.67	X	0.63	X	0.7	=	86.96	(77)
Southeast _{0.9x}	0.77	X	6.3	X	62.67	X	0.63	X	0.7	=	120.67	(77)
Southeast _{0.9x}	0.77	X	4.78	X	62.67	X	0.63	X	0.7	=	91.56	(77)
Southeast _{0.9x}	0.77	X	4.54	X	85.75	X	0.63	X	0.7	=	118.98	(77)
Southeast _{0.9x}	0.77	X	6.3	X	85.75	X	0.63	X	0.7	=	165.1	(77)
Southeast _{0.9x}	0.77	X	4.78	X	85.75	X	0.63	X	0.7	=	125.27	(77)
Southeast _{0.9x}	0.77	X	4.54	X	106.25	X	0.63	X	0.7	=	147.42	(77)
Southeast _{0.9x}	0.77	X	6.3	X	106.25	X	0.63	x	0.7	=	204.57	(77)
Southeast 0.9x	0.77	X	4.78	X	106.25	x	0.63	X	0.7	=	155.22	(77)
Southeast 0.9x	0.77	X	4.54	X	119.01	X	0.63	X	0.7	=	165.13	(77)
Southeast 0.9x	0.77	X	6.3	X	119.01	X	0.63	X	0.7	=	229.14	(77)
Southeast 0.9x	0.77	X	4.78	X	119.01	x	0.63	x	0.7	=	173.85	(77)
Southeast 0.9x	0.77	X	4.54	X	118.15	x	0.63	x	0.7	=	163.93	(77)
Southeast 0.9x	0.77	x	6.3	X	118.15	x	0.63	x	0.7	=	227.48	(77)
Southeast 0.9x	0.77	x	4.78	X	118.15	x	0.63	x	0.7	=	172.6	(77)
Southeast _{0.9x}	0.77	x	4.54	x	113.91	x	0.63	X	0.7	=	158.05	(77)
Southeast 0.9x	0.77	x	6.3	x	113.91	x	0.63	x	0.7] =	219.32	(77)
Southeast 0.9x	0.77	x	4.78	x	113.91	x	0.63	x	0.7] =	166.4	(77)
Southeast 0.9x	0.77	x	4.54	x	104.39	x	0.63	x	0.7	Ī =	144.84	(77)
Southeast 0.9x	0.77	x	6.3	x	104.39	x	0.63	x	0.7	j =	200.99	(77)
Southeast 0.9x	0.77	x	4.78	x	104.39	x	0.63	x	0.7	j =	152.5	(77)
Southeast 0.9x	0.77	x	4.54	x	92.85	x	0.63	x	0.7	j =	128.83	(77)
Southeast 0.9x	0.77	×	6.3	x	92.85	x	0.63	x	0.7	j =	178.77	(77)
Southeast 0.9x	0.77	x	4.78	x	92.85	x	0.63	x	0.7	j =	135.64	(77)
Southeast 0.9x	0.77	X	4.54	x	69.27	x	0.63	x	0.7	j =	96.11	(77)
Southeast 0.9x	0.77	j×	6.3	x	69.27	x	0.63	x	0.7	j =	133.37	(77)
Southeast 0.9x	0.77	X	4.78	x	69.27	x	0.63	x	0.7	j =	101.19	(77)
Southeast _{0.9x}	0.77	x	4.54	×	44.07	×	0.63	X	0.7	j =	61.15	(77)
_		_		-		-		•		-		_

Southeast 0.9x	0.77	x	6.3	3	X	44.07	×		0.63	x [0.7	=	84.85	(77)
Southeast 0.9x	0.77	X	4.78	8	X	44.07	×		0.63	x	0.7	=	64.38	(77)
Southeast 0.9x	0.77	X	4.5	4	X	31.49	×		0.63	x	0.7	=	43.69	(77)
Southeast 0.9x	0.77	X	6.3	3	X	31.49	x		0.63	x [0.7	=	60.63	(77)
Southeast 0.9x	0.77	x	4.78	8	X	31.49	×		0.63	x [0.7		46	(77)
Rooflights 0.9x	1	x	0.73	3	X	26	×		0.63	x	0.7		7.52	(82)
Rooflights 0.9x	1	x	0.73	3	X	54	x		0.63	x [0.7	-	15.61	(82)
Rooflights 0.9x	1	x	0.73	3	X	96	×		0.63	x [0.7		27.76	(82)
Rooflights 0.9x	1	X	0.73	3	X	150	x		0.63	x [0.7	=	43.37	(82)
Rooflights 0.9x	1	X	0.73	3	X	192	×		0.63	x [0.7	=	55.52	(82)
Rooflights 0.9x	1	X	0.73	3	X	200	×		0.63	x [0.7	=	57.83	(82)
Rooflights 0.9x	1	X	0.73	3	X	189	×		0.63	x [0.7	=	54.65	(82)
Rooflights 0.9x	1	X	0.73	3	X	157	×		0.63	x [0.7	=	45.4	(82)
Rooflights 0.9x	1	X	0.73	3	X	115	×		0.63	x [0.7	=	33.25	(82)
Rooflights 0.9x	1	X	0.73	3	X	66	x		0.63	x [0.7	=	19.08	(82)
Rooflights 0.9x	1	X	0.73	3	X	33	×		0.63	x [0.7	=	9.54	(82)
Rooflights 0.9x	1	X	0.73	3	X	21	×		0.63	x [0.7	=	6.07	(82)
Solar gains in	watts, calc	ulated	for each	month	١		(83)	m = S	um(74)m	(82)m			-	
(83)m= 186.54		49.51	570.94	650.99		51.01 625.		5.48	491.6	358.15	224.17	159.14		(83)
Total gains –	internal and	l solar	(84)m =	(73)m	+ (8	33)m , watt	s						_	
(84)m= 565.21	697.8	11.87	911.47	969.38	I۵	4 7 00 000 /					l	I		(01)
(01)	1 337.10	11.07	V 1 1 . 1 7	000.00	9.	47.99 909.	15 8	55.4	793.01	681.6	572.86	526.82	_	(84)
	rnal temper		I			47.99 909.	15 8	55.4	793.01	681.6	572.86	526.82		(04)
	rnal temper	ature (heating	seasor	า)					681.6	572.86	526.82	21	(85)
7. Mean inte	rnal tempera e during hea	ature (ating pe	heating eriods in	seasor the liv	n) ing	area from	Γable :			681.6	572.86	526.82	21	
7. Mean inte	rnal temper e during hea ctor for gain	ature (ating pe	heating eriods in	seasor the liv	n) ing n (s	area from	Γable :			681.6	Nov	Dec	21	
7. Mean inte	rnal temper during hea ctor for gain	ature (ating pe as for li	heating eriods in ving are	seasor the liv	ing n (s	area from T	Γable :	9, Th	1 (°C)				21	
7. Mean intercontrol Temperature Utilisation fa	rnal temper e during hea ctor for gain Feb	ature (ating pe as for li Mar 0.97	heating eriods in ving are Apr	seasor the livea, h1,n May	ing n (s	area from Tee Table 9a Jun Jul 0.61 0.45	Γable (9, Th Aug).5	1 (°C) Sep 0.74	Oct	Nov	Dec	21	(85)
7. Mean intercontrol Temperature Utilisation fa Jan (86)m= 1	rnal temper e during hea ctor for gain Feb 0.99	ature (ating pe as for li Mar 0.97	heating eriods in ving are Apr	seasor the livea, h1,n May	ing n (se	area from Tee Table 9a Jun Jul 0.61 0.45	Table sa)	9, Th Aug).5	1 (°C) Sep 0.74	Oct	Nov	Dec	21	(85)
7. Mean internation far Jan (86)m= 1 Mean internation (87)m= 19.73	rnal temper e during hea ctor for gain Feb 0.99 0 cal temperatu 19.96 2	ature (ating persons for li Mar 0.97 ure in li 20.26	heating eriods in ving are Apr 0.91 iving are	seasor the liv a, h1,n May 0.79 ea T1 (f	ing (second)	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9	Γable : a) I	9, Th Aug).5 Table	1 (°C) Sep 0.74 e 9c) 20.92	Oct 0.94	Nov 0.99	Dec 1	21	(85)
7. Mean internation for Temperature Utilisation fa Jan (86)m= 1 Mean internation	rnal temperature during hea	ature (ating persons for li Mar 0.97 ure in li 20.26	heating eriods in ving are Apr 0.91 iving are	seasor the liv a, h1,n May 0.79 ea T1 (f	n (se	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9	Γable : a) 1	9, Th Aug).5 Table	1 (°C) Sep 0.74 e 9c) 20.92	Oct 0.94	Nov 0.99	Dec 1	21	(85)
7. Mean intercent Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.73 Temperature (88)m= 19.87	rnal temperate during hea	ature (ating person of the state of the sta	heating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of	ing (so	area from July Jun July Jun July Juny July July July July July July July Jul	Γable 9 1	9, Th Aug 0.5 Table 0.99 9, Ti 9.9	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C)	Oct 0.94 20.58	Nov 0.99 20.08	Dec 1	21	(85)
7. Mean internation (86)m= 1 Mean internation (87)m= 19.73 Temperature (88)m= 19.87 Utilisation fa	rnal temperature during hea ctor for gain 0.99 0.99 0.99 1.00 0.90 0.9	ature (ating peas for li Mar 0.97 ure in li 20.26 ting peas for response for re-	heating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89 est of dv	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling,	n) ing n (se	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9 relling from 19.9 19.5 m (see Tab	Γable 9 a) 1	9, Th Aug).5 Table).99 9, Tl 9.9	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89	Oct 0.94 20.58	Nov 0.99 20.08	Dec 1 19.69 19.88	21	(85) (86) (87) (88)
7. Mean intercontrol Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.73 Temperature (88)m= 19.87 Utilisation fa (89)m= 0.99	rnal temper e during hea ctor for gain Feb 0.99 al temperatu 19.96 2 during hea 19.88 1 ctor for gain 0.98	ature (ating pens for li Mar 0.97 ure in li 20.26 19.88 us for re 0.96	cheating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89 est of dv 0.88	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73	n) ing n (se	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9 relling from 19.9 19.5 m (see Tab 0.52 0.34	Γable 9 a) 1	9, Th Aug 0.5 Table 0.99 9, Tl 9.9)	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89	Oct 0.94 20.58 19.89 0.92	Nov 0.99 20.08	Dec 1	21	(85)
7. Mean interaction for the control of the control	rnal temperate during heat temperature during heat 19.88 1 1 19.98 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ature (ating person of the second of the se	heating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89 est of dv 0.88 he rest of	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73	ing (solloon) (s	area from July Jun July Jun July Juny July July July July July July July Jul	Fable (a) Fable (b) Fable (c)	9, Th Aug 0.5 Table 0.99 9, Tl 9.9 .39 3 to 5	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89 0.65 7 in Tabl	Oct 0.94 20.58 19.89 0.92 e 9c)	Nov 0.99 20.08 19.88	Dec 1 19.69 19.88	21	(85) (86) (87) (88)
7. Mean intercontrol Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.73 Temperature (88)m= 19.87 Utilisation fa (89)m= 0.99	rnal temperate during heat temperature during heat 19.88 1 1 19.98 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ature (ating pens for li Mar 0.97 ure in li 20.26 19.88 us for re 0.96	cheating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89 est of dv 0.88	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73	ing (solloon) (s	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9 relling from 19.9 19.5 m (see Tab 0.52 0.34	Fable (a) Fable (b) Fable (c)	9, Th Aug 0.5 Table 0.99 9, Tl 9.9)	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89 0.65 7 in Tabl	Oct 0.94 20.58 19.89 0.92 e 9c)	Nov 0.99 20.08 19.88 0.99	Dec 1 19.69 19.88 1		(85) (86) (87) (88) (89)
7. Mean interaction far Jan (86)m= 1 Mean internation (87)m= 19.73 Temperature (88)m= 19.87 Utilisation far (89)m= 0.99 Mean internation (90)m= 18.21	rnal temper e during hea ctor for gain Feb 0.99 al temperatu 19.96 2 during hea 19.88 1 ctor for gain 0.98 al temperatu 18.53 1	ature (ating person of the second of the se	cheating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89 est of dv 0.88 he rest of 19.44	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73 of dwel 19.75	n (second of the second of the	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9 relling from 19.9 19.9 m (see Table 9a T2 (follow 9.88 19.8	Fable 9 a) Fable 9 Table 9 a fable 9	9, Th Aug 0.5 Table 0.99 9, Ti 9.9 0.39 3 to 5	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89 0.65 7 in Table 19.83	Oct 0.94 20.58 19.89 0.92 e 9c)	Nov 0.99 20.08 19.88	Dec 1 19.69 19.88 1	21	(85) (86) (87) (88)
7. Mean internation for Utilisation far Utilisation far Utilisation far (86)m= 1 Mean internation far (87)m= 19.73 Temperature (88)m= 19.87 Utilisation far (89)m= 0.99 Mean internation far (90)m= 18.21	rnal temper e during hea ctor for gain Feb 0.99 al temperatu 19.96 2 during hea 19.88 1 octor for gain 0.98 al temperatu 18.53 1 dal temperatu 18.53	ature (ating person of the second of the se	cheating eriods in ving are Apr 0.91 ving are 20.6 eriods in 19.89 est of dv 0.88 he rest of 19.44	the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73 of dwel 19.75	n) ing (sing) follo 2 f dw h2, 1 ellling	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 to 0.97 20.9 relling from 19.9 19.9 T2 (follow 9.88 19.8 g) = fLA × Table 3.52	Γable 9 a) I	9, Th Aug 0.5 Table 0.99 9, Th 9.9 3 to 7 9.89	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89 0.65 7 in Table 19.83 f A) × T2	Oct 0.94 20.58 19.89 0.92 e 9c) 19.42 LA = Liv	Nov 0.99 20.08 19.88 0.99	Dec 1 19.69 19.88 1 18.15 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean internation factor of the following states of the factor of the	rnal temper e during hea ctor for gain Feb 0.99 0.99 0 el temperatu 19.96 2 e during hea 19.88 1 ctor for gain 0.98 0 le temperatu 18.53 1 le temperatu 19.28 1 temperatu 19.28 1 temperatu 19.28 1 temperatu 19.28 1 temperatu	ature (ating persons for limiting persons for reconstruction) at the second sec	cheating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89 est of dv 0.88 he rest of 19.44	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73 of dwel 19.75	n (second property of the second property of	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9 relling from 19.9 19.5 m (see Table 0.52 0.34 T2 (follow 9.88 19.8 g) = fLA × T 0.45 20.4	Γable 9 1	9, Th Aug 0.5 Table 0.99 9, Tl 9.9 3 to 7 0.89 1 — fL	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89 0.65 7 in Tabl 19.83 f .A) × T2 20.4	Oct 0.94 20.58 19.89 0.92 e 9c) 19.42 LA = Liv	Nov 0.99 20.08 19.88 0.99	Dec 1 19.69 19.88 1		(85) (86) (87) (88) (89)
7. Mean internation (86)m= 1 Mean internation (87)m= 19.73 Temperature (88)m= 19.87 Utilisation far (89)m= 0.99 Mean internation (90)m= 18.21 Mean internation (92)m= 19.01 Apply adjust	rnal temper e during hea ctor for gain Feb 0.99 0 0 0 0 0 0 0 0 0	ature (ating person of the state of the stat	cheating eriods in ving are Apr 0.91 ving are 20.6 eriods in 19.89 est of dv 0.88 he rest of 19.44 rest of 19.44 eriods internal	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73 of dwel 19.75 ole dwe 20.33 tempe	n) ing n (see) 2 f dw h2, 1 lling 1 ratu	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 to 0.97 20.9 relling from 19.9 19.5 m (see Table 9a 0.52 0.34 T2 (follow 9.88 19.8 g) = fLA × Tee from Tale	Γable 9 10 7 in 19 20 Table 9 11 00 Steps 9 19 Γ1 + (17 20 ble 4e	9, Th Aug 0.5 Table 0.99 9, Th 9.9 3 to 7 9.89 1 — fL 0.47 , whe	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89 0.65 7 in Table 19.83 f A) × T2 20.4 ere appro	Oct 0.94 20.58 19.89 0.92 e 9c) 19.42 LA = Liv	Nov 0.99 20.08 19.88 0.99 18.72 ing area ÷ (4	Dec 1 19.69 19.88 1 18.15 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean internation (86)m= 1 Mean internation (87)m= 19.73 Temperature (88)m= 19.87 Utilisation far (89)m= 0.99 Mean internation (90)m= 18.21 Mean internation (92)m= 19.01 Apply adjust (93)m= 19.01	rnal temper e during hea ctor for gain Feb 0.99 0 0 0 0 0 0 0 0 0	ature (ating persons for reconstruction) ating persons for reconstruction to the second seco	cheating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89 est of dv 0.88 he rest of 19.44	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73 of dwel 19.75 ole dwe 20.33	n) ing n (see) 2 f dw h2, 1 lling 1 ratu	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9 relling from 19.9 19.5 m (see Table 0.52 0.34 T2 (follow 9.88 19.8 g) = fLA × T 0.45 20.4	Γable 9 10 7 in 19 20 Table 9 11 00 Steps 9 19 Γ1 + (17 20 ble 4e	9, Th Aug 0.5 Table 0.99 9, Tl 9.9 3 to 7 0.89 1 — fL	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89 0.65 7 in Tabl 19.83 f .A) × T2 20.4	Oct 0.94 20.58 19.89 0.92 e 9c) 19.42 LA = Liv	Nov 0.99 20.08 19.88 0.99	Dec 1 19.69 19.88 1 18.15 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean internation (86)m= 1 Mean internation (87)m= 19.73 Temperature (88)m= 19.87 Utilisation far (89)m= 0.99 Mean internation (90)m= 18.21 Mean internation (92)m= 19.01 Apply adjust (93)m= 19.01 8. Space hear	rnal temper e during hea ctor for gain Feb 0.99 19.96 2 during hea 19.88 1 temperatu 19.88 1 temperatu 18.53 1 temperatu 18.53 1 temperatu 19.28 1 temperatu	ature (ating persons for limited persons for record for limited persons for record for limited persons for record for limited persons for record for limited persons for record for limited persons for record for limited persons for record for limited persons for limited persons for record for limited persons for limited perso	cheating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89 est of dv 0.88 he rest of 19.44 the who 20.05 internal 20.05	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73 of dwel 19.75 ole dwel 20.33 tempe 20.33	h2, (selling h2, (aratular)	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9 relling from 19.9 19.9 m (see Table 0.52 0.34 T2 (follow 9.88 19.8 g) = fLA × Tee 0.45 20.4 re from Tal 0.45 20.4	Γable 9 a) I	9, Th Aug 0.5 Table 0.99 9, Ti 9.9 .39 3 to 7 9.89 1 — fL 0.47 , whee	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89 0.65 7 in Table 19.83 f A) × T2 20.4 ere appro 20.4	Oct 0.94 20.58 19.89 0.92 e 9c) 19.42 LA = Liv 20.03 priate 20.03	Nov 0.99 20.08 19.88 0.99 18.72 ing area ÷ (4	Dec 1 19.69 19.88 1 1 18.15 4) =	0.53	(85) (86) (87) (88) (89) (90) (91)
7. Mean internation (86)m= 1 Mean internation (87)m= 19.73 Temperature (88)m= 19.87 Utilisation far (89)m= 0.99 Mean internation (90)m= 18.21 Mean internation (92)m= 19.01 Apply adjust (93)m= 19.01	rnal temper e during hea ctor for gain Feb 0.99 al temperature 19.96 2 during hea 19.88 1 ctor for gain 0.98 al temperature 18.53 1 ment to the 19.28 1 ating require mean interr	ature (ating persons for li Mar 0.97 ure in li 20.26 19.88 us for re 0.96 ure (for 19.65 mean 19.65 mean 19.65 mean 19.65 mean 19.65 mean 19.65 mean 19.61 mean 19.65 mean 19.65 mean 19.65 mean 19.65	cheating eriods in ving are Apr 0.91 iving are 20.6 eriods in 19.89 est of dv 0.88 he rest of 19.44 the who 20.05 internal 20.05 internal 20.05	seasor the liv a, h1,n May 0.79 ea T1 (f 20.85 rest of 19.89 velling, 0.73 of dwel 19.75 cole dwe 20.33 tempe 20.33	h2, (selling h2, (aratular)	area from Tee Table 9a Jun Jul 0.61 0.45 w steps 3 t 0.97 20.9 relling from 19.9 19.9 m (see Table 0.52 0.34 T2 (follow 9.88 19.8 g) = fLA × Tee 0.45 20.4 re from Tal 0.45 20.4	Γable 9 a) I	9, Th Aug 0.5 Table 0.99 9, Ti 9.9 .39 3 to 7 9.89 1 — fL 0.47 , whee	1 (°C) Sep 0.74 e 9c) 20.92 h2 (°C) 19.89 0.65 7 in Table 19.83 f A) × T2 20.4 ere appro 20.4	Oct 0.94 20.58 19.89 0.92 e 9c) 19.42 LA = Liv 20.03 priate 20.03	Nov 0.99 20.08 19.88 0.99 18.72 ing area ÷ (4	Dec 1 19.69 19.88 1 1 18.15 4) =	0.53	(85) (86) (87) (88) (89) (90) (91)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilis	ation fac	tor for a	ains, hm	·										
(94)m=	0.99	0.98	0.95	0.88	0.75	0.57	0.4	0.45	0.7	0.92	0.98	0.99		(94)
Usefu	ıl gains,	hmGm	, W = (94	1)m x (84	4)m				l .		ļ			
(95)m=	560.76	684.01	773.37	806.32	731.07	536.73	364.86	381.21	551.94	626.57	563.18	523.74		(95)
Montl	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
					erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
	1431.55		<u> </u>	1070.48	826.68	555.61	367.81	386	600.69	903.34	1186.21	1424.86		(97)
•							r	 ` -)m – (95		' 			
(98)m=	647.87	478.93	372.55	190.2	71.14	0	0	0	0	205.92	448.58	670.44		٦,,,,
								Tota	ıl per year	(kWh/year	r) = Sum(9	8) _{15,912} =	3085.62	(98)
Space	e heatin	g require	ement in	kWh/m²	² /year								39.92	(99)
9a. En	ergy rec	luiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatir	•												,
Fracti	ion of sp	ace hea	it from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	ace hea	it from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	- ir
Space	e heatin	g require	ement (c	alculate	d above))			•		•			
	647.87	478.93	372.55	190.2	71.14	0	0	0	0	205.92	448.58	670.44		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20	06)									(211)
	693.65	512.77	398.88	203.64	76.17	0	0	0	0	220.47	480.28	717.81		_
								Tota	ıl (kWh/yea	ar) =Sum(2	211)	=	3303.66	(211)
•		• •	econdar	• •	month									
			00 ÷ (20											
(215)m=	0	0	0	0	0	0	0	0 	0	0	0	0		7,,,,,
								Tota	ıı (kvvn/yea	ar) =Sum(2	215) _{15,10. 12}		0	(215)
	heating		tor (oolo	ام امدادات	hava)									
Output	200.1	175.05	ter (calc 182.13	161.54	156.4	137.75	131.97	147.12	148.74	169.37	180.8	195.4		
Efficie	ncy of w	ater hea	ıter										80.3	(216)
(217)m=	87.79	87.46	86.81	85.46	83.21	80.3	80.3	80.3	80.3	85.54	87.25	87.9		」 (217)
Fuel fo	r water	heating,	kWh/mo	onth		ļ	ļ	ļ	<u> </u>		ļ			
(219)m	1 = (64)	m x 100	÷ (217)	m								1		
(219)m=	227.92	200.16	209.79	189.02	187.96	171.54	164.35	183.21	185.23	197.99	207.23	222.28		,
_								I ota	I = Sum(2				2346.69	(219)
	al totals	fuelue	ed, main	evetem	1					k'	Wh/year	· 	3303.66	1
•	_			System	1							[] 1
	heating												2346.69	_
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								

central heating pump:			30]	(230c)
boiler with a fan-assisted flue			45]	(230e)
Total electricity for the above, kWh/year	sum of (230a	a) (230g) =		75	(231)
Electricity for lighting				336.4	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh	ctor	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	=	713.59	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	506.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1220.48	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	174.59	(268)
Total CO2, kg/year	sum	of (265) (271) =		1433.99	(272)

TER =

(273)

18.55

			Jser D	etaile: -						
Access May 1	Chris Haaler - II				- NI	L		OTDO	016000	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	2		Stroma Softwa					016363 on: 1.0.4.12	
Softmare Hume.	2			Address:				. 0.00		
Address :					·					
1. Overall dwelling dime	ensions:									
Ground floor				a(m²)	(1a) x		ight(m)	(2a) =	Volume(m³) (3a)
	a) ((\. (1-)					2.7	(2a) -	169.83	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e))+(1N)	6	52.9	(4)) . (O) . (O	D . (O) .	(0.)		_
Dwelling volume					(3a)+(3b))+(3c)+(3c	l)+(3e)+	.(3n) =	169.83	(5)
2. Ventilation rate:	main se	condary		other		total			m³ per hou	r
Number of objects	heating h	eating	+ [1 = F			40 =	-	_
Number of chimneys		0	<u> </u>	0	<u> </u>	0			0	(6a)
Number of open flues	0 +	0	+	0	」	0		20 =	0	(6b)
Number of intermittent fa					L	2		10 =	20	(7a)
Number of passive vents	;					0	X '	10 =	0	(7b)
Number of flueless gas fi	ires					0	X 4	40 =	0	(7c)
								Air ch	anges per ho	ur
Infiltration due to chimne	vs_flues and fans = (6a	a)+(6b)+(7a)+	+(7b)+(7	7c) =	Г	20		÷ (5) =	0.12	(8)
	peen carried out or is intende				ontinue fr			(0)	0.12	
Number of storeys in the	he dwelling (ns)								0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber f resent, use the value corresp				•	uction			0	(11)
deducting areas of openii		oonaing to th	e greate	er wall area	a (aner					
If suspended wooden t	floor, enter 0.2 (unseale	ed) or 0.1	(seale	d), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0								0	(13)
Percentage of windows	s and doors draught str	ripped							0	(14)
Window infiltration				0.25 - [0.2					0	(15)
Infiltration rate	50	. ,		(8) + (10)	. , , ,	, , ,	, ,		0	(16)
Air permeability value,	·		•	•	•	etre of e	envelope	area	5	(17)
If based on air permeabil Air permeability value applie	-					is heina u	sed		0.37	(18)
Number of sides sheltere		been done e	or a acg	nee an per	meability	io being a	ocu		2	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporat	ting shelter factor			(21) = (18)	x (20) =				0.31	(21)
Infiltration rate modified f	or monthly wind speed									_
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7									
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2\m ÷ 4									
	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
` '									J	

Adjusted infilt	ration rate	e (allowi	ng for sh	nelter an	nd wind s	peed) =	(21a) x	(22a)m					
0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37]	
Calculate effe		_	ate for t	ne appıı	cable ca	se						0	(23a
If exhaust air	neat pump u	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	 :
If balanced wi	th heat recov	very: effici	ency in %	allowing f	for in-use f	actor (from	n Table 4h) =				0	
a) If balanc	ed mecha	nical ve	ntilation	with he	at recove	ery (MVI	HR) (24a	a)m = (2:	2b)m + (2	23b) × [1 – (23c)) ÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a
b) If balanc	ed mecha	nical ve	ntilation	without	heat rec	covery (N	/IV) (24b)m = (22	2b)m + (2	23b)		_	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24)
c) If whole if (22b)	house exti m < 0.5 ×			•	•				.5 × (23b))			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(240
d) If natura if (22b)	ventilatio m = 1, the			•	•				0.5]			_	
(24d)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57]	(240
Effective ai	r change r	rate - en	ter (24a) or (24l	o) or (24	c) or (24	d) in box	(25)				_	
(25)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3. Heat loss	es and hea	at loss p	aramete	er:									
ELEMENT	Gros: area (s	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/ł	〈)	k-value kJ/m²·		A X k kJ/K
Doors					2	x	1	=	2				(26)
Windows Typ	e 1				1.74	x1	/[1/(1.4)+	0.04] =	2.31				(27)
Windows Typ	e 2				0.43	x1	/[1/(1.4)+	0.04] =	0.57				(27)
Windows Typ	e 3				2.95	x1	/[1/(1.4)+	0.04] =	3.91				(27)
Windows Typ	e 4				3.93	x1	/[1/(1.4)+	0.04] =	5.21				(27)
Windows Typ	e 5				2.95	x1	/[1/(1.4)+	0.04] =	3.91				(27)
Walls Type1	51.43	3	13.74	4	37.69) x	0.18	=	6.78				(29)
Walls Type2	36.05	5	2		34.05	, x	0.18	=	6.13				(29)
Roof	62.9		0		62.9	X	0.13	=	8.18				(30)
Total area of	elements,	m²			150.3	8							(31)
* for windows an						ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	ıs given in	paragrapl	h 3.2	
Fabric heat lo	ss, W/K =	S (A x	U)				(26) (30)	+ (32) =				41.3	31 (33)
Heat capacity	Cm = S(A)	Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	1419	6.7 (34)
Thermal mas	s paramet	er (TMF	? = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		25	0 (35)
For design asses can be used inst				construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal bridg	,	•		• .	•	<						9.2	6 (36)
if details of therm Total fabric he		are not kn	own (36) =	= 0.15 x (3	31)			(33) +	(36) =			50.5	57 (37)
Ventilation he	at loss ca	lculated	monthly	y				(38)m	= 0.33 × (25)m x (5))		
												-	

				l						l			(00)
(38)m= 32.47		32.13	31.34	31.19	30.49	30.49	30.36	30.76	31.19	31.49	31.8		(38)
Heat transfe		·	81.9	01.76	81.06	81.06	80.93	(39)m 81.33	= (37) + (37)	38)m 82.06	82.37		
(39)m= 83.04	02.07	82.7	01.9	81.76	61.00	61.00	00.93		81.76 Average =	Sum(39) ₁		81.9	(39)
Heat loss pa	rameter (I	HLP), W	/m²K	-	_	_	_		= (39)m ÷		12712-	01.0	
(40)m= 1.32	1.32	1.31	1.3	1.3	1.29	1.29	1.29	1.29	1.3	1.3	1.31		_
Number of d	avs in mo	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.3	(40)
Jan		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 he	ating ene	rgy requ	irement:								kWh/ye	ar:	
Assumed oc	cupancy	N									.06		(42)
if TFA > 13	3.9, N = 1		[1 - exp	(-0.0003	849 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		.00		(42)
if TFA £ 13 Annual avera	•	ater usad	ne in litre	es per da	av Vd av	erage =	(25 x N)	+ 36		83	5.18		(43)
Reduce the ann	nual average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		7.10		(10)
not more that 1.		· ·	<u> </u>				Ι.			l			
Jan Hot water usage		Mar	Apr	May	Jun	Jul Table 1c v	Aug	Sep	Oct	Nov	Dec		
	<u> </u>	84.84	81.52	78.19	74.86	74.86	78.19	81.52	84.84	88.17	91.5		
(44)m= 91.5	00.17	04.04	01.32	70.19	74.00	74.00	70.19	l		m(44) _{1 12} =	<u> </u>	998.16	(44)
Energy content	of hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			· /	L		 ` ′
(45)m= 135.6	9 118.67	122.46	106.77	102.44	88.4	81.92	94	95.12	110.86	121.01	131.41		
If instantaneous	water heati	ing at noint	of use (no	n hot water	r storaga)	enter () in	hoves (46		Γotal = Su	m(45) _{1 12} =		1308.75	(45)
(46)m= 20.35		18.37	16.01	15.37	13.26	12.29	14.1	14.27	16.63	18.15	19.71		(46)
Water storage		10.57	10.01	15.57	13.20	12.29	14.1	14.21	10.03	10.13	19.71		(40)
Storage volu	me (litres) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community	_			_			` '						
Otherwise if Water storage		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
a) If manufa		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature	factor fro	m Table	2b								0		(49)
Energy lost f		_	-				(48) x (49)) =			0		(50)
b) If manufa Hot water sto			-										(51)
If community	-			ic Z (KVV	ii/iiti e/ue	iy <i>)</i>					0		(31)
Volume factor	•										0		(52)
Temperature	factor fro	m Table	2b								0		(53)
Energy lost f		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	0		(54)
Enter (50) o	. , .	,	مام می می				(/FC) (FF) (44).	_		0		(55)
Water storag		1				ı	((56)m = ((50)
(56)m= 0 If cylinder conta	ins dedicate	d solar sto	0 rage. (57)	0 m = (56)m	0 x [(50) – (0 H11)] ÷ (5	0 0). else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Appendi	x H	(56)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
(07)111-				L "									(01)

Timary choat loss (amada) from Table 0													
Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m		(58)											
(modified by factor from Table H5 if there is solar water heating and a cylinder 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) ÷ 365 × (41)m		'											
(61)m= 46.63 40.58 43.24 40.2 39.84 36.92 38.15 39.84 40.2 43.24	43.48 46.63	(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= 182.32 159.26 165.7 146.97 142.29 125.32 120.07 133.85 135.32 154.09	164.49 178.03	(62)											
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)													
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)													
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													
Output from water heater													
Output from water heater (64)m= 182.32 159.26 165.7 146.97 142.29 125.32 120.07 133.85 135.32 154.09 164.49 178.03													
Output from water heater	(annual) _{1 12}	1807.7 (64)											
Heat gains from water heating, kWh/month 0.25 $$ [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m	+ (57)m + (59)m]											
(65)m= 56.77 49.61 51.53 45.55 44.02 38.62 36.77 41.22 41.68 47.67	51.11 55.35	(65)											
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from	om community h	eating											
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= 103.12 103.12 103.12 103.12 103.12 103.12 103.12 103.12 103.12 103.12	103.12 103.12	(66)											
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	•	1											
(67)m= 16.07 14.28 11.61 8.79 6.57 5.55 5.99 7.79 10.46 13.28	15.5 16.52	(67)											
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5		ı											
(68)m= 180.2 182.07 177.35 167.32 154.66 142.76 134.81 132.94 137.65 147.68	160.35 172.25	(68)											
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5		ı											
(69)m= 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31	33.31 33.31	(69)											
Pumps and fans gains (Table 5a)		I											
(70)m= 3 3 3 3 3 3 3 3 3 3	3 3	(70)											
Losses e.g. evaporation (negative values) (Table 5)	•	J											
(71)m= -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49	-82.49 -82.49	(71)											
Water heating gains (Table 5)		I											
(72)m= 76.31 73.82 69.26 63.26 59.17 53.64 49.43 55.4 57.89 64.07	70.98 74.39	(72)											
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m	1)m + (72)m	ı											
(73)m= 329.51 327.1 315.16 296.31 277.34 258.88 247.17 253.06 262.93 281.97	303.76 320.1	(73)											
6. Solar gains:													
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicab	le orientation.												
Orientation: Access Factor Area Flux g_	FF	Gains											
Table 6d m² Table 6a Table 6b Ta	able 6c	(W)											
Southwest _{0.9x} 0.77 x 3.93 x 36.79 0.63 x	0.7	44.19 (79)											
Southwest _{0.9x} 0.77 x 2.95 x 36.79 0.63 x	0.7	33.17 (79)											

ОИ		1		1		1		1		1		–
Southwest _{0.9x}	0.77	X	3.93	X	62.67		0.63	X	0.7] =	75.27	(79)
Southwest _{0.9x}	0.77	X	2.95	Х	62.67		0.63	X	0.7] =	56.5	(79)
Southwest _{0.9x}	0.77	X	3.93	X	85.75	<u> </u>	0.63	X	0.7] =	102.99	(79)
Southwest _{0.9x}	0.77	X	2.95	X	85.75		0.63	X	0.7] =	77.31	(79)
Southwest _{0.9x}	0.77	X	3.93	X	106.25	[0.63	X	0.7	=	127.61	(79)
Southwest _{0.9x}	0.77	X	2.95	X	106.25		0.63	X	0.7	=	95.79	(79)
Southwest _{0.9x}	0.77	X	3.93	X	119.01		0.63	X	0.7	_ =	142.94	(79)
Southwest _{0.9x}	0.77	X	2.95	X	119.01		0.63	X	0.7	=	107.3	(79)
Southwest _{0.9x}	0.77	X	3.93	X	118.15		0.63	X	0.7	=	141.91	(79)
Southwest _{0.9x}	0.77	X	2.95	X	118.15		0.63	X	0.7	=	106.52	(79)
Southwest _{0.9x}	0.77	X	3.93	x	113.91		0.63	X	0.7] =	136.81	(79)
Southwest _{0.9x}	0.77	X	2.95	X	113.91		0.63	X	0.7	=	102.7	(79)
Southwest _{0.9x}	0.77	X	3.93	x	104.39		0.63	X	0.7	=	125.38	(79)
Southwest _{0.9x}	0.77	X	2.95	X	104.39		0.63	X	0.7	=	94.11	(79)
Southwest _{0.9x}	0.77	X	3.93	X	92.85		0.63	X	0.7	=	111.52	(79)
Southwest _{0.9x}	0.77	X	2.95	x	92.85		0.63	x	0.7	=	83.71	(79)
Southwest _{0.9x}	0.77	X	3.93	x	69.27		0.63	x	0.7	=	83.19	(79)
Southwest _{0.9x}	0.77	X	2.95	x	69.27		0.63	x	0.7	=	62.45	(79)
Southwest _{0.9x}	0.77	x	3.93	x	44.07]	0.63	x	0.7] =	52.93	(79)
Southwest _{0.9x}	0.77	X	2.95	x	44.07		0.63	X	0.7] =	39.73	(79)
Southwest _{0.9x}	0.77	X	3.93	x	31.49		0.63	x	0.7	=	37.82	(79)
Southwest _{0.9x}	0.77	X	2.95	x	31.49		0.63	X	0.7	=	28.39	(79)
Northwest _{0.9x}	0.77	X	1.74	x	11.28	X	0.63	X	0.7	=	12	(81)
Northwest 0.9x	0.77	X	0.43	x	11.28	X	0.63	X	0.7	=	1.48	(81)
Northwest _{0.9x}	0.77	X	2.95	x	11.28	X	0.63	X	0.7	=	10.17	(81)
Northwest _{0.9x}	0.77	X	1.74	x	22.97	X	0.63	X	0.7	=	24.43	(81)
Northwest 0.9x	0.77	X	0.43	x	22.97	X	0.63	X	0.7	=	3.02	(81)
Northwest _{0.9x}	0.77	X	2.95	x	22.97	X	0.63	X	0.7	=	20.71	(81)
Northwest _{0.9x}	0.77	X	1.74	x	41.38	X	0.63	X	0.7	=	44.01	(81)
Northwest 0.9x	0.77	X	0.43	x	41.38	X	0.63	x	0.7	=	5.44	(81)
Northwest _{0.9x}	0.77	x	2.95	x	41.38	x	0.63	x	0.7] =	37.31	(81)
Northwest _{0.9x}	0.77	x	1.74	x	67.96	x	0.63	x	0.7	Ī =	72.27	(81)
Northwest 0.9x	0.77	x	0.43	x	67.96	x	0.63	x	0.7	j =	8.93	(81)
Northwest _{0.9x}	0.77	x	2.95	x	67.96	x	0.63	x	0.7	Ī =	61.27	(81)
Northwest _{0.9x}	0.77	x	1.74	x	91.35	x	0.63	x	0.7	j =	97.15	(81)
Northwest _{0.9x}	0.77	x	0.43	x	91.35	x	0.63	x	0.7] =	12	(81)
Northwest _{0.9x}	0.77	x	2.95	x	91.35	x	0.63	x	0.7] =	82.35	(81)
Northwest _{0.9x}	0.77	x	1.74	x	97.38	x	0.63	x	0.7] =	103.57	(81)
Northwest _{0.9x}	0.77	x	0.43	x	97.38	x	0.63	x	0.7] =	12.8	(81)
Northwest _{0.9x}	0.77	x	2.95	x	97.38	x	0.63	x	0.7	j =	87.8	(81)
Northwest _{0.9x}	0.77	x	1.74	x	91.1	x	0.63	х	0.7] =	96.89	(81)
L		_		•		•		•				_

Northwe	est _{0.9x}	0.77	X	0.4	13	x	91.1	X	0.63	X	0.7	=	11.97	(81)
Northwe	est _{0.9x}	0.77	X	2.9	95	x	91.1	x	0.63	x	0.7	=	82.13	(81)
Northwe	est _{0.9x}	0.77	x	1.7	' 4	X	72.63	x	0.63	x	0.7	=	77.24	(81)
Northwe	est _{0.9x}	0.77	X	0.4	13	X	72.63	X	0.63	x	0.7	=	9.54	(81)
Northwe	est _{0.9x}	0.77	X	2.9	95	X	72.63	×	0.63	x	0.7	=	65.48	(81)
Northwe	est _{0.9x}	0.77	x	1.7	' 4	X	50.42	x	0.63	x	0.7	=	53.62	(81)
Northwe	est _{0.9x}	0.77	X	0.4	13	X	50.42	×	0.63	x	0.7	=	6.63	(81)
Northwe	est _{0.9x}	0.77	X	2.9	95	X	50.42	×	0.63	x	0.7	=	45.46	(81)
Northwe	est _{0.9x}	0.77	X	1.7	74	X	28.07	X	0.63	x	0.7	=	29.85	(81)
Northwe	est _{0.9x}	0.77	x	0.4	13	X	28.07	x	0.63	x	0.7	=	3.69	(81)
Northwe	est _{0.9x}	0.77	X	2.9	95	X	28.07	X	0.63	x	0.7	=	25.3	(81)
Northwe	est _{0.9x}	0.77	X	1.7	74	X	14.2	x	0.63	x	0.7	=	15.1	(81)
Northwe	est _{0.9x}	0.77	X	0.4	13	X	14.2	x	0.63	x	0.7	=	1.87	(81)
Northwe	est _{0.9x}	0.77	X	2.9	95	X	14.2	x	0.63	x	0.7	=	12.8	(81)
Northwe	est _{0.9x}	0.77	X	1.7	' 4	x	9.21	X	0.63	X	0.7	=	9.8	(81)
Northwe	est _{0.9x}	0.77	X	0.4	13	x	9.21	X	0.63	X	0.7	=	1.21	(81)
Northwe	est _{0.9x}	0.77	X	2.9	95	X	9.21	X	0.63	X	0.7	=	8.31	(81)
Solar g	ains in	watts, calc	culated	for eacl	h month	1		(83)r	n = Sum(74)m	(82)m			_	
(83)m=	101.02	179.93 2	267.06	365.88	441.74	4	52.59 430.	5 37	.76 300.94	204.4	122.43	85.52		(83)
Total g	ains – ii	nternal and	d solar	(84)m =	= (73)m	+ (8	33)m , watt	3					_	
(84)m=	420 E2	-07.00				1							1	(0.4)
(04)111-	430.53	507.02	582.21	662.19	719.08	7	11.48 677.6	624	.82 563.87	486.4	5 426.19	405.62]	(84)
` ′		nal tempe			ļ		11.48 677.6	624	.82 563.87	486.4	426.19	405.62		(84)
7. Me	an inter	nal tempe	rature ((heating	seasor	า)	11.48 677.6 area from T			486.4	426.19	405.62	21	(84)
7. Me	an inter erature	nal temper	rature ((heating eriods ir	seasor the livi	n) ing		able 9		486.4	5 426.19	405.62	21	
7. Me	an inter erature	nal temper	rature ((heating eriods ir	seasor the livi	n) ing : n (s:	area from 1	able 9		486.4		405.62 Dec	21	
7. Me	an inter erature ation fac	nal temper during hea tor for gair Feb	rature (ating pons	(heating eriods ir iving are	seasor the livi	n) ing :	area from 1	able 9	, Th1 (°C)				21	
7. Me Temp Utilisa (86)m=	an inter erature ation fac Jan	nal temper during hea tor for gair Feb	rature (ating pons for li Mar 0.98	(heating eriods ir iving are Apr 0.94	seasor the livi ea, h1,n May	ing (se	area from 7 ee Table 9a Jun Jul 0.67 0.51	able 9	, Th1 (°C) ug Sep 57 0.82	Oct	Nov	Dec	21	(85)
7. Me Temp Utilisa (86)m=	an inter erature ation fac Jan	nal temper during heat tor for gain Feb 0.99	rature (ating pons for li Mar 0.98	(heating eriods ir iving are Apr 0.94	seasor the livi ea, h1,n May	ing (so	area from 1 ee Table 9a Jun Jul	Table 9 A 0. 7 in -	, Th1 (°C) ug Sep 57 0.82 Table 9c)	Oct	Nov 0.99	Dec	21	(85)
7. Me Temp Utilisa (86)m= Mean (87)m=	an interestation factorial displays an an interna 19.61	nal temper during heat tor for gain Feb 0.99 I temperate	rature (ating points for li Mar 0.98 ure in l 20.09	(heating eriods in iving are 0.94 iving are 20.47	seasor the living the high the	ing (se	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 t 0.94 20.99	Table 9 0. 0. 0 7 in 2 20	, Th1 (°C) ug Sep 57 0.82 Table 9c) 98 20.86	Oct 0.96	Nov 0.99	Dec 1	21	(85)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp	an interesture erature Jan 1 interna 19.61 erature	nal temper during hea tor for gain Feb 0.99 I temperat 19.8	rature (ating points for li Mar 0.98 ure in l 20.09	(heating eriods in iving are 0.94 iving are 20.47	seasor the living the high the	n (se	area from 1 ee Table 9a Jun Jul 0.67 0.51 w steps 3 t	Table 9 7 7 7 7 8 9 10 10 10 10 10 10 10 10 10	, Th1 (°C) ug Sep 57 0.82 Table 9c) 98 20.86	Oct 0.96	Nov 0.99	Dec 1	21	(85)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m=	an interesture erature 19.61 erature 19.83	nal temper during hea tor for gain Feb 0.99 I temperat 19.8 during hea	rature (ating pens for li Mar 0.98 ure in l 20.09 ating pens for li 19.83	(heating eriods ir iving are 20.47 eriods ir 19.84	seasor the living the high the	n (so	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 t 0.94 20.99 elling from 9.85 19.86	Table 9 7 7 7 7 8 9 19 19	y, Th1 (°C) ug Sep 57 0.82 Table 9c) 98 20.86 9, Th2 (°C)	Oct 0.96	Nov 0.99	Dec 1	21	(86)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa	an interesture erature 19.61 erature 19.83	nal temper during heator for gain Feb 0.99 I temperate 19.8 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	rature (ating points for li Mar 0.98 ure in l 20.09 ating points for r	criods ir iving are 0.94 iving are 20.47 eriods ir 19.84 est of dv	seasor the living the	n (so continue) follo h2,	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 tr 0.94 20.99 elling from 9.85 19.89 m (see Tab	Table 9 7 7 8 9 19 19 19 19 19 19 19 19	, Th1 (°C) ug Sep 57 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85	Oct 0.96 20.45	Nov 0.99 19.96	Dec 1 19.58		(85) (86) (87) (88)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m=	an interestation factorial stress of the str	nal temper during heat tor for gain Feb 0.99 I temperate 19.8 2 during heat 19.83 tor for gain	rature (ating points for li Mar 0.98 ure in l 20.09 ating points for r 0.97	criods ir iving are 0.94 iving are 20.47 eriods ir 19.84 est of do 0.92	seasor the living the living the search of t	n (se control of the	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 tr 0.94 20.99 elling from 9.85 19.80 m (see Tab	Table 9 0. 19 19 19 19 19 19 19 19 19 19 19 19 19	y, Th1 (°C) ug Sep 57 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85	Oct 0.96 20.45 19.84 0.95	Nov 0.99	Dec 1	21	(86)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean	an interestation factors Jan 1 interna 19.61 erature 19.83 ation factors interna interna	nal temper during heat tor for gair Feb 0.99 I temperate 19.8 during heat 19.83 tor for gair 0.99 I temperate	rature (ating pens for li Mar 0.98 ure in l 20.09 ating pens for r 0.97 ure in t	cheating eriods ir 19.84 est of do 0.92 che rest	seasor the livities, h1,n May 0.84 ea T1 (f 20.78 rest of 19.84 welling, 0.79 of dwell	n (so contains a conta	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 t 0.94 20.99 elling from 9.85 19.83 m (see Tab 0.57 0.39	Table 9 20 Table 9 0.	y, Th1 (°C) ug Sep 57 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85 44 0.74 6 to 7 in Table	Oct 0.96 20.45 19.84 0.95 e 9c)	Nov 0.99 19.96	Dec 1 19.58 19.83		(85) (86) (87) (88)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m=	an interestation factorial stress of the str	nal temper during heat tor for gair Feb 0.99 I temperate 19.8 during heat 19.83 tor for gair 0.99 I temperate	rature (ating points for li Mar 0.98 ure in l 20.09 ating points for r 0.97	criods ir iving are 0.94 iving are 20.47 eriods ir 19.84 est of do 0.92	seasor the living the living the search of t	n (so contains a conta	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 tr 0.94 20.99 elling from 9.85 19.80 m (see Tab	Table 9 20 Table 9 0.	y, Th1 (°C) ug Sep 57 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85 44 0.74 3 to 7 in Tabl 84 19.74	Oct 0.96 20.45 19.84 0.95 e 9c) 19.21	Nov 0.99 19.96 19.84 0.99	Dec 1 19.58 19.83		(85) (86) (87) (88) (89)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean (90)m=	an interestation factorial and internation l and internation factorial	nal temper during heat tor for gair 19.8 during heat 19.83 tor for gair 0.99 temperate 18.27	rature (ating points for li Mar 0.98 ure in l 20.09 ating points for r 0.97 ure in t 18.69	cheating eriods in iving are 0.94 iving are 20.47 eriods in 19.84 est of do 0.92 the rest 19.23	seasor the living the	n (se control of the second of	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 t 0.94 20.99 elling from 9.85 19.85 m (see Tab 0.57 0.39 T2 (follow) 9.81 19.86	Table 9 7 7 8 9 19 19 10 10 10 10 10 10 10	y Th1 (°C) ug Sep 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85 44 0.74 6 to 7 in Table 84 19.74	Oct 0.96 20.45 19.84 0.95 e 9c) 19.21	Nov 0.99 19.96	Dec 1 19.58 19.83	0.47	(85) (86) (87) (88)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean (90)m=	an interest erature ation factor of the street of the stre	nal temper during hea tor for gair Feb 0.99 I temperat 19.8 during hea 19.83 tor for gair 0.99 I temperat 18.27	rature (ating points for li Mar 0.98 ure in l 20.09 ating points for r 0.97 ure in t 18.69 ure (for	cheating eriods in iving are 0.94 iving are 20.47 eriods in 19.84 est of do 0.92 the rest 19.23	seasor the livities, h1,n May 0.84 ea T1 (f 20.78 n rest of 19.84 welling, 0.79 of dwell 19.63	n (se control of the second of	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 t 0.94 20.99 elling from 9.85 19.85 m (see Tab 0.57 0.39 T2 (follow) 9.81 19.86	Table 9 7 7 8 9 19 19 10 10 10 10 10 10 10	y, Th1 (°C) ug Sep 57 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85 44 0.74 3 to 7 in Tabl 84 19.74	Oct 0.96 20.45 19.84 0.95 e 9c) 19.21	Nov 0.99 19.96 19.84 0.99	Dec 1 19.58 19.83		(85) (86) (87) (88) (89) (90) (91)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean (90)m=	an interest erature erature of the second of	during heator for gair Feb 0.99 I temperate 19.8 during heat 19.83 tor for gair 0.99 I temperate 18.27 I temperate 18.27	rature (ating poins for limited for limite	cheating eriods in iving are 20.47 eriods in 19.84 est of do 0.92 the rest 19.23 er the whole 19.8	season the living the living the living of t	n (se control of the	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 t 0.94 20.99 elling from 9.85 19.85 m (see Tab 0.57 0.39 T2 (follow 19.81 19.83 g) = fLA × 7 0.34 20.36	Table 9 7 7 7 8 7 8 7 8 8 8 9 10 10 10 10 10 10 10 10 10	y Sep 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85 19.74 19.	Oct 0.96 20.45 19.84 0.95 e 9c) 19.21 LA = Liv	Nov 0.99 19.96 19.84 0.99 18.51 ving area ÷ (4	Dec 1 19.58 19.83		(85) (86) (87) (88) (89)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean (90)m= Mean (92)m= Apply	an interest erature erature 19.61 erature 19.83 etion face 1 interna 18.75 adjustn	during heat tor for gair 19.8 during heat 19.83 tor for gair 0.99 temperate 18.27 temperate 18.27 temperate 18.98 ment to the	rature (ating points for li Mar 0.98 ure in li 20.09 ating points for ri 0.97 ure in ti 18.69 ure (for li 19.34 e mean	cheating eriods in iving are 20.47 eriods in 19.84 est of do 0.92 the rest 19.23 er the whole 19.8 internal	seasor the living the	n) ing (ing	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 tr 0.94 20.99 elling from 9.85 19.89 m (see Table 20.57 0.39 T2 (follow 20.57) 9.81 19.89 g) = fLA × 7 0.34 20.34 re from Tal	Table 9 0. Table 9 20 Table 9a) O. Table 9a) O. Steps 3 Table 9a) O. Steps 3 Table 9a) O. Steps 3	g Sep 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85 44 0.74 6 to 7 in Tabl 84 19.74 - fLA) × T2 37 20.26 where appro	Oct 0.96 20.45 19.84 0.95 e 9c) 19.21 LA = Liv	Nov 0.99 19.96 19.84 0.99 18.51 ving area ÷ (4	Dec 1 19.58 19.83 1 17.96 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean (90)m= Mean (92)m= Apply (93)m=	an interest erature erature ation face 19.61 erature 19.83 etion face 1 interna 18 interna 18.75 adjustn 18.75	during heat tor for gair Feb 0.99 I temperate 19.83 Itemperate 18.27 I temperate 18.27 I temperate 18.98 Inent to the 18.98	rature (ating poins for limited for limite	cheating eriods in iving are 20.47 eriods in 19.84 est of do 0.92 the rest 19.23 er the whole 19.8	season the living the living the living of t	n) ing (ing	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 t 0.94 20.99 elling from 9.85 19.85 m (see Tab 0.57 0.39 T2 (follow 19.81 19.83 g) = fLA × 7 0.34 20.36	Table 9 10 10 10 10 10 10 10 10 10 1	y Sep 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85 19.74 19.	Oct 0.96 20.45 19.84 0.95 e 9c) 19.21 LA = Liv	Nov 0.99 19.96 19.84 0.99 18.51 ving area ÷ (4	Dec 1 19.58 19.83 1 17.96		(85) (86) (87) (88) (89) (90) (91)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean (90)m= Mean (92)m= Apply (93)m= 8. Spa	an interest erature erature of the street er	during heat tor for gair Feb 0.99 I temperate 19.83 Itemperate 18.27 I temperate 18.98 Itemperate 18.98 Item	rature (ating points for limited for limit	cheating eriods in iving are 20.47 eriods in 19.84 est of do 0.92 the rest 19.23 r the whole 19.8 internal 19.8	seasor the living the	n) ing (ing	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 tr 0.94 20.99 elling from 9.85 19.89 m (see Table) 0.57 0.39 T2 (follow) 9.81 19.89 g) = fLA × 7 0.34 20.36 re from Table 0.34 20.36	Table 9 10 10 10 10 10 10 10 10 10 1	g Sep 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85 44 0.74 6 to 7 in Tabl 84 19.74 — fLA) × T2 37 20.26 where approximation of the second of the secon	Oct 0.96 20.45 19.84 0.95 e 9c) 19.21 LA = Liv	Nov 0.99 19.96 19.84 0.99 18.51 ving area ÷ (4	Dec 1 19.58 19.83 1 17.96 4) =	0.47	(85) (86) (87) (88) (89) (90) (91)
7. Me Temp Utilisa (86)m= Mean (87)m= Temp (88)m= Utilisa (89)m= Mean (90)m= Mean (92)m= Apply (93)m= 8. Spa	an interest erature erature ation face 19.61 erature 19.83 etion face 18.75 adjustness ace hear to the resture erature 18.75 ace hear to the resture erature 18.75 ace hear to the resture erature 18.75 ace hear to the resture erature eratu	during heat tor for gair 19.8 considering heat 19.83 considering heat 19.83 considering heat 19.83 considering heat 19.83 considering heat 19.83 considering heat 19.83 considering heat 19.83 considering heat 19.84 considering heat 19.85 considering hea	rature (ating points for limited for limit	cheating eriods in iving are 20.47 eriods in 19.84 est of do 0.92 the rest 19.23 er the whole 19.8 internal 19.8 enperature.	seasor the living the	n) ing (ing	area from 7 ee Table 9a Jun Jul 0.67 0.51 w steps 3 tr 0.94 20.99 elling from 9.85 19.89 m (see Table) 0.57 0.39 T2 (follow) 9.81 19.89 g) = fLA × 7 0.34 20.36 re from Table 0.34 20.36	Table 9 10 10 10 10 10 10 10 10 10 1	g Sep 0.82 Table 9c) 98 20.86 9, Th2 (°C) 85 19.85 44 0.74 6 to 7 in Tabl 84 19.74 - fLA) × T2 37 20.26 where appro	Oct 0.96 20.45 19.84 0.95 e 9c) 19.21 LA = Liv	Nov 0.99 19.96 19.84 0.99 18.51 ving area ÷ (4	Dec 1 19.58 19.83 1 17.96 4) =	0.47	(85) (86) (87) (88) (89) (90) (91)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisat	tion factor f	or ga	ains, hm	1:										
(94)m=	0.99 0.	Ť	0.97	0.92	0.8	0.62	0.45	0.5	0.77	0.95	0.99	1		(94)
Useful	gains, hm	Gm ,	W = (94	4)m x (8	4)m									
(95)m=	427.8 500	.29	564.2	608.1	578.17	439.99	301.75	313.94	433.57	460.52	420.92	403.62		(95)
Monthl	ly average	exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3 4	9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
_	oss rate for				erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m	ī —	•		•	
` '	1200.04 116		1062.06		691.89	465.22	306.16	321.47	500.74	751.18	991.68	1195.36	I	(97)
	heating re	_		r									1	
(98)m=	574.54 447	'.83	370.41	205.2	84.61	0	0	0	0	216.25	410.95	589.05		_
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2898.84	(98)
Space	heating re	quire	ement in	kWh/m²	²/year								46.09	(99)
9a. Ene	rgy require	men	ts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	heating:													_
Fractio	n of space	hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fractio	on of space	hea	t from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fractio	on of total h	eatir	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficier	ncy of mair	spa	ce heat	ing syste	em 1								93.4	(206)
Efficier	ncy of seco	ndaı	y/suppl	ementar	y heating	g system	າ, %						0	(208)
	Jan F	eb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	heating re	quire	ement (c	alculate	d above))								
	574.54 447	'.83	370.41	205.2	84.61	0	0	0	0	216.25	410.95	589.05		
(211)m	= {[(98)m >	(20	4)] } x 1	00 ÷ (20	06)									(211)
	615.14 479	.48	396.59	219.7	90.58	0	0	0	0	231.53	439.99	630.68		
								Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	3103.69	(211)
Space	heating fu	el (se	econdar	y), kWh/	month							•		
	m x (201)]	x 10	00 ÷ (20	8)										
(215)m=	0)	0	0	0	0	0	0	0	0	0	0		_
								Tota	I (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
Water h	•													
	from water 182.32 159	heat	er (calc 165.7	ulated a	bove) 142.29	125.32	120.07	133.85	135.32	154.09	164.49	178.03		
	cy of water			140.97	142.29	125.52	120.07	133.03	133.32	154.09	104.43	170.03	80.3	(216)
(217)m=			87.02	85.89	83.79	80.3	80.3	80.3	80.3	85.9	87.26	87.84	80.3	(217)
` ′ L				<u> </u>	03.79	00.3	00.3	00.3	00.3	05.9	07.20	67.64	i	(211)
	water hea = (64)m x	_												
(219)m=		.98	190.42	171.11	169.81	156.06	149.52	166.68	168.52	179.38	188.5	202.69		
_	•							Tota	I = Sum(2	19a) ₁₁₂ =		•	2132.47	(219)
Annual	totals									k'	Wh/year		kWh/year	
Space h	neating fue	use	d, main	system	1								3103.69	
Water h	eating fuel	use	d										2132.47	
Electrici	ity for pum	os, fa	ans and	electric	keep-ho	t								

central heating pump:			30]	(230c)
boiler with a fan-assisted flue			45	j	(230e)
Total electricity for the above, kWh/year	sum of (230a	i) (230g) =		75	(231)
Electricity for lighting				283.88	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy kWh/year	Emission factors in the Emissi	ctor	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	=	670.4	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	460.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1131.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	147.33	(268)
Total CO2, kg/year	sum	of (265) (271) =		1317.27	(272)

TER =

(273)

20.94

			User D	otaile: -						
Access w Name	Chris Hadrad				. Nieses	h a == -		CTDA	016262	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 201	2		Stroma Softwa					016363 on: 1.0.4.12	
Continui o Humo.	5.1.5.1.1.2.1.2.1.			Address:				7 0 1 0 1 0		
Address :			·		·					
1. Overall dwelling dime	ensions:									
Ground floor				a(m²)	(1a) x		ight(m)	(2a) =	Volume(m³) (3a)
	-> . (4 -> . (4 -> . (4 - > . (4 - >	\. (4)					2.7	(2a) -	204.66	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1n)	7	75.8	(4)) . (0) . (0	10 - (0) -	(0.)		_
Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	.(3n) =	204.66	(5)
2. Ventilation rate:	main se	condary		other		total			m³ per hou	r
Number of objects	heating h	eating	+ -		1 = F			40 =	-	_
Number of chimneys		0	<u> </u>	0	<u> </u>	0			0	(6a)
Number of open flues	0 +	0	+	0	」	0		20 =	0	(6b)
Number of intermittent fa					L	3		10 =	30	(7a)
Number of passive vents						0		10 =	0	(7b)
Number of flueless gas fi	ires					0	X 4	40 =	0	(7c)
								Air ch	anges per ho	our
Infiltration due to chimne	vs. flues and fans = (6)	a)+(6b)+(7a))+(7b)+(7	7c) =	Г	30		÷ (5) =	0.15	(8)
If a pressurisation test has b	•				ontinue fr			(0)	0.10	
Number of storeys in the	he dwelling (ns)								0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber t resent, use the value corresp				•	uction			0	(11)
deducting areas of openii		onaing to ti	ie great	er wall area	a (anter					
If suspended wooden to	floor, enter 0.2 (unseal	ed) or 0.1	(seale	d), else	enter 0				0	(12)
If no draught lobby, en									0	(13)
Percentage of windows	s and doors draught st	ripped							0	(14)
Window infiltration				0.25 - [0.2			. (45) -		0	(15)
Infiltration rate	2.50	:		(8) + (10)	. , , ,	, , ,	. ,		0	(16)
Air permeability value, If based on air permeabil	•		•	•	•	etre of e	envelope	area	5	(17)
Air permeability value applie	-					is beina u	sed		0.4	(18)
Number of sides sheltere				, ,	,	3 .			1	(19)
Shelter factor				(20) = 1 - [0.075 x (1	9)] =			0.92	(20)
Infiltration rate incorporat	ting shelter factor			(21) = (18)	x (20) =				0.37	(21)
Infiltration rate modified f	or monthly wind speed									<u> </u>
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7								_	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4									
	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
						L			I	

Adjusted infiltra	ation rate	e (allowi	ng for sh	nelter ar	nd wind s	speed) =	(21a) x	(22a)m				_		
0.47 Calculate effect	0.46	0.45	0.4	0.39 he appli	0.35	0.35	0.34	0.37	0.39	0.41	0.43]		
If mechanica		-	rate for t	пс аррп	oabic oa	.00						C		(23
If exhaust air he	eat pump ı	using Appe	endix N, (2	3b) = (23a	a) × Fmv (equation (N5)) , othe	rwise (23b) = (23a)			C		(23b
If balanced with	heat reco	very: effic	iency in %	allowing	for in-use f	actor (fror	n Table 4h	ı) =				C		(230
a) If balance	d mecha	anical ve	entilation	with he	at recov	ery (MV	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]		
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0			(24
b) If balance	d mecha	anical ve	entilation	without	heat red	covery (I	MV) (24k	o)m = (22	2b)m + (2	23b)		•		
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0			(24)
c) If whole h if (22b)n				•	•				.5 × (23b))		_		
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]		(24
d) If natural if (22b)n				•	•				0.5]			_		
(24d)m= 0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59]		(240
Effective air	change	rate - er	nter (24a) or (24l	b) or (24	c) or (24	d) in bo	x (25)				_		
(25)m= 0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59			(25)
3. Heat losse	s and he	eat loss i	paramete	er:										
ELEMENT	Gros area	SS	Openin m	gs	Net Ar ۱, A		U-val W/m2		A X U (W/I	〈)	k-value kJ/m²·		A X kJ/l	
Doors					2	x	1		2					(26)
Windows Type	· 1				1.03	x1	/[1/(1.4)+	0.04] =	1.37					(27
Windows Type	2				2.18	x1	/[1/(1.4)+	0.04] =	2.89					(27
Windows Type	3				1.8	x1	/[1/(1.4)+	0.04] =	2.39					(27)
Windows Type	4				2.25	x1	/[1/(1.4)+	0.04] =	2.98					(27
Windows Type	: 5				6.27	x1	/[1/(1.4)+	0.04] =	8.31					(27
Windows Type	6				0.96	<u>x</u> 1	/[1/(1.4)+	0.04] =	1.27					(27
Windows Type	· 7				1.62	<u></u>	/[1/(1.4)+	0.04] =	2.15	一				(27)
Rooflights					0.8491	173 x1	/[1/(1.7) +	0.04] =	1.4435	Ħ				(27
Walls Type1	68.4	.5	16.1	1	52.34	1 x	0.18	i	9.42	= [ΠГ		(29)
Walls Type2	4.38	3	2		2.38	×	0.18	-	0.43	F i		T F		(29]
Roof	75.8	3	0.85	_	74.9	5 x	0.13	-	9.74	F i		T F		(30)
Total area of e	lements	, m²			148.6	3								— (31)
* for windows and ** include the area						lated using	g formula 1	l/[(1/U-valu	ıe)+0.04] a	ıs given in	n paragrapi	h 3.2		
Fabric heat los	s, W/K =	= S (A x	U)				(26) (30) + (32) =				44	3	(33
Heat capacity	Cm = S(Axk)						((28)	(30) + (32	2) + (32a)	(32e) =	1107	1.36	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) iı	n kJ/m²K			Indica	tive Value	Medium		25	0	(35)
For design assess	ments wh	ere the de	tails of the	construct	tion are no	t known pi	recisely the	e indicative	values of	TMP in T	able 1f			

	ric heat								` '	(36) =			54.85	(37
entilatio/	on heat l	oss ca		monthly	/		ı			= 0.33 × (25)m x (5)			
		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
88)m= 4	41.16 4	10.87	40.59	39.27	39.02	37.87	37.87	37.66	38.31	39.02	39.52	40.04		(38
leat tr <u>an</u>	nsfer coe	fficien	ıt, W/K						(39)m	= (37) + (3	38)m			
39)m=	96 9	95.72	95.44	94.11	93.87	92.72	92.72	92.5	93.16	93.87	94.37	94.89		
leat loss	s parame	eter (F	IIP) W/	m²K						Average = = (39)m ÷	Sum(39) ₁	12 /12=	94.11	(3
		1.26	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.24	1.25		
	<u> </u>									Average =	Sum(40) ₁	12 /12=	1.24	(4
lumber	of days i	n mor	ıth (Tabl	e 1a)										_
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
l1)m=	31	28	31	30	31	30	31	31	30	31	30	31		(4
. Wate	r heating	g ener	gy requi	rement:								kWh/yea	ar:	
seumod	d occupa	nov N	.I											(4
				[1 - exp	(-0.0003	49 x (TF	A -13.9)2)] + 0.0	013 x (ΓFA -13.		38		(4
	£ 13.9, I				`			, . .	•					
								(25 x N) to achieve		e taraet o		.69		(4
	ariridara nat 125 litro	_				_	_	o acriieve	a water us	e largel o	1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	usage in lit			•	,				СОР		1.01			
4)m= 9	99.75	96.13	92.5	88.87	85.24	81.62	81.62	85.24	88.87	92.5	96.13	99.75		
<u>L</u>	I	1								Γotal = Su	m(44) _{1 12} =		1088.23	(4
nergy con	ntent of ho	t water i	used - cald	culated mo	onthly $= 4$.	190 x Vd,n	n x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
5)m= 1	47.93 1	29.38	133.51	116.4	111.69	96.38	89.31	102.48	103.71	120.86	131.93	143.26		
				. ,		, ,				Total = Su	m(45) _{1 12} =		1426.84	(4
instantan					not water	storage),		boxes (46)	to (61)					
		19.41	20.03	17.46	16.75	14.46	13.4	15.37	15.56	18.13	19.79	21.49		(4
	arada la	აა.			olor or \A		otorogo	within co	ime ves	sel		0		(4
ater sto	•		includin	a any so	11 OF VV	WHRS								(-
/ater sto torage \	volume ((litres)		-			_							
Vater sto torage v	volume (unity hea	(litres) iting a	nd no ta	nk in dw	elling, e	nter 110	litres in	(47)				<u> </u>		
Vater storage value communication of the communicat	volume (unity hea	(litres) iting a tored l	nd no ta	nk in dw	elling, e	nter 110	litres in					<u> </u>		
Vater storage value community of the storage value	volume (unity hea e if no s	(litres) iting a tored l ss:	nd no ta hot wate	nk in dw er (this in	relling, e icludes i	nter 110 nstantar	litres in	(47)			47)	0		(4
/ater storage v commu therwise /ater storage	volume (unity hea e if no s orage los	(litres) iting a tored l ss: er's de	nd no ta hot wate	nk in dwer (this in	relling, e icludes i	nter 110 nstantar	litres in	(47)			47)			
Vater storage value communitherwise Vater storage (a) If mar empera	volume (unity hea e if no so orage los nufacture	(litres) Iting and tored less: Iter's dector from	nd no ta hot wate eclared lo m Table	nk in dw er (this in oss facto 2b	relling, e icludes i	nter 110 nstantar	litres in neous co n/day):	(47)	ers) ente		47)	0		(4 (4 (5
Vater storage value communitherwise Vater storage (a) If mar empera nergy Ico) If mar	volume (unity hea e if no si orage los nufacture iture fact ost from nufacture	(litres) ating and tored I ass: er's decor from water er's de	nd no ta hot wate eclared k m Table storage eclared c	nk in dw er (this in oss facto 2b , kWh/ye	relling, e cludes i or is kno ear oss facto	nter 110 nstantar wn (kWh	litres in neous co n/day): known:	(47) ombi boild	ers) ente		47)	0 0		(4
Vater storage value communitherwise Vater storage of the communitherwise value of the community of the commu	volume (unity hea unity hea unity hea orage los nufacture ture fact ost from nufacture or storage	(litres) ating and tored I ss: er's dector from water er's dece loss	nd no ta hot wate eclared lo m Table storage eclared of factor fr	nk in dwer (this in oss factor 2b, kWh/ye cylinder I	relling, e cludes i or is kno ear oss facto	nter 110 nstantar wn (kWh	litres in neous co n/day): known:	(47) ombi boild	ers) ente		47)	0 0		(4
/ater storage vectorage ve	volume (unity head be if no solution orage lose orage lose orage lose orage lose orage orage orage orage orage orage unity head	(litres) ating and tored I ss: er's dector from water er's dece loss atting setting se	nd no ta hot wate eclared lo m Table storage eclared of factor from	nk in dwer (this in oss factor 2b, kWh/ye cylinder I	relling, e cludes i or is kno ear oss facto	nter 110 nstantar wn (kWh	litres in neous co n/day): known:	(47) ombi boild	ers) ente		47)	0 0 0		(4 (5 (5
vater stotorage vater stoto vater stoto vater stoto vater stoto vater stoto vater stoto vater stotora vater stotora vater stora vater stor	volume (unity hea unity hea unity hea orage los nufacture ture fact ost from nufacture or storage	(litres) uting au tored I ss: er's de tor fron water er's de e loss uting so om Tab	nd no ta hot wate eclared lo m Table storage eclared of factor from ee section	nk in dw er (this in oss facto 2b , kWh/ye eylinder I om Tabl on 4.3	relling, e cludes i or is kno ear oss facto	nter 110 nstantar wn (kWh	litres in neous co n/day): known:	(47) ombi boild	ers) ente		47)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(4 (5 (5
vater storage vater storage vater storage vater storage vater storage vater storage vater storage vater storage vater storage vater storage vater storage vater storage vater	volume (unity hea e if no si orage los nufacture ature fact ost from nufacture er storage unity hea factor fro	(litres) ating a tored I ss: er's de tor fror water er's de e loss ating so om Tab	nd no ta hot wate eclared k m Table storage eclared of factor from ee section ble 2a m Table	nk in dw er (this in oss facto 2b , kWh/ye cylinder I om Tabl on 4.3	relling, e ocludes in or is known ear oss facto e 2 (kWl	nter 110 nstantar wn (kWh	litres in neous co n/day): known:	(47) ombi boild	ers) ente	er 'O' in (47)	0 0 0		(4

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

Orientation: Access Fac Table 6d	tor	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	x	6.27	x	11.28	x	0.63	x	0.7	=	21.62	(75)
Northeast 0.9x 0.77	X	0.96	x	11.28	x	0.63	х	0.7	=	3.31	(75)
Northeast 0.9x 0.77	×	6.27	x	22.97	x	0.63	х	0.7	=	44.01	(75)
Northeast 0.9x 0.77	×	0.96	x	22.97	x	0.63	x	0.7] =	6.74	(75)
Northeast 0.9x 0.77	X	6.27	x	41.38	x	0.63	х	0.7	=	79.29	(75)
Northeast 0.9x 0.77	X	0.96	x	41.38	x	0.63	х	0.7	=	12.14	(75)
Northeast 0.9x 0.77	X	6.27	x	67.96	X	0.63	х	0.7	=	130.22	(75)
Northeast 0.9x 0.77	X	0.96	x	67.96	x	0.63	x	0.7	=	19.94	(75)
Northeast _{0.9x} 0.77	X	6.27	x	91.35	x	0.63	х	0.7	=	175.04	(75)
Northeast 0.9x 0.77	X	0.96	X	91.35	X	0.63	х	0.7	=	26.8	(75)
Northeast _{0.9x} 0.77	X	6.27	x	97.38	x	0.63	x	0.7	=	186.61	(75)
Northeast 0.9x 0.77	X	0.96	x	97.38	x	0.63	x	0.7	=	28.57	(75)
Northeast 0.9x 0.77	X	6.27	x	91.1	x	0.63	x	0.7	=	174.57	(75)
Northeast 0.9x 0.77	X	0.96	X	91.1	x	0.63	x	0.7	=	26.73	(75)
Northeast _{0.9x} 0.77	X	6.27	x	72.63	x	0.63	x	0.7	=	139.17	(75)
Northeast _{0.9x} 0.77	X	0.96	X	72.63	x	0.63	x	0.7	=	21.31	(75)
Northeast _{0.9x} 0.77	X	6.27	X	50.42	x	0.63	x	0.7	=	96.62	(75)
Northeast _{0.9x} 0.77	X	0.96	x	50.42	x	0.63	x	0.7	=	14.79	(75)
Northeast _{0.9x} 0.77	X	6.27	x	28.07	X	0.63	x	0.7	=	53.78	(75)
Northeast 0.9x 0.77	X	0.96	x	28.07	X	0.63	х	0.7	=	8.23	(75)
Northeast _{0.9x} 0.77	X	6.27	x	14.2	x	0.63	х	0.7	=	27.2	(75)
Northeast _{0.9x} 0.77	X	0.96	X	14.2	x	0.63	x	0.7	=	4.17	(75)
Northeast 0.9x 0.77	X	6.27	X	9.21	x	0.63	x	0.7	=	17.66	(75)
Northeast 0.9x 0.77	X	0.96	X	9.21	x	0.63	x	0.7	=	2.7	(75)
Southeast 0.9x 0.77	X	1.62	X	36.79	X	0.63	X	0.7	=	18.22	(77)
Southeast 0.9x 0.77	X	1.62	X	62.67	X	0.63	X	0.7	=	31.03	(77)
Southeast 0.9x 0.77	X	1.62	X	85.75	X	0.63	X	0.7	=	42.46	(77)
Southeast 0.9x 0.77	X	1.62	X	106.25	X	0.63	X	0.7	=	52.6	(77)
Southeast 0.9x 0.77	X	1.62	X	119.01	X	0.63	X	0.7	=	58.92	(77)
Southeast 0.9x 0.77	X	1.62	X	118.15	X	0.63	X	0.7	=	58.5	(77)
Southeast 0.9x 0.77	X	1.62	X	113.91	X	0.63	X	0.7	=	56.4	(77)
Southeast 0.9x 0.77	X	1.62	X	104.39	X	0.63	x	0.7	=	51.68	(77)
Southeast 0.9x 0.77	X	1.62	X	92.85	X	0.63	X	0.7	=	45.97	(77)
Southeast 0.9x 0.77	X	1.62	X	69.27	X	0.63	X	0.7	=	34.29	(77)
Southeast 0.9x 0.77	X	1.62	x	44.07	x	0.63	x	0.7	=	21.82	(77)
Southeast 0.9x 0.77	X	1.62	x	31.49	x	0.63	x	0.7	=	15.59	(77)
Southwest _{0.9x} 0.77	×	1.03	x	36.79]	0.63	x	0.7	=	11.58	(79)
Southwest _{0.9x} 0.77	X	2.18	x	36.79]	0.63	x	0.7	=	24.51	(79)
Southwest _{0.9x} 0.77	×	1.8	×	36.79]	0.63	X	0.7	=	20.24	(79)

ОИ		1		1		_				1		٦
Southwest _{0.9x}	0.77	X	2.25	X	36.79	Ļ	0.63	X	0.7] =	25.3	(79)
Southwest _{0.9x}	0.77	X	1.03	X	62.67	Ļ	0.63	X	0.7	=	19.73	(79)
Southwest _{0.9x}	0.77	X	2.18	X	62.67	L	0.63	X	0.7] =	41.76	(79)
Southwest _{0.9x}	0.77	X	1.8	X	62.67	L	0.63	X	0.7] =	34.48	(79)
Southwest _{0.9x}	0.77	X	2.25	X	62.67	L	0.63	X	0.7	=	43.1	(79)
Southwest _{0.9x}	0.77	X	1.03	X	85.75	L	0.63	X	0.7	=	26.99	(79)
Southwest _{0.9x}	0.77	X	2.18	X	85.75		0.63	X	0.7	=	57.13	(79)
Southwest _{0.9x}	0.77	X	1.8	X	85.75		0.63	X	0.7	=	47.17	(79)
Southwest _{0.9x}	0.77	X	2.25	X	85.75		0.63	X	0.7	=	58.97	(79)
Southwest _{0.9x}	0.77	X	1.03	X	106.25		0.63	X	0.7	=	33.45	(79)
Southwest _{0.9x}	0.77	X	2.18	X	106.25		0.63	X	0.7	=	70.79	(79)
Southwest _{0.9x}	0.77	X	1.8	X	106.25		0.63	X	0.7	=	58.45	(79)
Southwest _{0.9x}	0.77	X	2.25	X	106.25		0.63	X	0.7	=	73.06	(79)
Southwest _{0.9x}	0.77	X	1.03	X	119.01		0.63	X	0.7	=	37.46	(79)
Southwest _{0.9x}	0.77	X	2.18	X	119.01		0.63	X	0.7	=	79.29	(79)
Southwest _{0.9x}	0.77	X	1.8	x	119.01		0.63	X	0.7	=	65.47	(79)
Southwest _{0.9x}	0.77	X	2.25	x	119.01		0.63	X	0.7	=	81.84	(79)
Southwest _{0.9x}	0.77	X	1.03	x	118.15		0.63	X	0.7	=	37.19	(79)
Southwest _{0.9x}	0.77	x	2.18	x	118.15		0.63	X	0.7	=	78.72	(79)
Southwest _{0.9x}	0.77	X	1.8	x	118.15		0.63	X	0.7	=	64.99	(79)
Southwest _{0.9x}	0.77	X	2.25	x	118.15		0.63	X	0.7	=	81.24	(79)
Southwest _{0.9x}	0.77	X	1.03	x	113.91		0.63	X	0.7	=	35.86	(79)
Southwest _{0.9x}	0.77	X	2.18	x	113.91		0.63	X	0.7	=	75.89	(79)
Southwest _{0.9x}	0.77	X	1.8	x	113.91		0.63	X	0.7	=	62.66	(79)
Southwest _{0.9x}	0.77	X	2.25	x	113.91		0.63	X	0.7	=	78.33	(79)
Southwest _{0.9x}	0.77	X	1.03	x	104.39		0.63	X	0.7	=	32.86	(79)
Southwest _{0.9x}	0.77	x	2.18	x	104.39		0.63	X	0.7] =	69.55	(79)
Southwest _{0.9x}	0.77	X	1.8	x	104.39		0.63	X	0.7	=	57.43	(79)
Southwest _{0.9x}	0.77	X	2.25	x	104.39		0.63	X	0.7	=	71.78	(79)
Southwest _{0.9x}	0.77	X	1.03	x	92.85		0.63	X	0.7] =	29.23	(79)
Southwest _{0.9x}	0.77	x	2.18	x	92.85		0.63	x	0.7] <u>=</u>	61.86	(79)
Southwest _{0.9x}	0.77	x	1.8	x	92.85		0.63	x	0.7	Ī =	51.08	(79)
Southwest _{0.9x}	0.77	x	2.25	x	92.85	Ē	0.63	x	0.7	j =	63.85	(79)
Southwest _{0.9x}	0.77	x	1.03	x	69.27		0.63	x	0.7] <u>-</u>	21.8	(79)
Southwest _{0.9x}	0.77	x	2.18	x	69.27	F	0.63	x	0.7	j =	46.15	(79)
Southwest _{0.9x}	0.77	x	1.8	x	69.27	Ē	0.63	x	0.7	j =	38.1	(79)
Southwest _{0.9x}	0.77	x	2.25	x	69.27	Ē	0.63	x	0.7	j =	47.63	(79)
Southwest _{0.9x}	0.77	x	1.03	×	44.07	Ē	0.63	x	0.7	j =	13.87	(79)
Southwest _{0.9x}	0.77	x	2.18	×	44.07	Ē	0.63	x	0.7	j =	29.36	(79)
Southwest _{0.9x}	0.77	x	1.8	x	44.07	Ē	0.63	x	0.7	j =	24.24	(79)
Southwest _{0.9x}	0.77	x	2.25	x	44.07	Ē	0.63	x	0.7	j =	30.3	(79)
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	_						_						
Southwest _{0.9x} 0.77	X	1.0)3	X	31.4	9	L	0.63	X	0.7	=	9.91	(79)
Southwest _{0.9x} 0.77	X	2.1	18	X	31.4	9		0.63	X	0.7	=	20.98	(79)
Southwest _{0.9x} 0.77	X	1.8	8	X	31.4	9		0.63	x	0.7	=	17.32	(79)
Southwest _{0.9x} 0.77	x	2.2	25	X	31.4	9		0.63	x	0.7	=	21.65	(79)
Rooflights 0.9x 1	x	8.0	35	X	26		x	0.63	x	0.7	=	8.76	(82)
Rooflights 0.9x 1	x	0.8	35	X	54		x	0.63	x	0.7	=	18.2	(82)
Rooflights 0.9x 1	x	0.8	35	X	96	;	x	0.63	x	0.7		32.35	(82)
Rooflights 0.9x 1	x	0.8	35	X	150)	x	0.63	x	0.7	=	50.55	(82)
Rooflights 0.9x 1	x	8.0	35	X	192	2	x	0.63	x	0.7	=	64.71	(82)
Rooflights 0.9x 1	x	0.8	35	X	200)	x	0.63	x	0.7	=	67.4	(82)
Rooflights 0.9x 1	x	8.0	35	X	189)	x	0.63	x	0.7	=	63.7	(82)
Rooflights 0.9x 1	x	8.0	35	X	157	7	x	0.63	x	0.7	=	52.91	(82)
Rooflights 0.9x 1	x	0.8	35	X	115	5	x	0.63	x	0.7	=	38.76	(82)
Rooflights 0.9x 1	x	8.0	35	X	66	;	x	0.63	x	0.7	=	22.24	(82)
Rooflights 0.9x 1	x	8.0	35	X	33		x	0.63	x	0.7	=	11.12	(82)
Rooflights 0.9x 1	x	0.8	35	X	21		x	0.63	x	0.7	=	7.08	(82)
Solar gains in watts, calcu	ılated	for eacl	h month	1		(8	33)m =	Sum(74)m	(82)m			_	
(83)m= 133.55 239.03 3	56.5	489.06	589.52	60	03.22 5	74.12	496.69	9 402.15	272.24	162.09	112.89		(83)
Total gains – internal and	solar	(84)m =	= (73)m	+ (8	33)m , w	atts						_	
(84)m= 507.61 610.47 7°	4.35	825.37	903.99	89	96.57 8	54.11	783.1	699.89	591.73	506.49	476.11		(84)
7. Mean internal tempera	ature (heating	seasor	า)								_	
7. Mean internal tempera Temperature during hea					area froi	m Table	e 9, 1	Гh1 (°C)				21	(85)
·	ting pe	eriods ir	n the livi	ing			e 9, 1	Гh1 (°C)				21	(85)
Temperature during hea	ting pe	eriods ir	n the livi	ing n (s	ee Table		e 9, 1		Oct	Nov	Dec	21	(85)
Temperature during hea Utilisation factor for gain Jan Feb	ting pe	eriods ir	n the livi ea, h1,m	ing n (s	ee Table Jun	e 9a)		· · ·	Oct 0.96	Nov 0.99	Dec 1	21	(85)
Temperature during hea Utilisation factor for gain Jan Feb (86)m= 1 0.99 0	ting pos s for li Mar	eriods ir iving are Apr 0.93	n the livi ea, h1,m May	ing n (sa	ee Table Jun 0.63 (9a) Jul 0.47	Aug 0.53	9 Sep 0.79		+		21	
Temperature during hea Utilisation factor for gain Jan Feb (86)m= 1 0.99 0 Mean internal temperature	ting pos s for li Mar	eriods ir iving are Apr 0.93	n the livi ea, h1,m May	ing n (sa l	ee Table Jun 0.63 w steps	9a) Jul 0.47	Aug 0.53	Sep 0.79 ble 9c)		+		21	
Temperature during hear Utilisation factor for gain Jan Feb (86)m=	ting possible for life to the second	eriods in ving are Apr 0.93 iving are 20.55	n the livi ea, h1,m May 0.81 ea T1 (for	ing n (se	D.63 (w steps 0.96 2	9a) Jul 0.47 3 to 7 i	Aug 0.53 in Tal 20.99	Sep 0.79 ble 9c) 20.89	0.96	0.99	1	21	(86)
Temperature during hear Utilisation factor for gain Jan Feb (86)m=	ting positing positions of the second	eriods ir iving are Apr 0.93 iving are 20.55 eriods ir	n the livi ea, h1,m May 0.81 ea T1 (for 20.83	ing (sollo	Jun 0.63 w steps 0.96 2 relling from	9a) Jul 0.47 3 to 7 i 20.99 Dom Tab	Aug 0.53 in Ta 20.99 ble 9,	Sep 0.79 ble 9c) 20.89 Th2 (°C)	20.5	0.99	19.64	21	(86)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 Compared to the second sec	s for li Mar 0.98 re in l 0.17 ting pe	Apr 0.93 iving are 20.55 eriods ir	n the livi ea, h1,m May 0.81 ea T1 (for 20.83 n rest of	ing (solid collocation) (s	Jun 0.63 w steps 0.96 2 relling from	9a) Jul 0.47 3 to 7 i 20.99 om Tab 19.9	Aug 0.53 in Ta 20.99 ble 9,	Sep 0.79 ble 9c) 20.89	0.96	0.99	1	21	(86)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 0 Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain	s for li Mar 0.98 re in l 0.17 ting pe 9.87	eriods ir ving are Apr 0.93 iving are 20.55 eriods ir 19.89 est of dy	n the livi ea, h1,m May 0.81 ea T1 (for 20.83 n rest of 19.89 welling,	ing 1 (so 1 (s	y steps 0.96 2 elling from 19.9	9a) Jul 0.47 3 to 7 i 20.99 com Tab 19.9 Table 9	Aug 0.53 in Ta 20.99 ble 9, 19.9	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9	0.96 20.5 19.89	0.99	19.64	21	(86) (87) (88)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 0 Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1	s for li Mar 0.98 re in l 0.17 ting pe	Apr 0.93 iving are 20.55 eriods ir	n the livi ea, h1,m May 0.81 ea T1 (for 20.83 n rest of	ing 1 (so 1 (s	Jun 0.63 w steps 0.96 celling from 19.9 m (see	9a) Jul 0.47 3 to 7 i 20.99 om Tab 19.9	Aug 0.53 in Ta 20.99 ble 9,	Sep 0.79 ble 9c) 20.89 Th2 (°C)	20.5	0.99	19.64	21	(86)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 (Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain (89)m= 1 0.99 (0.99) (0.99) (0.99)	ting positions for line in land positions positions for response in terms of the control of the	eriods in ving are 0.93 viving are 20.55 eriods in 19.89 est of do 0.9 he rest	n the livies, h1,m May 0.81 ea T1 (for 20.83 n rest of 19.89 welling, 0.75 of dwell	ing (sollo) (collo) (dw) (h2,) (diing)	w steps 0.96 2 relling fro 19.9 7 m (see - 0.53 0	9a) Jul 0.47 3 to 7 i 20.99 Dm Tab 19.9 Table 9 0.36 Dw step	Aug 0.53 in Ta 20.99 ble 9, 19.9 0.41 os 3 to	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9 0.71 0 7 in Table	0.96 20.5 19.89	0.99 20.02 19.88 0.99	1 19.64 19.88	21	(86) (87) (88) (89)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 (Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain (89)m= 1 0.99 (0.99) (0.99) (0.99)	ting positions for limited by the second sec	eriods in ving are Apr 0.93 iving are 20.55 eriods in 19.89 est of do	n the livi ea, h1,m May 0.81 ea T1 (for 20.83 n rest of 19.89 welling, 0.75	ing (sollo) (collo) (dw) (h2,) (diing)	w steps 0.96 2 relling fro 19.9 7 m (see - 0.53 0	9a) Jul 0.47 3 to 7 i 20.99 Dom Tab 19.9 Table 9 0.36	Aug 0.53 in Ta 20.99 ble 9, 19.9 9a) 0.41	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9 0.71 0 7 in Table 19.81	0.96 20.5 19.89 0.94 e 9c) 19.33	0.99 20.02 19.88 0.99	1 19.64 19.88 1 18.07		(86) (87) (88) (89)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 (Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain (89)m= 1 0.99 (0.99) (0.99) (0.99)	ting positions for line in land positions positions for response in terms of the control of the	eriods in ving are 0.93 viving are 20.55 eriods in 19.89 est of do 0.9 he rest	n the livies, h1,m May 0.81 ea T1 (for 20.83 n rest of 19.89 welling, 0.75 of dwell	ing (sollo) (collo) (dw) (h2,) (diing)	w steps 0.96 2 relling fro 19.9 7 m (see - 0.53 0	9a) Jul 0.47 3 to 7 i 20.99 Dm Tab 19.9 Table 9 0.36 Dw step	Aug 0.53 in Ta 20.99 ble 9, 19.9 0.41 os 3 to	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9 0.71 0 7 in Table 19.81	0.96 20.5 19.89 0.94 e 9c) 19.33	0.99 20.02 19.88 0.99	1 19.64 19.88 1 18.07	21	(86) (87) (88) (89)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 (Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain (89)m= 1 0.99 (0.99) (0.99) (0.99) (0.99)	ting positions for limited to the second sec	eriods in ving are Apr 0.93 iving are 20.55 eriods in 19.89 est of do 0.9 he rest 19.37	n the livies, h1,m May 0.81 ea T1 (for 20.83 n rest of 19.89 welling, 0.75 of dwell 19.73	ing (see) (see	w steps 0.96 2 relling from (see - 0.53 (s	9a) Jul 0.47 3 to 7 i 20.99 Dom Tab 19.9 Table 9 0.36 Dow step 19.9	Aug 0.53 in Tal 20.99 ble 9, 19.9 0.41 0s 3 to 19.9	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9 0.71 0.7 in Table 19.81	0.96 20.5 19.89 0.94 e 9c) 19.33	0.99 20.02 19.88 0.99	1 19.64 19.88 1 18.07		(86) (87) (88) (89)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 0 Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain (89)m= 1 0.99 0 Mean internal temperature (90)m= 18.11 18.4 1 Mean internal temperature (90)m= 18.11 18.4 1	ting positions for limited to the second sec	eriods in ving are Apr 0.93 iving are 20.55 eriods in 19.89 est of do 0.9 he rest 19.37	n the livies, h1,m May 0.81 ea T1 (for 20.83 n rest of 19.89 welling, 0.75 of dwell 19.73	h2,	ee Table Jun 0.63 w steps 0.96 2 elling fro 19.9 m (see 0.53 T2 (follo 9.88	9a) Jul 0.47 3 to 7 i 20.99 Dom Tab 19.9 Table 9 0.36 Dow step 19.9 × T1 +	Aug 0.53 in Tal 20.99 ble 9, 19.9 0.41 0s 3 to 19.9	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9 0.71 0.71 19.81 fLA) × T2	0.96 20.5 19.89 0.94 e 9c) 19.33	0.99 20.02 19.88 0.99 18.63 ring area ÷ (4	1 19.64 19.88 1 18.07		(86) (87) (88) (89)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 0 Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain (89)m= 1 0.99 0 Mean internal temperature (90)m= 18.11 18.4 1 Mean internal temperature (90)m= 18.11 18.4 1	ting positions for limited by the second sec	eriods in ving are Apr 0.93 iving are 20.55 eriods in 19.89 est of dv 0.9 he rest 19.37 r the wh 19.83	n the livies, h1,m May 0.81 ea T1 (for 20.83 n rest of 19.89 welling, 0.75 of dwell 19.73 ole dwell 20.16	ing (second of the second of t	ee Table Jun 0.63 w steps 0.96 2 elling fro 19.9 m (see 0.53 T2 (follo 9.88 g) = fLA 20.3 2	3 to 7 i 20.99 Table 9 0.36 Dw step 19.9 × T1 +	Aug 0.53 in Ta 20.99 ole 9, 19.9 0.41 os 3 to 19.9 · (1 – 20.32	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9 0.71 0.7 in Table 19.81 ffLA) × T2 2 20.23	0.96 20.5 19.89 0.94 e 9c) 19.33 LA = Liv	0.99 20.02 19.88 0.99 18.63 ring area ÷ (4	1 19.64 19.88 1 18.07		(86) (87) (88) (89) (90) (91)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 0 Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain (89)m= 1 0.99 0 Mean internal temperature (90)m= 18.11 18.4 1 Mean internal temperature (92)m= 18.72 18.97 1 Apply adjustment to the	ting positions for limited by the second sec	eriods in ving are Apr 0.93 iving are 20.55 eriods in 19.89 est of dv 0.9 he rest 19.37 r the wh 19.83	n the livies, h1,m May 0.81 ea T1 (for 20.83 n rest of 19.89 welling, 0.75 of dwell 19.73 ole dwell 20.16	h2, h2, ratu	ee Table Jun 0.63 w steps 0.96 2elling from 19.9 T2 (follo 9.88 g) = fLA 20.3 2ere from	9a) Jul 0.47 3 to 7 i 20.99 Dom Tab 19.9 Table 9 0.36 Dow step 19.9 × T1 + 20.32 Table 4	Aug 0.53 in Ta 20.99 ole 9, 19.9 0.41 os 3 to 19.9 · (1 – 20.32	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9 0.71 0.71 0.7 in Table 19.81 ffLA) × T2 2 20.23 here appro	0.96 20.5 19.89 0.94 e 9c) 19.33 LA = Liv	0.99 20.02 19.88 0.99 18.63 ring area ÷ (4) 19.17	1 19.64 19.88 1 18.07		(86) (87) (88) (89) (90) (91)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 0 Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain (89)m= 1 0.99 0 Mean internal temperature (90)m= 18.11 18.4 1 Mean internal temperature (92)m= 18.72 18.97 1 Apply adjustment to the	ting positions for limited positions for received positions for rece	eriods in ving are Apr 0.93 iving are 20.55 eriods in 19.89 est of do 0.9 he rest 19.37 r the wh 19.83 internal	n the living the livin	h2, h2, ratu	ee Table Jun 0.63 w steps 0.96 2elling from 19.9 T2 (follo 9.88 g) = fLA 20.3 2ere from	9a) Jul 0.47 3 to 7 i 20.99 Dom Tab 19.9 Table 9 0.36 Dow step 19.9 × T1 + 20.32 Table 4	Aug 0.53 in Tal 20.99 ole 9, 19.9 0.41 os 3 to 19.9 · (1 – 20.32 4e, w	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9 0.71 0.71 0.7 in Table 19.81 ffLA) × T2 2 20.23 here appro	0.96 20.5 19.89 0.94 e 9c) 19.33 LA = Liv	0.99 20.02 19.88 0.99 18.63 ring area ÷ (4) 19.17	1 19.64 19.88 1 18.07 1) =		(86) (87) (88) (89) (90) (91) (92)
Temperature during hear Utilisation factor for gain Jan Feb (86)m= 1 0.99 (9) Mean internal temperature (87)m= 19.67 19.86 2 Temperature during hear (88)m= 19.87 19.87 1 Utilisation factor for gain (89)m= 1 0.99 (9) Mean internal temperature (90)m= 18.11 18.4 1 Mean internal temperature (92)m= 18.72 18.97 1 Apply adjustment to the (93)m= 18.72 18.97 1	ting positions for limited by the second sec	eriods in ving are Apr 0.93 iving are 20.55 eriods in 19.89 est of do 0.9 he rest 19.37 r the wh 19.83 internal 19.83	n the living the livin	h2, h2, ratu	ee Table Jun 0.63 w steps 0.96 2elling from 19.9 m (see 0.53 T2 (follo 9.88 g) = fLA 20.3 2ere from 20.3 2	9a) Jul 0.47 3 to 7 i 20.99 Dom Tab 19.9 Table 9 0.36 Dow step 19.9 × T1 + 20.32 Table 4 20.32	Aug 0.53 in Tal 20.99 ole 9, 19.9 0.41 os 3 to 19.9 · (1 – 20.32 4e, wi 20.32	Sep 0.79 ble 9c) 20.89 Th2 (°C) 19.9 0.71 0.71 0.7 in Table 19.81 ffLA) × T2 2. 20.23 here approxes	0.96 20.5 19.89 0.94 e 9c) 19.33 A = Liv 19.79 priate 19.79	0.99 20.02 19.88 0.99 18.63 ring area ÷ (4) 19.17	1 19.64 19.88 1 18.07 4) =	0.39	(86) (87) (88) (89) (90) (91) (92)

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb

Utilis	ation fac	tor for a	ains, hm	ı•										
(94)m=	0.99	0.99	0.97	0.9	0.77	0.57	0.4	0.46	0.73	0.94	0.99	1		(94)
	∟ ul gains.	hmGm	. W = (94	1)m x (84	1 4)m					<u> </u>				
(95)m=	504.59	602.05	689.4	745.02	694.52	510.36	342.61	357.89	513.51	556.48	500.28	473.96		(95)
Mont	hly aver	age exte	rnal tem	perature	from Ta	able 8				Į.				
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m=		1346.49			794.04	528.52	345.32	362.82	571.34	862.22	1138.74	1374.26		(97)
-				r each n		Wh/mont	h = 0.02	24 x [(97)m – (95					
(98)m=	654.3	500.26	399.72	204.21	74.05	0	0	0	0	227.47	459.69	669.82		_
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	3189.53	(98)
Spac	e heatin	g require	ement in	kWh/m²	/year								42.08	(99)
9a. En	ergy red	quiremer	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatir	•										ı		_
				econdar		mentary	system						0	(201)
Fract	ion of sp	ace hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of	main spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of	seconda	ry/supple	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Spac	e heatin	g require	ement (c	alculate	d above)								
	654.3	500.26	399.72	204.21	74.05	0	0	0	0	227.47	459.69	669.82		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20	6)									(211)
	700.53	535.61	427.97	218.64	79.28	0	0	0	0	243.54	492.18	717.16		_
								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	3414.91	(211)
Spac	e heatin	g fuel (s	econdar	y), kWh/	month									
		1	00 ÷ (20					i	ī		·			
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		٦
								rota	ı (kvvn/yea	ar) =Sum(2	215) _{15,10. 12}		0	(215)
	heating		4a /a.a.la.	ام امیلامانی										
Output	198.77	173.63	180.65	ulated al	155.13	136.63	130.9	145.92	147.53	168	179.33	194.1		
Efficie	ncv of w	ater hea		ļ				ļ	<u> </u>	<u> </u>	<u> </u>		80.3	(216)
(217)m=		87.56	86.99	85.66	83.31	80.3	80.3	80.3	80.3	85.81	87.32	87.92		(217)
Fuel fo	r water	neating.	kWh/mo	onth						l	l			
		-) ÷ (217)											
(219)m=	226.32	198.29	207.66	187.04	186.21	170.15	163.01	181.72	183.73	195.77	205.38	220.78		_
								Tota	I = Sum(2				2326.05	(219)
	al totals		ad masi-	ovoto m	1					k'	Wh/year		kWh/year	٦
	_			system	I								3414.91	_
Water	heating	fuel use	d										2326.05	
Electri	city for p	oumps, f	ans and	electric	keep-ho	t								

central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)) (230g) =	75 (231)
Electricity for lighting			331.26 (232)
12a. CO2 emissions – Individual heating system	s including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	737.62 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	502.43 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1240.05 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	171.93 (268)
Total CO2, kg/year	sum	of (265) (271) =	1450.9 (272)

TER =

(273)

19.14

eight associates

Appendix Energy Assessment 34A-36 Kilburn High Road

LEAN Scenario

		l Isar E	Details:							
Assessor Name:	Chris Hocknell	– USE ITL	Strom	a Nium	her:		STDO	016363		
Software Name:	Stroma FSAP 2012		Softwa	_				on: 1.0.4.12		
	F	roperty	Address	Apartm	ent 1					
Address :										
Overall dwelling dimens	nsions:	۸ro	a(m²)		۸ _۷ ۵ _۵	ight(m)		Volume(m ³	31	
Ground floor				(1a) x		2.7	(2a) =	138.51	(3a)	
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1	n)		(4)]			
Dwelling volume	, (-, (-, (-, (-,	′ <u> </u>	01.0)+(3c)+(3c	d)+(3e)+	.(3n) =	138.51	(5)	
							,	130.31		
2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	r	
Number of chimneys	heating heating 0	- + -	0] = [0	x 4	40 =	0	(6a)	
Number of open flues	0 + 0		0]	0	x	20 =	0	一 (6b)	
Number of intermittent far	ns			J	0	x ·	10 =	0	(7a)	
Number of passive vents				L	0	x	10 =	0	(7b)	
Number of flueless gas fir	res			L	0	X	40 =	0	(7c)	
				L					(, o)	
							Air ch	nanges per ho	our	
•	vs, flues and fans = $(6a)+(6b)+(6b)$				0		÷ (5) =	0	(8)	
If a pressurisation test has be Number of storeys in th	een carried out or is intended, procee	ed to (17),	otherwise o	continue fr	om (9) to	(16)		0	(9)	
Additional infiltration	e dwelling (113)					[(9)	-1]x0.1 =	0	(10)	
Structural infiltration: 0.	25 for steel or timber frame of	0.35 fo	r masonr	y constr	uction			0	(11)	
if both types of wall are pro deducting areas of opening	esent, use the value corresponding to as): if equal user 0.35	o the grea	ter wall are	a (after						
	oor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)	
If no draught lobby, ent	er 0.05, else enter 0							0	(13)	
•	and doors draught stripped		0.05 10.0	(4.4) 4	1001			0	(14)	
Window infiltration Infiltration rate			0.25 - [0.2 (8) + (10)		_	+ (15) =		0	(15)	
	q50, expressed in cubic metre	es per ho	. , , , ,				area	3	(16)	
•	ty value, then (18) = [(17) ÷ 20]+(•	•	•				0.15	(18)	
	s if a pressurisation test has been do	ne or a de	gree air pe	rmeability	is being u	sed			<u> </u>	
Number of sides sheltered Shelter factor	d		(20) = 1 -	[0.0 75 x (1	19)] =			0.92	(19) (20)	
Infiltration rate incorporati	ng shelter factor		(21) = (18) x (20) =				0.02	(21)	
Infiltration rate modified for	or monthly wind speed									
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind spe	eed from Table 7					i		1		
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7			
Wind Factor (22a)m = (22	?)m ÷ 4									
(22a)m= 1.27 1.25 1	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18			

· —	ation rate (al		1	1	` 	`	`	T		1	1	
0.18 Calculate effec	0.17 0.1		0.15 the appli	0.13 cable ca	0.13 ise	0.13	0.14	0.15	0.16	0.16	İ	
If mechanica											0.5	(23
If exhaust air he	eat pump using	Appendix N, (2	23b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b	o) = (23a)			0.5	(23
If balanced with	heat recovery:	efficiency in %	allowing	for in-use t	actor (fron	n Table 4h) =				75.65	(23
a) If balance	d mechanica	al ventilatior	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24a)m= 0.3	0.3 0.2	9 0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(24
b) If balance	d mechanica	al ventilation	without	heat red	covery (I	MV) (24b)m = (22	2b)m + (2	23b)		,	
24b)m= 0	0 0	0	0	0	0	0	0	0	0	0		(2
c) If whole he if (22b)m	ouse extract o < 0.5 × (23		•	•				.5 × (23b))			
24c)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	ventilation or n = 1, then (2							0.5]		•	1	
24d)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24
Effective air	change rate	- enter (24a	a) or (24l	b) or (24	c) or (24	d) in bo	x (25)	-		-		
25)m= 0.3	0.3 0.2	9 0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(2
3. Heat losses	s and heat lo	ss paramet	er:									
LEMENT	Gross area (m²)	Openir		Net Aı A ,ı		U-val W/m2		A X U (W/ł	〈)	k-value kJ/m²·l		XXk J/K
Doors				2	х	1.3		2.6				(2
Vindows Type	1			9.56	x1	/[1/(1.3)+	0.04] =	11.81				(2
Vindows Type	2			4.62	x1	/[1/(1.3)+	0.04] =	5.71				(2
Vindows Type	3			4.17	x1	/[1/(1.3)+	0.04] =	5.15				(2
Rooflights Type	e 1			1.05	x1	/[1/(1.6) +	0.04] =	1.68				(2
Rooflights Type	e 2			1.79	x1	/[1/(1.6) +	0.04] =	2.864				(2
Valls Type1	35.48	22.5	i2	12.90	3 X	0.15	= i	1.94	<u> </u>			(2
Valls Type2	30.48	2		28.48	3 X	0.13	<u> </u>	3.8			= ==	(2
Roof	51.3	2.8	4	48.40	3 X	0.1	<u> </u>	4.85			= =	(3
otal area of e	lements, m²			117.2	6							(3
for windows and					ated using	g formula 1	/[(1/U-valu	ue)+0.04] a	s given in	paragraph	1 <i>3.2</i>	
* include the area			lls and par	titions		(26) (20) + (22) -					—,,
abric heat los	`	,				(26) (30) + (32) =	(20) + (20	2) + (225)	(220) =	45.29	(3
leat capacity (Thermal mass	•	•	- ΤΕΛ\ iı	n k l/m²k			((28)	(30) + (32 ative Value:	, , ,	(326) -	8309.74	(3
or design assess	•		,			recisely the				able 1f	250	(3
an be used instea			. condition		pr	- 5.551y till			11110			
hermal bridge	es : S (L x Y)	calculated	using Aր	pendix	K						11.73	(3
details of therma		ot known (36)	= 0.15 x (3	31)			(22)	(26) -				— ,_
atal tahria ha	41 1055						(33) +	(30) =			57.03	(3
otal fabric hea entilation hea		atad manth	.,					i = 0.33 × (25)m v: (5)	\	37.03	

(00)	10.10	40.00	10.51	40.00	44.50	44.50	14.40	44.04	10.00	40.7	10.00		(20)
(38)m= 13.65	13.49	13.33	12.54	12.38	11.59	11.59	11.43	11.91	12.38	12.7	13.02		(38)
Heat transfer c	70.52	nt, W/K 70.36	69.57	69.41	68.62	68.62	68.46	(39)m 68.93	69.41	38)m 69.73	70.04		
(39)111- 10.00	70.52	70.30	09.57	09.41	00.02	00.02	00.40			Sum(39) ₁	<u> </u>	69.53	(39)
Heat loss para	meter (F	HLP), W	/m²K				_		= (39)m ÷				 `
(40)m= 1.38	1.37	1.37	1.36	1.35	1.34	1.34	1.33	1.34	1.35	1.36	1.37		_
Number of day	s in moi	nth (Tab	le 1a)					/	Average =	Sum(40) ₁	12 /12=	1.36	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing enei	rgy requi	irement:								kWh/ye	ar:	
Assumed occu	nancy I	N									70		(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		73		(42)
if TFA £ 13.9 Annual average	,	ator usac	no in litro	ne por de	w Vd av	orago =	(25 v NI)	T 36					(42)
Reduce the annua	l average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		5.25		(43)
not more that 125	litres per p	person per	day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage ir			ı	· · · · · · · · · · · · · · · · · · ·	ı	ı	. /						
(44)m= 82.77	79.76	76.75	73.74	70.73	67.72	67.72	70.73	73.74	76.75	79.76 m(44) _{1 12} =	82.77	903	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x C	OTm / 3600			` '	<u> </u>	903	(++)
(45)m= 122.75	107.36	110.79	96.59	92.68	79.97	74.11	85.04	86.05	100.29	109.47	118.88		
#:	-111		/				h (40		Γotal = Su	m(45) _{1 12} =		1183.97	(45)
If instantaneous w			· ·	1		1		, ,					(40)
(46)m= 18.41 Water storage	16.1 loss:	16.62	14.49	13.9	12	11.12	12.76	12.91	15.04	16.42	17.83		(46)
Storage volume) includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	eating a	ind no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufacti		eclared l	oss facto	or is kno	wn (kWł	n/dav):					0		(48)
Temperature fa					`	J /					0		(49)
Energy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=			0		(50)
b) If manufacti			-										
Hot water stora If community h	•			e 2 (KVV	n/litre/da	ıy)					0		(51)
Volume factor	_		011 1.0								0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (, ,	,									0		(55)
Water storage	loss cal	culated f	for each	month			((56)m = (55) × (41)r	n				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0	. 11	(56)
If cylinder contains				1	I	1						: н	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	0	(58)											
(modified by factor from Table H5 if there is solar water heating and a cylinder thermo		(50)											
(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	<u>. </u>												
(61)m= 42.18 36.71 39.11 36.37 36.05 33.4 34.51 36.05 36.37 39.11	39.34 42.18	(61)											
Total heat required for water heating calculated for each month (62) m = $0.85 \times (45)$ m +	(46)m + (57)m + (59)r	n + (61)m											
(62)m= 164.93 144.07 149.9 132.95 128.72 113.37 108.62 121.08 122.42 139.4	148.81 161.06	(62)											
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribut	tion to water heating)												
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)													
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													
(64)m= 164.93 144.07 149.9 132.95 128.72 113.37 108.62 121.08 122.42 139.4	148.81 161.06												
Output from water heate	er (annual) _{1 12}	1635.35 (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= 51.36 44.88 46.61 41.21 39.83 34.94 33.27 37.29 37.7 43.12	46.23 50.07	(65)											
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is fi	rom community heatin	a											
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= 86.42 86.42 86.42 86.42 86.42 86.42 86.42 86.42 86.42 86.42 86.42	86.42 86.42	(66)											
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	302	, ,											
(67)m= 13.43 11.93 9.7 7.34 5.49 4.63 5.01 6.51 8.74 11.09	12.95 13.8	(67)											
	12.00	(01)											
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 150.61 152.17 148.23 139.85 129.27 119.32 112.67 111.11 115.05 123.43	124.02 442.00	(68)											
	134.02 143.96	(00)											
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	T T T	(00)											
(69)m= 31.64 31.64 31.64 31.64 31.64 31.64 31.64 31.64 31.64 31.64	31.64 31.64	(69)											
Pumps and fans gains (Table 5a)													
(70)m= 3 3 3 3 3 3 3 3 3 3	3 3	(70)											
Losses e.g. evaporation (negative values) (Table 5)													
(71)m= -69.14 -69.14 -69.14 -69.14 -69.14 -69.14 -69.14 -69.14 -69.14 -69.14	-69.14 -69.14	(71)											
Water heating gains (Table 5)													
(72)m= 69.03 66.78 62.65 57.23 53.53 48.53 44.72 50.12 52.37 57.96	64.21 67.3	(72)											
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m	71)m + (72)m												
(73)m= 285 282.8 272.51 256.35 240.21 224.41 214.32 219.66 228.08 244.41	263.1 276.99	(73)											
6. Solar gains:													
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applical	ble orientation.												
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b T		iins W)											
Noticed [
Northeast 0.9x		28.78 (75)											
Northeast 0.9x 0.77 x 4.62 x 11.28 x 0.55 x	0.7	13.91 (75)											

Northogat a a		7		1		1		ı		1		¬
Northeast 0.9x	0.77	」 ^X	9.56] X	22.97] X]	0.55	X	0.7] =	58.58	(75)
Northeast 0.9x	0.77	X	4.62	X	22.97	X	0.55	X	0.7] =	28.31	(75)
Northeast 0.9x	0.77	X	9.56	X	41.38	X	0.55	X	0.7] =	105.54	(75)
Northeast 0.9x	0.77	X	4.62	X	41.38	X	0.55	X	0.7] =	51.01	(75)
Northeast _{0.9x}	0.77	X	9.56	X	67.96	X	0.55	X	0.7] =	173.33	(75)
Northeast _{0.9x}	0.77	X	4.62	X	67.96	X	0.55	X	0.7] =	83.77	(75)
Northeast _{0.9x}	0.77	X	9.56	X	91.35	X	0.55	X	0.7] =	232.99	(75)
Northeast _{0.9x}	0.77	X	4.62	X	91.35	X	0.55	X	0.7	=	112.6	(75)
Northeast _{0.9x}	0.77	X	9.56	X	97.38	X	0.55	X	0.7	=	248.39	(75)
Northeast _{0.9x}	0.77	X	4.62	X	97.38	X	0.55	X	0.7	=	120.04	(75)
Northeast _{0.9x}	0.77	X	9.56	X	91.1	X	0.55	X	0.7	=	232.37	(75)
Northeast _{0.9x}	0.77	X	4.62	X	91.1	X	0.55	X	0.7	=	112.29	(75)
Northeast _{0.9x}	0.77	X	9.56	X	72.63	X	0.55	X	0.7] =	185.25	(75)
Northeast _{0.9x}	0.77	X	4.62	X	72.63	X	0.55	X	0.7	=	89.52	(75)
Northeast _{0.9x}	0.77	X	9.56	X	50.42	X	0.55	X	0.7	=	128.61	(75)
Northeast _{0.9x}	0.77	x	4.62	X	50.42	x	0.55	x	0.7] =	62.15	(75)
Northeast _{0.9x}	0.77	x	9.56	X	28.07	x	0.55	X	0.7] =	71.59	(75)
Northeast _{0.9x}	0.77	x	4.62	X	28.07	x	0.55	X	0.7	=	34.6	(75)
Northeast _{0.9x}	0.77	X	9.56	X	14.2	X	0.55	X	0.7	=	36.21	(75)
Northeast _{0.9x}	0.77	x	4.62	X	14.2	x	0.55	x	0.7	=	17.5	(75)
Northeast _{0.9x}	0.77	X	9.56	X	9.21	x	0.55	x	0.7	=	23.5	(75)
Northeast _{0.9x}	0.77	X	4.62	x	9.21	x	0.55	x	0.7	j =	11.36	(75)
Northwest 0.9x	0.77	×	4.17	x	11.28	x	0.55	x	0.7	Ī =	25.11	(81)
Northwest 0.9x	0.77	X	4.17	x	22.97	x	0.55	x	0.7	Ī =	51.1	(81)
Northwest _{0.9x}	0.77	X	4.17	x	41.38	x	0.55	x	0.7	j =	92.07	(81)
Northwest _{0.9x}	0.77	x	4.17	x	67.96	x	0.55	x	0.7	Ī =	151.21	(81)
Northwest 0.9x	0.77	x	4.17	x	91.35	x	0.55	x	0.7	Ī =	203.26	(81)
Northwest _{0.9x}	0.77	X	4.17	x	97.38	x	0.55	x	0.7	j =	216.7	(81)
Northwest _{0.9x}	0.77	x	4.17	x	91.1	x	0.55	x	0.7	j =	202.71	(81)
Northwest 0.9x	0.77	x	4.17	x	72.63	x	0.55	x	0.7] =	161.61	(81)
Northwest _{0.9x}	0.77	x	4.17	x	50.42	x	0.55	x	0.7	j =	112.19	(81)
Northwest _{0.9x}	0.77	x	4.17	x	28.07	x	0.55	x	0.7	j =	62.45	(81)
Northwest 0.9x	0.77	x	4.17	x	14.2	x	0.55	x	0.7	j =	31.59	(81)
Northwest _{0.9x}	0.77	x	4.17	x	9.21	x	0.55	x	0.7	j =	20.5	(81)
Rooflights 0.9x	1	x	1.05	x	26	x	0.55	x	0.8	j =	10.81	(82)
Rooflights 0.9x	1	Īx	1.79	x	26	x	0.55	x	0.8	j =	18.43	(82)
Rooflights _{0.9x}	1	j x	1.05	x	54	x	0.55	x	0.8] =	22.45	(82)
Rooflights _{0.9x}	1	×	1.79	x	54	x	0.55	х	0.8] =	38.28	(82)
Rooflights _{0.9x}	1	i x	1.05	X	96	X	0.55	X	0.8	j =	39.92	(82)
Rooflights _{0.9x}	1	i x	1.79	X	96	x	0.55	x	0.8	j =	68.05	(82)
Rooflights _{0.9x}	1] x	1.05	X	150	X	0.55	X	0.8	j =	62.37	(82)
L		_				1		1	•	1		

Rooflights 0.	9x 1	X	1.79	9	x	150	x	0.55	X	0.8	=	106.33	(82)
Rooflights 0.	9x 1	x	1.05	5	x	192	x	0.55	x	0.8	=	79.83	(82)
Rooflights 0.	9x 1	x	1.79	9	x	192	x	0.55	x	0.8	=	136.1	(82)
Rooflights 0.	9x 1	X	1.05	5	x	200	x	0.55	X	0.8	=	83.16	(82)
Rooflights 0.	9x 1	X	1.79	9	x	200	x	0.55	x	0.8	=	141.77	(82)
Rooflights 0.	9x 1	x	1.05	5	x	189	x	0.55	x	0.8	=	78.59	(82)
Rooflights 0.	9x 1	X	1.79	9	x	189	x	0.55	X	0.8	=	133.97	(82)
Rooflights 0.	9x 1	X	1.05	5	x	157	x	0.55	x	0.8	=	65.28	(82)
Rooflights 0.	9x 1	X	1.79	9	x	157	x	0.55	X	0.8	=	111.29	(82)
Rooflights 0.	9x 1	X	1.05	5	X	115	x	0.55	x	0.8	=	47.82	(82)
Rooflights 0.	9x 1	X	1.79	9	X	115	x	0.55	X	0.8	=	81.52	(82)
Rooflights 0.	9x 1	X	1.05	5	X	66	X	0.55	X	0.8	=	27.44	(82)
Rooflights 0.	9x 1	X	1.79	9	x	66	x	0.55	x	0.8	=	46.78	(82)
Rooflights 0.	9x 1	X	1.05	5	X	33	x	0.55	x	0.8	=	13.72	(82)
Rooflights 0.	9x 1	X	1.79	9	x	33	x	0.55	X	0.8	=	23.39	(82)
Rooflights 0.	9x 1	X	1.05	5	x	21	x	0.55	X	0.8	=	8.73	(82)
Rooflights 0.	9x 1	X	1.79	9	X	21	x	0.55	X	0.8	=	14.89	(82)
Solar gains	in watts, calc	ulated	for each	month			(83)m	= Sum(74)m	(82)m				
(83)m= 97.	03 198.73 3	56.59	577.01	764.78	81	10.06 759.93	612	.94 432.28	242.87	7 122.41	78.98		(83)
Total gains	– internal and	d solar	(84)m =	(73)m	+ (8	33)m , watts						_	
	1 1												
(84)m= 382	.03 481.53 6	529.1	833.36	1004.99	10	34.47 974.26	832	.61 660.36	487.28	385.52	355.97		(84)
` ′	.03 481.53 6					34.47 974.26	832	.61 660.36	487.28	385.52	355.97		(84)
7. Mean in		ature (heating	season)				487.28	3 385.52	355.97	21	(84)
7. Mean in	nternal temper	rature (heating eriods in	season the livi	ng a	area from Tal			487.28	385.52	355.97	21	
7. Mean in Temperat	nternal temper ure during hea	rature (heating eriods in	season the livi	ng a	area from Tal	ole 9		487.28 Oct		355.97 Dec	21	
7. Mean in Temperat	nternal temper ure during hea factor for gair an Feb	rature (ating pe	heating eriods in ving are	season the livi a, h1,m	ng a	area from Tal	ole 9	Th1 (°C)				21	
7. Mean in Temperat Utilisation [86]m= 1	nternal temper ure during hea factor for gair an Feb	rature (ating pens for li Mar 0.95	heating eriods in ving area Apr	season the living a, h1,m May 0.61	ng a	area from Tal ee Table 9a) Jun Jul 0.42 0.31	ole 9	Th1 (°C) ug Sep 8 0.66	Oct	Nov	Dec	21	(85)
7. Mean in Temperat Utilisation Ja (86)m=	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperate	rature (ating pens for li Mar 0.95	heating eriods in ving area Apr	season the living a, h1,m May 0.61	ng a	area from Tal ee Table 9a) Jun Jul 0.42 0.31	ole 9	Th1 (°C) ug Sep 18 0.66 Table 9c)	Oct	Nov 0.99	Dec	21	(85)
7. Mean in Temperat Utilisation [86]m= 1 Mean inte (87)m= 19.	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperatu 59 19.84 2	ature (ating pens for limited Mar 0.95 ure in limited 20.26	heating eriods in ving area Apr 0.82 iving are 20.72	the living the living	ng a (Se	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7	ole 9 A 0.3 7 in T	Th1 (°C) ug Sep 18 0.66 Table 9c) 1 20.93	Oct 0.94	Nov 0.99	Dec 1	21	(85)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperatu 59 19.84 2 ure during hea	ature (ating pens for limited Mar 0.95 ure in limited 20.26	heating eriods in ving area Apr 0.82 iving are 20.72	the living the living	ng a (se constitution)	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7	ole 9 A 0.3 7 in T	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 9, Th2 (°C)	Oct 0.94	Nov 0.99	Dec 1	21	(85)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19.	rnal temperature during heat of the factor for gain an Feb 0.99 rnal temperature during heat 19.78 19.78	ature (ating pens for li Mar 0.95 ure in li 20.26 ating pens 19.79	heating eriods in ving are Apr 0.82 iving are 20.72 eriods in 19.8	the living a, h1,m May 0.61 rest of 19.8	ng a (se color) of the color of	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81	ole 9 A 0.3 7 in T 2 able 9	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 9, Th2 (°C)	Oct 0.94 20.53	Nov 0.99	Dec 1	21	(85) (86) (87)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation	rnal temperature during heat factor for gair no 199 no 19.84 20 no 19.84 20 no 19.84 20 no 19.84 20 no 19.78 19.78 19.78 factor for gair	ature (ating pens for li Mar 0.95 ure in li 20.26 ating pens for restrictions for restrictions at the second se	heating eriods in ving are 0.82 iving are 20.72 eriods in 19.8 est of dw	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling,	ng a (se color) of the color of	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table	A 0.37 in T 2 19. 19. 9a)	Th1 (°C) ug Sep 18 0.66 Table 9c) 1 20.93 10, Th2 (°C) 81 19.81	Oct 0.94 20.53	Nov 0.99 19.96	Dec 1 19.55	21	(85) (86) (87) (88)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9	rnal temperature during hear factor for gair no.99 rnal temperature during hear 19.78 19.78 factor for gair no.98	ature (ating pens for limited	heating eriods in ving area 0.82 iving are 20.72 eriods in 19.8 est of dw	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54	mg (second of the second of th	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23	A 0.3 on T 19. on T 1	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81	Oct 0.94 20.53 19.8 0.91	Nov 0.99	Dec 1	21	(85) (86) (87)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte	rnal temperature during heat of temperature duri	ature (ating persons for li Mar 0.95 ure in li 20.26 ating persons for re 0.93 ure in t	heating eriods in ving are 20.72 eriods in 19.8 est of dw 0.77 he rest of	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling)	ng a (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) and (see colors) are colors) a	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste	A 0.37 in T 2 able (19. 9a) 0.2	Th1 (°C) ug Sep 88 0.66 fable 9c) 1 20.93 9, Th2 (°C) 81 19.81 19.81 10.57 to 7 in Tabl	Oct 0.94 20.53 19.8 0.91 e 9c)	Nov 0.99 19.96 19.79	Dec 1 19.55 19.79	21	(85) (86) (87) (88) (89)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9	rnal temperature during heat of temperature duri	ature (ating pens for limited	heating eriods in ving area 0.82 iving are 20.72 eriods in 19.8 est of dw	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54	ng a (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) and (see colors) are colors) a	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23	A 0.3 on T 19. on T 1	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 10.57 10 7 in Table 11.78	Oct 0.94 20.53 19.8 0.91 e 9c)	Nov 0.99 19.96 19.79 0.99	Dec 1 19.55 19.79 1		(85) (86) (87) (88) (89)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte	rnal temperature during heat of temperature duri	ature (ating persons for li Mar 0.95 ure in li 20.26 ating persons for re 0.93 ure in t	heating eriods in ving are 20.72 eriods in 19.8 est of dw 0.77 he rest of	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling)	ng a (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) are colors) and (see colors) are colors) are colo	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste	A 0.37 in T 2 able (19. 9a) 0.2	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 10.57 to 7 in Table 81 19.78	Oct 0.94 20.53 19.8 0.91 e 9c)	Nov 0.99 19.96 19.79	Dec 1 19.55 19.79 1	0.57	(85) (86) (87) (88) (89)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18.	rnal temperature during heat of temperature duri	ature (ating pens for limited	heating eriods in ving area (a.82) diving area (a.72) eriods in 19.8 est of dw (a.77) he rest of 19.6	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling)	ng a (see) (collor) (dw 1 1 1 1	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81	9a) 0.2 eps 3	Th1 (°C) ug Sep 18 0.66 Table 9c) 1 20.93 19, Th2 (°C) 81 19.81 10.57 10 7 in Table 11 19.78	Oct 0.94 20.53 19.8 0.91 e 9c)	Nov 0.99 19.96 19.79 0.99	Dec 1 19.55 19.79 1		(85) (86) (87) (88) (89)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19.	rnal temperature during hear factor for gair for	ature (ating pens for limited for limited for real limited for lim	heating eriods in ving area (a.82) iving area (a.72) eriods in (a.77) he rest of the who (a.20.23)	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling) of dwelling 19.76 of dwelling 20.43	ng a (see color) oblio dw 1 h2, cling 1	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 19.78 to 7 in Tabl 81 19.78 f	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1		(85) (86) (87) (88) (89)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19. Apply adju	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperatu 59 19.84 2 ure during hea 78 19.78 factor for gair 99 0.98 rnal temperatu 52 18.77 rnal temperatu 13 19.38 ustment to the	ature (ating persons for li Mar 0.95 ure in li 20.26 ating persons for re 0.93 ure in t 19.17 ure (for 19.79 mean	heating eriods in ving are 0.82 iving are 20.72 eriods in 19.8 est of dw 0.77 he rest of 19.6 the who 20.23 internal	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling, 19.76 ole dwe 20.43 temper	ng a collor of the collor of t	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48 re from Table	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 19.78 to 7 in Tabl 81 19.78 f	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1 18.49		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19.	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperatu 59 19.84 2 ure during hea 78 19.78 factor for gair 99 0.98 rnal temperatu 52 18.77 rnal temperatu 13 19.38 ustment to the	ature (ating pens for limited for limited for real limited for lim	heating eriods in ving area (a.82) iving area (a.72) eriods in (a.77) he rest of the who (a.20.23)	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling) of dwelling 19.76 of dwelling 20.43	ng a collor of the collor of t	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 19.77 to 7 in Tabl 81 19.78 f - fLA) × T2 48 20.43 where approximation of the second o	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1 18.49		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19. Apply adju (93)m= 18. 8. Space	rnal temperature during heating require during heating require to the properature during heating require	ature (ating pens for rule) ating pens for rule)	heating eriods in ving are Apr 0.82 iving are 20.72 eriods in 19.8 est of dw 0.77 he rest of 19.6 the who 20.23 internal 20.08	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling 19.76 ble dwe 20.43 temper 20.28	ng a collor of the collor of t	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48 re from Table 0.33 20.33	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 0, Th2 (°C) 81 19.81 19.81 19.78 to 7 in Tabl 81 19.78 f - fLA) × T2 48 20.43 where approximates a second	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv 20.06 ppriate 19.91	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1 18.49 4) =	0.57	(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19. Apply adjute (93)m= 18. 8. Space Set Ti to to to to to to to to to to to to to	rnal temperature during hear factor for gair for gair for gair for gair for gair factor for gair for gair factor for gair factor for gair	ature (ating pens for in 10.95 ating pens for reconstruction of 19.79 at 19.17 at 19.17 at 19.17 at 19.17 at 19.64 at 19	heating eriods in ving area (a.82) iving area (a.72) eriods in (a.77) he rest of the who (a.73) internal (a.0.8) internal (a.0.8)	the living a, h1,m May 0.61 ea T1 (for 20.94) rest of 19.8 velling, 0.54 of dwelling, 19.76 ble dwe 20.43 temper 20.28 e obtain	ng a collor of the collor of t	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48 re from Table 0.33 20.33	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 0, Th2 (°C) 81 19.81 19.81 19.78 to 7 in Tabl 81 19.78 f - fLA) × T2 48 20.43 where approximates a second	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv 20.06 ppriate 19.91	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1 18.49 4) =	0.57	(85) (86) (87) (88) (89) (90) (91)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisation fa	actor for o	ains, hm	1:										
(94)m= 0.99	0.98	0.93	0.79	0.57	0.38	0.26	0.32	0.61	0.91	0.98	0.99		(94)
Useful gain:	s, hmGm	, W = (94	4)m x (8	4)m					Į.	Į.			
(95)m= 378.92	2 471.43	586.4	655.24	570.01	389.8	255.75	268.12	402.46	443.43	379.08	353.79		(95)
Monthly ave	erage exte	ernal tem	perature	from Ta	able 8								
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	-	an interr	al tempe	erature,		=[(39)m :	x [(93)m	– (96)m	ī —	•			
(97)m= 1037.5		924.41	778.07	595.49	393.07	256.24	269.29	426.24	646.45	854.48	1032.6		(97)
Space heat		1											
(98)m= 490.0	5 362.05	251.48	88.44	18.96	0	0	0	0	151.05	342.28	505.03		-
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2209.34	(98)
Space heat	ing requir	ement in	kWh/m²	² /year								43.07	(99)
9a. Energy re	equireme	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heat	•										Ī		_
Fraction of	space hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fraction of	space hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction of	total heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency o	f main sp	ace heat	ing syste	em 1								90.3	(206)
Efficiency o	f seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heat	ing requir	ement (c	alculate	d above))			•					
490.0	5 362.05	251.48	88.44	18.96	0	0	0	0	151.05	342.28	505.03		
(211)m = {[(9	98)m x (20	04)] } x 1	100 ÷ (20	06)									(211)
542.69	9 400.94	278.49	97.94	20.99	0	0	0	0	167.27	379.05	559.28		
							Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}		2446.67	(211)
Space heat	ing fuel (s	econdar	y), kWh/	month									
$= \{[(98)m \times (2)]\}$													
(215)m= 0	0	0	0	0	0	0	0	0	0	0	0		_
							Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
Water heating	•												
Output from		149.9	ulated a 132.95	128.72	113.37	108.62	121.08	122.42	139.4	148.81	161.06		
Efficiency of		l .	102.00	120.72	110.07	100.02	121.00	122.72	100.4	140.01	101.00	81	(216)
(217)m= 87.76	-	86.59	84.48	82.09	81	81	81	81	85.58	87.26	87.86		(217)
Fuel for wate		L		02.00	0.			<u> </u>	00.00	07.20	07.00		()
(219)m = (64)	•						_						
(219)m= 187.93	3 164.77	173.12	157.39	156.82	139.96	134.1	149.49	151.14	162.88	170.53	183.31		
							Tota	I = Sum(2	19a) ₁₁₂ =			1931.43	(219)
Annual total									k\	Wh/year	•	kWh/year	_
Space heatir	ng fuel us	ed, main	system	1								2446.67	_
Water heatin	g fuel use	ed										1931.43	
Electricity for	pumps, f	ans and	electric	keep-ho	t								

mechanical ventilation - balanced, extract or positive input from o	111.95		(230a)		
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a)	(230g) =		186.95	(231)
Electricity for lighting				237.12	(232)
12a. CO2 emissions – Individual heating systems including micro					

12a. CO2 emissions – Individual heating systems	s including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	528.48 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216	417.19 (264)
Space and water heating	(261) + (262) + (263) + (264) =		945.67 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	97.03 (267)
Electricity for lighting	(232) x	0.519	123.07 (268)
Total CO2, kg/year	sum	of (265) (271) =	1165.76 (272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =	22.72 (273)
El rating (section 14)			84 (274)

User Details: STRO016363 **Assessor Name:** Chris Hocknell Stroma Number: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.12 **Software Name:** Property Address: Apartment 2 Address: 1. Overall dwelling dimensions Area(m²) Av. Height(m) Volume(m³) Ground floor 61.1 (1a) x 2.7 (2a) =164.97 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4) 61.1 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =164.97 (5) other total main secondary m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 O 0 0 (6b) Number of intermittent fans x 10 =(7a) 0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = \div (5) = (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)n Additional infiltration (10)[(9)-1]x0.1 =0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)Λ if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =n (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)3 If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise (18) = (16)0.15 (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)3 $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78 $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.12 Infiltration rate modified for monthly wind speed Jan Feb Jul Sep Oct Nov Mar Apr Mav Jun Aug Dec Monthly average wind speed from Table 7 (22)m=4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18 1.1

Adjusted infiltra	ation rate (a	allowii	ng for sh	ielter an	d wind	speed) =	(21a) x	(22a)m				1	
0.15 Calculate effec).14 ange r	0.13	0.12 he appli	0.11	0.11	0.11	0.12	0.12	0.13	0.14]	
If mechanica		_	ale for t	те арри	ouble of	.00						0.5	(23
If exhaust air he	eat pump using	g Appe	endix N, (2	3b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recovery	y: effici	ency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				75.65	(23
a) If balance	d mechanio	cal ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24a)m= 0.27	0.27 0).26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(24
b) If balance	d mechanio	cal ve	ntilation	without	heat red	covery (I	MV) (24b)m = (22	2b)m + (2	23b)	,	1	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
c) If whole h if (22b)n	ouse extrac n < 0.5 × (2			•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)n	ventilation on the second								0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change rate	e - en	ter (24a) or (24h	o) or (24	c) or (24	d) in bo	x (25)					
25)m= 0.27	0.27 0).26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(25
3. Heat losse	s and heat	loss p	aramete	er:									
LEMENT	Gross area (m²		Openin m	gs	Net Aı A ,ı		U-val W/m2		A X U (W/ł	〈)	k-value kJ/m²-		A X k J/K
Doors					2	х	1.3		2.6				(26
Vindows Type	1				8.26	x1	/[1/(1.3)+	0.04] =	10.21				(27
Vindows Type	2				4.21	x1	/[1/(1.3)+	0.04] =	5.2				(27
Vindows Type	3				3.21	x1	/[1/(1.3)+	0.04] =	3.97				(27
Vindows Type	4				4.37	x1	/[1/(1.3)+	0.04] =	5.4				(2
Rooflights					1.61	x1	/[1/(1.6) +	0.04] =	2.576				(27
Valls Type1	38.95		20.0	5	18.9	X	0.15	=	2.84				(29
Valls Type2	45.47		2		43.4	7 X	0.13	=	5.81				(29
Roof	61.1		1.61		59.49) x	0.1	=	5.95				(30
otal area of e	lements, m	2			145.5	2							(3
for windows and						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	1 3.2	
* include the area abric heat los				s and par	titions		(26) (30) + (32) =					
leat capacity		•	0)				(20) (00	((28)	(30) + (32	2) + <i>(</i> 32a)	(32e) =	44.39 12385.71	(3:
hermal mass	•	,) = Cm ÷	- TFA) ir	n kJ/m²K			***	itive Value:	, , ,	(020)	250	(3!
or design assess	•	•		,			recisely the				able 1f		
an be used instea													
hermal bridge	,	•		• .	•	K						12.49	(3
details of thermatoric head		not kn	own (36) =	: U.15 x (3	11)			(33) +	(36) =			56.87	(3
								()	()			30.07	
entilation hea	it loss calci	ulated	monthly	/				(38)m	= 0.33 × (25)m x (5))		

_								,					•	
(38)m=	14.7	14.54	14.38	13.59	13.43	12.64	12.64	12.48	12.96	13.43	13.75	14.06		(38)
Heat tra	ınsfer c	oefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	71.57	71.41	71.25	70.46	70.31	69.51	69.51	69.36	69.83	70.31	70.62	70.94		_
Heat los	ss para	meter (H	HLP), W/	/m²K	_	_		_		Average = = (39)m ÷	Sum(39) ₁	12 /12=	70.42	(39)
(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.16	1.16		_
Number	of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.15	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	-		-	-	-	-	-	-	-	-	-	-	•	
4. Wate	er heat	ing ener	rgy requi	irement:								kWh/ye	ear:	
Assume	אל טכנוו	nancy I	NI									04	Ī	(42)
if TFA), N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		.01		(42)
Annual a	averag	e hot wa										32		(43)
Reduce the		•		0 ,		•	Ū	to achieve	a water us	se target o	f			
Г			<i>'</i>	<u> </u>			<u> </u>	Ι Δα	Con	Oat	Nov	l Doo		
Hot water	Jan usage in	Feb litres per	Mar day for ea	Apr ach month	May Vd,m = fa	Jun ctor from 7	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	90.2	86.92	83.64	80.36	77.08	73.8	73.8	77.08	80.36	83.64	86.92	90.2		
(11)	00.2	00.02	00.01	00.00	77.00	70.0	7 0.0	177.00			m(44) _{1 12} =	<u> </u>	983.98	(44)
Energy co	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	133.76	116.99	120.72	105.25	100.99	87.14	80.75	92.66	93.77	109.28	119.29	129.54		
If instants	22222	atar baatii	na at naint	of was (no	hot water	r otorogo)	antar O in	boxes (46		Total = Su	m(45) _{1 12} =	=	1290.15	(45)
_			· ·		1		ı		` '	40.00	17.00	10.40		(46)
(46)m= Water st	20.06 torage	17.55 loss:	18.11	15.79	15.15	13.07	12.11	13.9	14.07	16.39	17.89	19.43		(46)
	_		includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comm	unity h	eating a	nd no ta	ınk in dw	elling, e	nter 110	litres in	(47)					1	
			hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water st	•		eclared l	oce fact	or ic kno	wo (k\\/k	a/dayı):						İ	(40)
Tempera					טווא פו וכ	wii (Kvvi	i/uay).					0		(48) (49)
Energy					-ar			(48) x (49)) =			0		(50)
			eclared o	-		or is not		(10) X (10)	,			0		(30)
Hot water		_			e 2 (kW	h/litre/da	ay)					0		(51)
If comm Volume	-	_		on 4.3								_	1	(50)
Tempera				2h							-	0		(52) (53)
Energy					aar			(47) x (51)	\ v (52) v (53) =				
Enter (5			-	, KVVII/ yt	zai			(41) X (31)	/ X (32) X (55) =	-	0		(54) (55)
Water s	, ,	, ,	,	for each	month			((56)m = (55) × (41)ı	m				(,
(56)m=	0 1	0	0	0	0	0	0	0	0	0	0	0		(56)
		-	_			-	-	0), else (5			-	-	I ix H	. ,
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
<u> </u>					•	•	•	•			•	•	•	

Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	0 (58)												
(modified by factor from Table H5 if there is solar water heating and a cylinder therr													
(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	<u></u>												
(61)m= 45.96 40.01 42.62 39.63 39.28 36.39 37.61 39.28 39.63 42.62	2 42.86 45.96 (61)												
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m	+ (46)m + (57)m + (59)m + (61)m												
(62)m= 179.73 156.99 163.34 144.88 140.27 123.54 118.36 131.94 133.4 151.	9 162.15 175.5 (62)												
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contril	bution to water heating)												
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)													
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													
Output from water heater													
(64)m= 179.73 156.99 163.34 144.88 140.27 123.54 118.36 131.94 133.4 151.	9 162.15 175.5												
Output from water hea	ater (annual) _{1 12} 1782.01 (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= 55.97 48.9 50.8 44.9 43.4 38.07 36.25 40.63 41.09 46.9	9 50.38 54.56 (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 Oc	t Nov Dec												
(66)m= 100.63 100.63 100.63 100.63 100.63 100.63 100.63 100.63 100.63 100.63													
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m= 15.66 13.91 11.32 8.57 6.4 5.41 5.84 7.59 10.19 12.9	4 15.1 16.1 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m= 175.71 177.54 172.94 163.16 150.81 139.21 131.45 129.63 134.23 144.0	01 156.35 167.96 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	1												
(69)m= 33.06 33.06 33.06 33.06 33.06 33.06 33.06 33.06 33.06 33.06 33.06	6 33.06 33.06 (69)												
Pumps and fans gains (Table 5a)	0 00.00 00.00												
(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3	3 3 (70)												
	3 3 (70)												
Losses e.g. evaporation (negative values) (Table 5) (71)m= -80.5	5 -80.5 -80.5 (71)												
	3 -80.5 -80.5												
Water heating gains (Table 5)	0 00 07 70 04 (72)												
(72)m= 75.22 72.77 68.27 62.36 58.33 52.88 48.73 54.61 57.06 63.10													
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m +													
(73)m= 322.79 320.41 308.72 290.28 271.73 253.68 242.21 248.02 257.67 276.	3 297.62 313.59 (73)												
6. Solar gains:	aghla ariantation												
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applications.													
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b	FF Gains Table 6c (W)												
Northeast 0.9x 0.77 x 4.21 x 11.28 x 0.55 x	0.7 = 12.67 (75)												
Northeast 0.9x	0.7 = 25.8 (75)												
	20.0												

Northeast _{0.9x}	^ 77	1		1 .,	14.00	1 .,	0.55	l		1 _	10.40	7(75)
Northeast 0.9x	0.77	X	4.21	X	41.38	X	0.55	X	0.7	= 	46.48	(75)
Northeast 0.9x	0.77	X	4.21	X	67.96	X	0.55	X	0.7	=	76.33	(75)
<u> </u>	0.77	X	4.21	X	91.35	X	0.55	X	0.7	= 	102.6	(75)
Northeast 0.9x	0.77] X]	4.21	X	97.38	X	0.55	X	0.7	= 	109.39	(75)
Northeast 0.9x	0.77	X	4.21	X	91.1	X	0.55	X	0.7	= 	102.33	(75)
Northeast _{0.9x}	0.77	X	4.21	X	72.63	X	0.55	X	0.7	=	81.58	<u> </u> (75)
Northeast 0.9x	0.77	X	4.21	X	50.42	X	0.55	X	0.7	=	56.63	(75)
Northeast _{0.9x}	0.77	X	4.21	X	28.07	X	0.55	X	0.7	=	31.53	(75)
Northeast _{0.9x}	0.77	X	4.21	X	14.2	X	0.55	X	0.7	=	15.95	(75)
Northeast 0.9x	0.77	X	4.21	X	9.21	X	0.55	X	0.7	=	10.35	(75)
Northwest 0.9x	0.77	X	8.26	X	11.28	X	0.55	X	0.7	=	24.87	(81)
Northwest _{0.9x}	0.77	X	3.21	X	11.28	X	0.55	X	0.7	=	9.66	(81)
Northwest _{0.9x}	0.77	X	4.37	X	11.28	X	0.55	X	0.7	=	13.16	(81)
Northwest 0.9x	0.77	X	8.26	X	22.97	X	0.55	X	0.7	=	50.61	(81)
Northwest 0.9x	0.77	X	3.21	X	22.97	X	0.55	X	0.7	=	19.67	(81)
Northwest 0.9x	0.77	X	4.37	x	22.97	x	0.55	x	0.7	=	26.78	(81)
Northwest 0.9x	0.77	X	8.26	X	41.38	X	0.55	X	0.7	=	91.19	(81)
Northwest 0.9x	0.77	X	3.21	X	41.38	x	0.55	x	0.7	=	35.44	(81)
Northwest _{0.9x}	0.77	X	4.37	X	41.38	x	0.55	X	0.7	=	48.25	(81)
Northwest _{0.9x}	0.77	X	8.26	x	67.96	X	0.55	X	0.7	=	149.76	(81)
Northwest _{0.9x}	0.77	X	3.21	x	67.96	x	0.55	x	0.7	=	58.2	(81)
Northwest _{0.9x}	0.77	x	4.37	x	67.96	x	0.55	x	0.7	j =	79.23	(81)
Northwest _{0.9x}	0.77	x	8.26	x	91.35	x	0.55	x	0.7	j =	201.31	(81)
Northwest 0.9x	0.77	x	3.21	x	91.35	x	0.55	x	0.7	j =	78.23	(81)
Northwest 0.9x	0.77	x	4.37	x	91.35	x	0.55	x	0.7	j =	106.5	(81)
Northwest 0.9x	0.77	x	8.26	x	97.38	x	0.55	x	0.7	j =	214.62	(81)
Northwest _{0.9x}	0.77	x	3.21	x	97.38	х	0.55	x	0.7	j =	83.4	(81)
Northwest 0.9x	0.77	x	4.37	x	97.38	x	0.55	x	0.7	j =	113.54	(81)
Northwest 0.9x	0.77	x	8.26	x	91.1	х	0.55	x	0.7	j =	200.77	(81)
Northwest 0.9x	0.77	X	3.21	x	91.1	x	0.55	х	0.7	j =	78.02	(81)
Northwest 0.9x	0.77	x	4.37	x	91.1	x	0.55	x	0.7	j =	106.22	(81)
Northwest 0.9x	0.77	X	8.26	x	72.63	x	0.55	x	0.7	j =	160.06	(81)
Northwest 0.9x	0.77	X	3.21	x	72.63	x	0.55	x	0.7	j =	62.2	(81)
Northwest _{0.9x}	0.77	X	4.37	x	72.63	x	0.55	x	0.7	j =	84.68	(81)
Northwest _{0.9x}	0.77	x	8.26	×	50.42	x	0.55	x	0.7	=	111.12	(81)
Northwest _{0.9x}	0.77	X	3.21	X	50.42	X	0.55	x	0.7	=	43.18	(81)
Northwest _{0.9x}	0.77	X	4.37	X	50.42	X	0.55	x	0.7	 =	58.79	(81)
Northwest _{0.9x}	0.77	X	8.26	X	28.07	X	0.55	x	0.7	 =	61.85	(81)
Northwest _{0.9x}	0.77) x	3.21	X	28.07	X	0.55	x	0.7	 =	24.04	(81)
Northwest _{0.9x}	0.77	X	4.37	X	28.07	X	0.55	x	0.7	 =	32.72	(81)
Northwest _{0.9x}	0.77	X	8.26	X	14.2) x	0.55	x	0.7	 =	31.29	(81)
_		1		1		1		I	<u> </u>	ı		

Northwest 0.	9x 0.77	X	3.2	1	X	14.2	X	0.55	X	0.7	=	12.16	(81)
Northwest 0.9	0.77	x	4.3	7	X	14.2	X	0.55	×	0.7	=	16.55	(81)
Northwest 0.	0.77	X	8.2	6	X	9.21	X	0.55	x	0.7	=	20.31	(81)
Northwest 0.	0.77	X	3.2	1	x	9.21	X	0.55	x	0.7	=	7.89	(81)
Northwest 0.	0.77	X	4.3	7	x	9.21	X	0.55	×	0.7	=	10.74	(81)
Rooflights 0.9	9x 1	X	1.6	1	X	26	X	0.55	x	0.8	=	16.58	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	54	X	0.55	×	0.8	=	34.43	(82)
Rooflights 0.9	9x 1	x	1.6	1	X	96	Īx	0.55	x	0.8		61.21	(82)
Rooflights 0.	9x 1	X	1.6	1	x	150	X	0.55	x	0.8	=	95.63	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	192	x	0.55	x	0.8	=	122.41	(82)
Rooflights 0.9	9x 1	X	1.6	1	X	200	X	0.55	x	0.8	=	127.51	(82)
Rooflights 0.9	9x 1	X	1.6	1	X	189	X	0.55	X	0.8	=	120.5	(82)
Rooflights 0.9	9x 1	X	1.6	1	X	157	X	0.55	x	0.8	=	100.1	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	115	X	0.55	X	0.8	=	73.32	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	66	X	0.55	X	0.8	=	42.08	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	33	X	0.55	X	0.8	=	21.04	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	21	X	0.55	X	0.8	=	13.39	(82)
Solar gains	in watts, calc	ulated	for each	month	1		(83)m	n = Sum(74)m	(82)m			_	
(83)m= 76.9		282.56	459.16	611.06	1	18.46 607.84	488	.61 343.04	192.2	96.98	62.68		(83)
Total gains	 internal and 	d solar	(84)m =	(73)m	+ (8	33)m , watts						_	
(84)m= 399.	72 477.69 5	91.28	749.44	882.8	90	02.15 850.05	736	.63 600.71	468.5	2 394.6	376.27]	(84)
` '	72 477.69 5 ternal temper		Į)2.15 850.05	736	.63 600.71	468.5	2 394.6	376.27		(84)
7. Mean in		ature (heating	season	1)				468.5	2 394.6	376.27	21	(84)
7. Mean in	ternal temper	rature (ating pe	heating eriods in	season the livi	n) ing	area from Ta			468.5	2 394.6	376.27	21	
7. Mean in	ternal temper ure during hea factor for gair	rature (ating pe	heating eriods in	season the livi	ing i	area from Ta	ble 9		468.5		376.27	21	
7. Mean in Temperate Utilisation	ternal temper ure during hea factor for gair n Feb	rature (ating pe	heating eriods in ving are	season the livi a, h1,m	ng (so	area from Ta	ble 9	, Th1 (°C)				21	
7. Mean in Temperate Utilisation Ja (86)m= 1	ternal temper ure during hea factor for gair n Feb	rature (ating pe ns for li Mar 0.97	heating eriods in ving are Apr	season the livi a, h1,m May	n) ing in (se	area from Ta ee Table 9a) Jun Jul 0.49 0.36	ble 9	, Th1 (°C) ug Sep	Oct	Nov	Dec	21	(85)
7. Mean in Temperate Utilisation Ja (86)m= 1	ternal temper ure during hea factor for gair n Feb 0.99	rature (ating pe ns for li Mar 0.97	heating eriods in ving are Apr	season the livi a, h1,m May	ing (so	area from Ta ee Table 9a) Jun Jul 0.49 0.36	ble 9	Th1 (°C) Sep 0.73 able 9c)	Oct	Nov 0.99	Dec	21	(85)
7. Mean in Temperate Utilisation [86]m= 1 Mean interest [87]m= 19.7	ternal temper ure during hea factor for gair n Feb 0.99 rnal temperatu	ature (ating pens for limited Mar 0.97 ure in limited 20.3	heating eriods in ving are Apr 0.88 iving are 20.71	season the livi a, h1,m May 0.69 ea T1 (fo	ing (sollo	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21	A 0.47 in 1 2	Sep 13 0.73 Table 9c) 1 20.93	Oct 0.96	Nov 0.99	Dec 1	21	(85)
7. Mean in Temperatu Utilisation Ja (86)m= 1 Mean inter (87)m= 19.7	ternal temper ure during hea factor for gair n Feb 0.99 rnal temperature 19.97 ure during hea	ature (ating pens for limited Mar 0.97 ure in limited 20.3	heating eriods in ving are Apr 0.88 iving are 20.71	season the livi a, h1,m May 0.69 ea T1 (fo	n (se collo	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21	A 0.47 in 1 2	Sep 3 0.73 able 9c) 1 20.93 9, Th2 (°C)	Oct 0.96	Nov 0.99	Dec 1	21	(85)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.3 Temperatu (88)m= 19.9	ternal temperater during heat factor for gair n Feb 0.99 rnal temperater 19.97 ure during heat 19.95	ating pens for limber of l	heating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96	ng (sollo ollo dw	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97	A 0.2 7 in 1 2 able 9	Sep 3 0.73 able 9c) 1 20.93 9, Th2 (°C)	Oct 0.96	Nov 0.99	Dec 1	21	(86)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation	ternal temper ure during hea factor for gair n Feb 0.99 cmal temperature during hea 19.95 cm factor for gair	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re	heating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv	season the livi a, h1,m May 0.69 ea T1 (fo 20.93 rest of 19.96 velling,	ollo h2,	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table	A 0.4 7 in 1 2 able 9 19.	Sep 13 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97	Oct 0.96 20.57	Nov 0.99 20.09	Dec 1 19.75	21	(85) (86) (87) (88)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1	ternal temper ure during hea factor for gair n Feb 0.99 cmal temperature during hea 19.95 cm factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63	(sollo ollo 1 h2,	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28	A 0.4 7 in 1 2 able 9 19. 9a) 0.3	Sep 13 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97	Oct 0.96 20.57 19.96 0.94	Nov 0.99	Dec 1	21	(86)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.9 Utilisation (89)m= 1 Mean inter	ternal temper ure during hea factor for gair n Feb 0.99 rnal temperature 19.97 ure during hea 19.95 factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96 ure in t	heating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of	season the livi ta, h1,m 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell	n (secollo 2 dw 1 h2, ing	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st	A 0.2 7 in T 2 able 9 19. e 9a) 0.3 eps 3	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Table	Oct 0.96 20.57 19.96 0.94 e 9c)	Nov 0.99 20.09 19.96	Dec 1 19.75 19.95	21	(85) (86) (87) (88)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1	ternal temper ure during hea factor for gair n Feb 0.99 rnal temperature 19.97 ure during hea 19.95 factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63	n (secollo 2 dw 1 h2, ing	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28	A 0.4 7 in 1 2 able 9 19. 9a) 0.3	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 to 7 in Table 97 19.93	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63	Nov 0.99 20.09 19.96 0.99	Dec 1 19.75 19.95		(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.9 Utilisation (89)m= 1 Mean inter	ternal temper ure during hea factor for gair n Feb 0.99 rnal temperature 19.97 ure during hea 19.95 factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96 ure in t	heating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of	season the livi ta, h1,m 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell	n (secollo 2 dw 1 h2, ing	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st	A 0.2 7 in T 2 able 9 19. e 9a) 0.3 eps 3	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 to 7 in Table 97 19.93	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63	Nov 0.99 20.09 19.96	Dec 1 19.75 19.95	21	(85) (86) (87) (88)
7. Mean in Temperate Utilisation (86)m= 1 Mean interection (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1 Mean interection (90)m= 18.8	ternal temper ure during hea factor for gair n Feb 0.99 rnal temperature 19.97 ure during hea 19.95 factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96 ure in t	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell	ollo 1 1 1 1 1 1 1 1 1	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97	A 0.4 7 in 1 2 able 9 19. e 9a) 0.3 eps 3	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 to 7 in Table 97 19.93	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63	Nov 0.99 20.09 19.96 0.99	Dec 1 19.75 19.95		(85) (86) (87) (88) (89)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1 Mean interest (90)m= 18.8	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 factor for gair 0.99 That temperature during heat 19.95 factor for gair 19.95 That temperature during heat 19.95 That temperature during heat 19.95 That temperature during heat 19.95	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96 ure in t	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell	ollo (sollo 2 de la la la la la la la la la la la la la	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97	A 0.4 7 in 1 2 able 9 19. e 9a) 0.3 eps 3	Th1 (°C) ug Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Table 97 19.93 f - fLA) × T2	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63	Nov 0.99 20.09 19.96 0.99	Dec 1 19.75 19.95		(85) (86) (87) (88) (89)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1 Mean interest (90)m= 18.8 Mean interest (92)m= 19.5	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 factor for gair 0.99 That temperature during heat 19.95 factor for gair 19.95 That temperature during heat 19.95 That temperature during heat 19.95 That temperature during heat 19.95	ature (ating pens for limited for limited for real limited for lim	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74 results the whole 20.18	season the livi a, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell 19.92 ole dwe 20.38	ollo 2 1 h2, (see 1 1 1 1 1 1 2 2 2 (see 1 1 1 1 1 1 1 1 1	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97 g) = fLA × T1 0.43 20.43	A 0.4 7 in 1 2 able 9 19. e 9a) 0.3 eps 3 19. + (1 20.	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Table 97 19.93 f - fLA) × T2 43 20.39	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63 LA = Liv	Nov 0.99 20.09 19.96 0.99	Dec 1 19.75 19.95 1 18.81 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1 Mean interest (90)m= 18.8 Mean interest (92)m= 19.5	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 That temperature during heat	ature (ating pens for limited for limited for real limited for lim	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74 results the whole 20.18	season the livi a, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell 19.92 ole dwe 20.38	ollo 2 fing (sollo 2) find (area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97 g) = fLA × T1 0.43 20.43	A 0.4 7 in 1 2 able 9 19. e 9a) 0.3 eps 3 19. + (1 20.	Th1 (°C) ug Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Tabl 97 19.93 f - fLA) × T2 43 20.39 where approximates a second content of the c	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63 LA = Liv	Nov 0.99 20.09 19.96 0.99	Dec 1 19.75 19.95 1 18.81 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.5 Utilisation (89)m= 1 Mean inter (90)m= 18.8 Mean inter (92)m= 19.2 Apply adju (93)m= 19.5	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 That temperature during heat	ature (ating pens for limited	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74 rest the who 20.18 internal	season the livi ta, h1,m May 0.69 ta T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell 19.92 tole dwe 20.38 temper	ollo 2 fing (sollo 2) find (area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97 g) = fLA × T1 0.43 20.43 re from Table	A 0.4 7 in T 2 able 9 19. eps 3 19. + (1 20. e 4e,	Th1 (°C) ug Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Tabl 97 19.93 f - fLA) × T2 43 20.39 where approximates a second content of the c	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63 LA = Liv	Nov 0.99 20.09 19.96 0.99 19.16 ving area ÷ (4	Dec 1 19.75 19.95 1 18.81 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.5 Utilisation (89)m= 1 Mean inter (90)m= 18.6 Mean inter (92)m= 19.2 Apply adju (93)m= 19.5 Set Ti to the	ternal temper ure during hear factor for gair n Feb 0.99 cmal temperature during hear 19.95 cmal temperature during hear	ature (ating pens for line 20.3 ating pens for record 20.9 ating pens for record 20.0 ating pens for record 20.0 ating pens for record 20.0 ating pens for record 20.0 ating pens for record 20.0 ating pens for record 20.0 ating pens for r	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74 the who 20.18 internal 20.03	season the livi a, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell 19.92 cole dwe 20.38 temper 20.23 e obtain	ollo 2 h2, (ting 1 h2, (ting 1 traiting 2 ratu 2	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97 g) = fLA × T1 0.43 20.43 re from Table 0.28 20.28	A 0.4 7 in T 2 able 9 19. eps 3 19. + (1 20. e 4e, 20.	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Table 97 19.93 f - fLA) × T2 43 20.39 where approx 28 20.24	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63 LA = Liv	Nov 0.99 20.09 19.96 0.99 19.16 ving area ÷ (4	Dec 1 19.75 19.95 1 18.81 4) =	0.45	(85) (86) (87) (88) (89) (90) (91)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisation factor for gains, hm:		
(94)m= 1 0.99 0.96 0.85 0.64 0.43 0.3 0.36 0.67 0.94 0.99 1		(94)
Useful gains, hmGm , W = (94)m x (84)m		
(95)m= 397.73 471.93 567.49 638.48 568.98 391.41 255.74 268.39 402.89 439.77 390.47 374.85		(95)
Monthly average external temperature from Table 8		
(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m]		
(97)m= 1060.27 1028.3 935.53 783.99 599.48 394.79 256.15 269.42 428.51 653.9 871.04 1055.96		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m		
(98)m= 492.93 373.88 273.82 104.77 22.69 0 0 0 159.31 346.01 506.74		,
Total per year (kWh/year) = Sum(98) _{15,912} =	2280.15	(98)
Space heating requirement in kWh/m²/year	37.32	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		_
Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 - (201) =	1	(202)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$	1	(204)
Efficiency of main space heating system 1	90.3	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	kWh/yea	ar
Space heating requirement (calculated above)		
492.93 373.88 273.82 104.77 22.69 0 0 0 159.31 346.01 506.74		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$		(211)
545.88 414.04 303.23 116.03 25.12 0 0 0 0 176.43 383.18 561.17		
Total (kWh/year) =Sum(211) _{15,10. 12} =	2525.08	(211)
Space heating fuel (secondary), kWh/month		_
= {[(98)m x (201)] } x 100 ÷ (208)		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0		_
Total (kWh/year) =Sum(215) _{15,10. 12} =	0	(215)
Water heating		
Output from water heater (calculated above)		
179.73 156.99 163.34 144.88 140.27 123.54 118.36 131.94 133.4 151.9 162.15 175.5	0.4	7(040)
Efficiency of water heater	81	(216)
(217)m= 87.61 87.33 86.59 84.66 82.18 81 81 81 81 85.51 87.11 87.71		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m		
(219)m= 205.14 179.76 188.65 171.13 170.69 152.52 146.12 162.89 164.69 177.65 186.15 200.1		
Total = Sum(219a) ₁₁₂ =	2105.48	(219)
Annual totals kWh/year	kWh/year	_
Space heating fuel used, main system 1	2525.08]
Water heating fuel used	2105.48]
Electricity for pumps, fans and electric keep-hot		_

mechanical ventilation - balanced, extract or posit	ve input from outside		133.34		(230a)
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a)	(230g) =	[208.34	(231)
Electricity for lighting				276.65	(232)
12a. CO2 emissions – Individual heating systems	including micro-CHP				
	Energy	Emission fac	tor	Emissions	
	kWh/year	kg CO2/kWh		kg CO2/yea	r
Space heating (main system 1)	kWh/year (211) x	kg CO2/kWh	= [kg CO2/yea	r](261)

Electricity for pumps, fans and electric keep-hot

Electricity for lighting

Space and water heating

Water heating

Total CO2, kg/year **Dwelling CO2 Emission Rate**

El rating (section 14)

(211) X	0.216	_	545.42
(215) x	0.519	=	0
(219) x	0.216	=	454.78
(261) + (262) + (263) + (264) =			1000.2
(231) x	0.519	=	108.13
(232) x	0.519	=	143.58
sum o	f (265) (271) =		1251.91
(272)	÷ (4) =		20.49
			9.4

(264)

(265)

(267)

(268)

(272)

(273)

(274)

		User [Details:						
Assessor Name:	Chris Hocknell		Strom	a Num	ber:		STRO	016363	
Software Name:	Stroma FSAP 2012		Softwa					n: 1.0.4.12	
		Property	Address	: Apartm	nent 3				
Address :									
1. Overall dwelling dime	ensions:	_	4 0						
Ground floor			a(m²) 77.3	(1a) x		2.7	(2a) =	Volume(m³)) (3a)
	a)+(1b)+(1c)+(1d)+(1e)+(77.3	(14) (4)		2.1	(24)	200.71	
Dwelling volume	a, (.a, (.a, (.a,(,	11.0	J)+(3c)+(3c	d)+(3e)+	(3n) =	208.71	(5)
2. Ventilation rate:									
2. Ventilation rate.	main second		other		total			m³ per hou	r
Number of chimneys	heating heating) 	0] = [0	X ·	40 =	0	(6a)
Number of open flues	0 + 0	- +	0	j = [0	x	20 =	0	(6b)
Number of intermittent fa	ins				0	x	10 =	0	(7a)
Number of passive vents	;			Ī	0	x	10 =	0	(7b)
Number of flueless gas fi	ires			Ī	0	x -	40 =	0	(7c)
				_			A : I-		_
				_				nanges per ho	_
	ys, flues and fans = (6a)+(6b)- neen carried out or is intended, proce			continue fr	0		÷ (5) =	0	(8)
Number of storeys in the		sea to (17),	ourer wide (oonanac n	0111 (0) 10	(10)		0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame	or 0.35 fo	r mason	ry constr	ruction			0	(11)
if both types of wall are padeducting areas of openia	resent, use the value corresponding	to the grea	ter wall are	ea (after					_
•	floor, enter 0.2 (unsealed) or	0.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic met	res per h	our per s	quare m	etre of e	envelope	area	3	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20]$	+(8), otherw	vise (18) = ((16)				0.15	(18)
	es if a pressurisation test has been c	lone or a de	gree air pe	rmeability	is being u	sed			_
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0 075 x (*	19\1 =			3	(19)
Infiltration rate incorporat	ting sholter factor		(21) = (18	•	10)]			0.78	(20)
·	-		(21) (10) X (20)				0.12	(21)
Infiltration rate modified f	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		-1	<u>, </u>	<u>'</u>	•	1	•	Ī	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Easter (222) = - (2)	2)m ÷ 4	•	•	•	•	-	-	•	
Wind Factor $(22a)m = (22a)m = 1.27$ 1.25	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18		
(/	3 1 00 0.00		1	<u> </u>		<u> </u>	1	I	

Adjusted infiltra	ation rate (a	allowin	g for sh	elter an	d wind s	speed) =	(21a) x	(22a)m				-	
0.15 Calculate effec		.14 Inge ra	0.13	0.12 he appli	0.11	0.11	0.11	0.12	0.12	0.13	0.14]	
If mechanica		_	210 101 1	по аррп	00010 00							0.5	(23
If exhaust air he	eat pump using	g Apper	ndix N, (2	3b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recovery	: efficie	ency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				75.65	(23
a) If balance	d mechanic	al ver	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24a)m= 0.27	0.27 0	.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(24
b) If balance	d mechanic	al ver	ntilation	without	heat red	covery (I	ИV) (24t	o)m = (22	2b)m + (2	23b)	•	1	
24b)m= 0		0	0	0	0	0	0	0	0	0	0]	(24
c) If whole he if (22b)m	ouse extrac ı < 0.5 × (20			•	•				.5 × (23b)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)m	ventilation on the second seco								0.5]				
24d)m= 0		0	0	0	0	0	0	0	0	0	0		(24
Effective air	change rate	e - ent	er (24a	or (24b	o) or (24	c) or (24	d) in bo	x (25)			•	•	
25)m= 0.27	0.27 0	.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(25
3. Heat losses	s and heat l	loss pa	aramete	er:									
ELEMENT	Gross area (m²		Openin m	gs	Net Ar A ,ı		U-valı W/m2		A X U (W/ł	〈)	k-value kJ/m²·l		XXk J/K
Doors					2	x	1.3	=	2.6				(26
Vindows Type	: 1				7.1	x1	/[1/(1.3)+	0.04] =	8.77				(27
Vindows Type	2				9.86	x1	/[1/(1.3)+	0.04] =	12.18				(27
Vindows Type	3				7.48	x1	/[1/(1.3)+	0.04] =	9.24				(2
Vindows Type	4				1.53	x1	/[1/(1.3)+	0.04] =	1.89				(2
Rooflights					1.14	, x1	/[1/(1.6) +	0.04] =	1.824				(2
Valls Type1	40.58	7 [25.97	7	14.6	1 X	0.15	= İ	2.19			\neg	(2
Valls Type2	56.98	ī i	2		54.98	3 X	0.13	-	7.34			= =	(29
Roof	77.3	Īi	1.14		76.16	3 X	0.1	-	7.62			= =	(30
otal area of e	lements, m	2			174.8	6							(3
for windows and						lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	1 <i>3.2</i>	
* include the area				s and par	titions		(26) (30)) + (32) =					
abric heat los leat capacity		•)				(20) (30)	((28)	(30) + (32	2) + (32a)	(32e) =	53.56	(33
hermal mass	,	,	= Cm ÷	· TFA) ir	n k.l/m²K	•		***	tive Value:	, , ,	(020) -	13907.54	(34
or design assess	•	`		,			ecisely the				able 1f	250	(0,
an be used instea						,							
hermal bridge	,	•			•	K						12.02	(3
details of therma otal fabric he		not kno	wn (36) =	0.15 x (3	31)			(33) ±	(36) =			05.50	
CHALLAUTE HE	at 1033							(33) +	(50) -			65.58	(3
entilation hea	it loss calcu	ıla t adı	monthly	,				(38)m	= 0.33 × (25)m v (5)	١	00.00	`

<i>(</i> 20). Г	10.50	40.00	10.10	47.40	40.00	45.00	45.00	1 45 70	40.00	40.00	17.00	17.70		(20)
(38)m=	18.59	18.39	18.19	17.19	16.99	15.99	15.99	15.79	16.39	16.99	17.39	17.79		(38)
Heat tra	84.17	83.97	1t, VV/K 83.77	82.77	82.57	81.57	81.57	81.37	(39)m 81.97	= (37) + (3 82.57	82.97	83.37		
(00)111	04.17		00.77	02.77	02.07	01.07	01.07	01.07			Sum(39) ₁	1	82.72	(39)
Heat los	ss para	meter (H	HLP), W	m²K						= (39)m ÷				
(40)m=	1.09	1.09	1.08	1.07	1.07	1.06	1.06	1.05	1.06	1.07	1.07	1.08		7
Number	r of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.07	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wat	er heat	ing enei	rgy requi	rement:								kWh/ye	ar:	
Assume	ed occu	pancy. I	N								2	.41		(42)
if TFA	A > 13.9	9, N = 1		[1 - exp	(-0.0003	49 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.				()
	A £ 13.9 averag	•	ater usad	ae in litre	s per da	ıv Vd,av	erage =	(25 x N)	+ 36		91	.43		(43)
Reduce th	he annua	l average		usage by	5% if the a	welling is	designed t	to achieve		se target o				, ,
not more			· ·			_		Ι Δ	0.5.7	0-4	N.	Daa		
Hot water	Jan r usage ir	Feb	Mar day for ea	Apr ach month	May Vd,m = fa	Jun ctor from 7	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
Г	100.57	96.91	93.26	89.6	85.94	82.29	82.29	85.94	89.6	93.26	96.91	100.57		
(11)			00.20	00.0		02.20	02.20	1 00.0	l		m(44) _{1 12} =		1097.15	(44)
Energy co	ontent of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	149.14	130.44	134.61	117.35	112.6	97.17	90.04	103.32	104.56	121.85	133.01	144.44		_
If instanta	aneous w	ater heati	na at point	of use (no	hot water	storage).	enter 0 in	boxes (46		Γotal = Su	m(45) _{1 12} =	<u> </u>	1438.53	(45)
_	22.37	19.57	20.19	17.6	16.89	14.58	13.51	15.5	15.68	18.28	19.95	21.67		(46)
Water s			20.10	17.0	10.00	11.00	10.01	10.0	10.00	10.20	10.00	21.07		(- /
Storage	volum	e (litres)) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	-	_	ind no ta		•			. ,		· · · (0) : (47)			
Water s			not wate	er (tnis ir	iciuaes i	nstantar	ieous co	mbi boil	ers) ente	er o in (47)			
	-		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temper	ature fa	actor fro	m Table	2b								0		(49)
			storage	-				(48) x (49)) =			0		(50)
•			eclared of factor fr	-								0		(51)
		•	ee secti		0 2 (• • • • • • • • • • • • • • • • • • • •					<u> </u>		(01)
Volume												0		(52)
Temper	ature fa	actor fro	m Table	2b								0		(53)
			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	0		(54)
,	, ,	54) in (5	culated f	or each	month			((56)m = (55) x (41);	m		0		(55)
(56)m=	o l	0	0	0	0	0	0	0	0	0	0	0		(56)
	•							-	_	_	-	m Appendix	кH	(00)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
` / - L		-												

Primary circu	it loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circu				,	,	` '	` '						
(modified b	y factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)		1	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0	I	(59)
Combi loss ca	alculated	for each	month ((61)m =	(60) ÷ 30	65 × (41)m						
(61)m= 50.96	44.61	47.52	44.19	43.8	40.58	41.93	43.8	44.19	47.52	47.79	50.96		(61)
Total heat red	quired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 200.1	175.05	182.13	161.54	156.4	137.75	131.97	147.12	148.74	169.37	180.8	195.4		(62)
Solar DHW input	calculated	using App	endix G o	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	r heating)		
(add addition	al lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from v	vater hea	ter					•	•					
(64)m= 200.1	175.05	182.13	161.54	156.4	137.75	131.97	147.12	148.74	169.37	180.8	195.4		
				Į.		l	Outp	out from wa	ater heate	r (annual)₁	12	1986.37	(64)
Heat gains fro	om water	heating.	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	ı + (61)m	า] + 0.8 x	([(46)m	+ (57)m	+ (59)m	1	•
(65)m= 62.33		56.64	50.07	48.39	42.45	40.42	45.3	45.81	52.4	56.17	60.77		(65)
include (57		L culation (L of (65)m	only if c	l vlinder i	s in the (l Iwelling	or hot w	ater is fr	om com	munity h	eating	
· ·	•		. ,	-	yiiilaci i		aweiling	OI HOLW	ator io ii	0111 00111	indinity ii	Calling	
5. Internal g).									
Metabolic gai				May	lun	11	۸۰۰۰	Con	Oct	Nov	Doo		
Jan 120.49	Feb	Mar	Apr	May 120.48	Jun	Jul 120.48	Aug 120.48	Sep	120.48	Nov	Dec		(66)
(66)m= 120.48		120.48	120.48	<u> </u>	120.48	<u> </u>	<u> </u>	120.48	120.46	120.48	120.48	1	(00)
Lighting gains	<u> </u>								45.74	40.07	10.50	1	(07)
(67)m= 19.05		13.76	10.42	7.79	6.57	7.1	9.23	12.39	15.74	18.37	19.58	I	(67)
Appliances ga	<u> </u>				i							1	
(68)m= 213.71	215.92	210.33	198.44	183.42	169.31	159.88	157.66	163.25	175.14	190.16	204.28	I	(68)
Cooking gain	s (calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also se	ee Table	5	•		•	
(69)m= 35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05		(69)
Pumps and fa	ans gains	(Table 5	5a)										
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m= -96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39		(71)
Water heating	g gains (1	able 5)											
(72)m= 83.78	81.14	76.13	69.54	65.04	58.96	54.33	60.89	63.63	70.42	78.02	81.67		(72)
Total interna	ıl gains =		Į.	!	(66)	m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m= 378.68		362.37	340.54	318.39	296.99	283.46	289.93	301.41	323.45	348.69	367.68		(73)
6. Solar gair													
Solar gains are		using sola	r flux from	Table 6a	and assoc	iated equa	itions to co	nvert to th	e applicab	le orientat	ion.		
Orientation:	Access F	actor	Area		Flu	Χ		g_		FF		Gains	
	Table 6d		m²			ble 6a	Т	able 6b	Ta	able 6c		(W)	
Northeast 0.9x	0.77	x	1.5	53	x 1	1.28	x	0.55	x	0.7		4.61	(75)
Northeast 0.9x		X	1.5			22.97) <u> </u>	0.55		0.7	=	9.38](75)
	<u> </u>												J, ,

Northoast a ou		1		1		1		l		1		7(75)
Northeast 0.9x	0.77	X	1.53	X	41.38	X	0.55	X	0.7] = 1	16.89	(75)
Northeast _{0.9x}	0.77	X	1.53	X	67.96	X	0.55	X	0.7] =	27.74	(75)
Northeast 0.9x	0.77	X	1.53	X	91.35	X	0.55	X	0.7] =	37.29	(75)
Northeast 0.9x	0.77	X	1.53	X	97.38	X	0.55	X	0.7] =	39.75	(75)
Northeast _{0.9x}	0.77	X	1.53	X	91.1	X	0.55	X	0.7] =	37.19	(75)
Northeast _{0.9x}	0.77	X	1.53	X	72.63	X	0.55	X	0.7	=	29.65	(75)
Northeast _{0.9x}	0.77	X	1.53	X	50.42	X	0.55	X	0.7	=	20.58	(75)
Northeast _{0.9x}	0.77	X	1.53	X	28.07	X	0.55	X	0.7	=	11.46	(75)
Northeast _{0.9x}	0.77	X	1.53	X	14.2	X	0.55	X	0.7	=	5.8	(75)
Northeast _{0.9x}	0.77	X	1.53	X	9.21	X	0.55	X	0.7	=	3.76	(75)
Southeast _{0.9x}	0.77	X	7.1	X	36.79	X	0.55	X	0.7	=	69.7	(77)
Southeast _{0.9x}	0.77	X	9.86	X	36.79	X	0.55	X	0.7	=	96.79	(77)
Southeast _{0.9x}	0.77	X	7.48	X	36.79	X	0.55	X	0.7	=	73.43	(77)
Southeast 0.9x	0.77	X	7.1	X	62.67	X	0.55	X	0.7	=	118.72	(77)
Southeast _{0.9x}	0.77	X	9.86	X	62.67	X	0.55	x	0.7	=	164.87	(77)
Southeast 0.9x	0.77	X	7.48	x	62.67	x	0.55	x	0.7	=	125.08	(77)
Southeast 0.9x	0.77	X	7.1	X	85.75	x	0.55	X	0.7	=	162.44	(77)
Southeast 0.9x	0.77	X	9.86	x	85.75	x	0.55	X	0.7	=	225.59	(77)
Southeast _{0.9x}	0.77	x	7.48	x	85.75	x	0.55	x	0.7	=	171.14	(77)
Southeast _{0.9x}	0.77	x	7.1	x	106.25	x	0.55	x	0.7	=	201.27	(77)
Southeast _{0.9x}	0.77	X	9.86	x	106.25	x	0.55	X	0.7] =	279.52	(77)
Southeast 0.9x	0.77	x	7.48	x	106.25	x	0.55	x	0.7] =	212.05	(77)
Southeast 0.9x	0.77	x	7.1	x	119.01	x	0.55	x	0.7	=	225.44	(77)
Southeast _{0.9x}	0.77	X	9.86	x	119.01	x	0.55	x	0.7	=	313.08	(77)
Southeast _{0.9x}	0.77	x	7.48	x	119.01	x	0.55	x	0.7	=	237.51	(77)
Southeast _{0.9x}	0.77	x	7.1	x	118.15	x	0.55	x	0.7	=	223.81	(77)
Southeast 0.9x	0.77	X	9.86	x	118.15	x	0.55	x	0.7	j =	310.82	(77)
Southeast 0.9x	0.77	x	7.48	x	118.15	x	0.55	x	0.7] =	235.79	(77)
Southeast 0.9x	0.77	×	7.1	x	113.91	x	0.55	x	0.7	Ī =	215.78	(77)
Southeast 0.9x	0.77	X	9.86	x	113.91	x	0.55	x	0.7	j =	299.66	(77)
Southeast 0.9x	0.77	x	7.48	x	113.91	x	0.55	x	0.7] =	227.33	(77)
Southeast 0.9x	0.77	x	7.1	x	104.39	х	0.55	x	0.7	j =	197.75	(77)
Southeast 0.9x	0.77	x	9.86	x	104.39	x	0.55	X	0.7	j =	274.62	(77)
Southeast 0.9x	0.77	x	7.48	x	104.39	x	0.55	x	0.7] =	208.33	(77)
Southeast 0.9x	0.77	x	7.1	x	92.85	х	0.55	x	0.7	j =	175.89	(77)
Southeast 0.9x	0.77	x	9.86	×	92.85	x	0.55	x	0.7	j =	244.27	(77)
Southeast 0.9x	0.77	×	7.48	×	92.85	x	0.55	x	0.7	j =	185.3	(77)
Southeast 0.9x	0.77	×	7.1	×	69.27	x	0.55	x	0.7	i =	131.21	(77)
Southeast _{0.9x}	0.77	X	9.86	X	69.27	X	0.55	X	0.7	j =	182.22	(77)
Southeast _{0.9x}	0.77	X	7.48	X	69.27	X	0.55	X	0.7] =	138.24	(77)
Southeast _{0.9x}	0.77	X	7.1	X	44.07	X	0.55	X	0.7	=	83.48	(77)
<u> </u>		1		1		1		l	<u> </u>	1		

Southeast _{0.9x}	0.77	x	9.86	х	4	4.07	x	0.55	X	0.7	=	115.94	(77)
Southeast _{0.9x}	0.77	x	7.48	x	4	4.07	x	0.55	x	0.7	=	87.95	(77)
Southeast _{0.9x}	0.77	x	7.1	x	3	1.49	x	0.55	x	0.7	=	59.65	(77)
Southeast _{0.9x}	0.77	×	9.86	x	3	1.49	x	0.55	x	0.7	=	82.83	(77)
Southeast _{0.9x}	0.77	X	7.48	x	3	1.49	x	0.55	X	0.7	=	62.84	(77)
Rooflights _{0.9x}	1	×	1.14	x		26	x	0.55	x	0.8	=	11.74	(82)
Rooflights 0.9x	1	×	1.14	x		54	x	0.55	x	0.8	=	24.38	(82)
Rooflights _{0.9x}	1	×	1.14	x		96	x	0.55	x	0.8	=	43.34	(82)
Rooflights _{0.9x}	1	X	1.14	×		150	x	0.55	x	0.8	=	67.72	(82)
Rooflights 0.9x	1	x	1.14	х		192	x	0.55	X	0.8	=	86.68	(82)
Rooflights _{0.9x}	1	X	1.14	x		200	x	0.55	X	0.8	=	90.29	(82)
Rooflights _{0.9x}	1	X	1.14	x		189	X	0.55	x	0.8	=	85.32	(82)
Rooflights _{0.9x}	1	X	1.14	х		157	x	0.55	x	0.8	=	70.88	(82)
Rooflights _{0.9x}	1	X	1.14	х		115	x	0.55	x	0.8	=	51.92	(82)
Rooflights _{0.9x}	1	X	1.14	X		66	x	0.55	X	0.8	=	29.8	(82)
Rooflights _{0.9x}	1	X	1.14	x		33	x	0.55	X	0.8	=	14.9	(82)
Rooflights _{0.9x}	1	x	1.14	х		21	x	0.55	X	0.8	=	9.48	(82)
Solar <u>g</u> ains in	watts, calcu	lated	for each r	nonth			(83)m	n = Sum(74)m	(82)m			_	
(<mark>83</mark>)m= 256.27	442.43 61	19.4	788.29	900	900.46	865.28	781	.22 677.96	492.93	308.06	218.56		(83)
Total gains –	internal and	solar	(84)m = (7)	73)m +	(83)m	, watts						_	
(84)m= 634.94	818.56 98	1.76	1128.83 12	218.39	1197.45	1148.74	1071	1.15 979.37	816.38	656.76	586.24		(84)
7. Mean inte	rnal tempera	ature (heating se	eason)									
Temperature	during heat	ing pe	eriods in th	ne living	g area t	rom Tal	ole 9	, Th1 (°C)				21	(85)
Utilisation fa	ctor for gains	s for li	ving area,	h1,m (see Ta	ble 9a)							
Jan	Feb I	Mar	Apr	May	Jun	Jul	Α	ug Sep	Oct	Nov	Dec		
(<mark>86</mark>)m= 0.99	0.97 0	.92	0.79	0.61	0.43	0.31	0.3	0.56	0.86	0.98	0.99		(86)
Mean interna	al temperatu	re in li	iving area	T1 (foll	low ste	ps 3 to 7	7 in T	able 9c)		•	•	•	
(87)m= 20.05	 	0.61		20.97	21	21	2		20.81	20.37	19.99]	(87)
Temperature	during heat	ina na	ariode in re	est of d	welling	from Ta	hla (Th2 (°C)				1	
(88)m= 20.01	, , , , , , , , , , , , , , , , , , , 	0.01		20.03	20.04	20.04	20.	` 	20.03	20.02	20.02	1	(88)
` '	<u>!</u>						ļ			1]	, ,
Utilisation fa			-	o.55	2,m (se 0.37	e Table 0.24	–	00 0 40	0.00	0.07	0.00	1	(89)
(89)m= 0.99	0.96 0	.89	0.75	0.55	0.37	0.24	0.2	28 0.49	0.82	0.97	0.99]	(09)
Mean interna	 	-	-		• •		·		e 9c)			7	
	19.42 1	9.7	19.93	20.01	20.04	20.04	20.		19.89		19.11		(90)
(90)m= 19.16	1 .0											0.52	(91)
(90)m= 19.16	1	'	•	•				f	LA = Liv	ing area ÷ (4	4) =	0.53	` ` ′
(90)m= 19.16 Mean interna	1	re (for	the whole	e dwelli	ng) = fl	_A × T1	+ (1		LA = Liv	ing area ÷ (4	4) =	0.53	` ′
`	al temperatui	re (for		e dwelli 20.51	ng) = fl 20.54	_A × T1 20.54	+ (1	– fLA) × T2	20.37		19.57	0.55	(92)
Mean interna	al temperatui	0.18	20.42	20.51	20.54	20.54	20.	– fLA) × T2 54 20.53	20.37	19.95	, 	0.55	
Mean interna (92)m= 19.62 Apply adjust	al temperature 19.89 20 ment to the r	0.18	20.42 2 internal te	20.51	20.54	20.54	20.	– fLA) × T2 54 20.53 where appro	20.37	19.95	,]	
Mean interna (92)m= 19.62 Apply adjust	19.89 20 ment to the r	0.18 mean 0.03	20.42 2 internal te	20.51 emperat	20.54 ture fro	20.54 m Table	20. 4e,	– fLA) × T2 54 20.53 where appro	20.37 opriate	19.95	19.57]	(92)
Mean interna 92)m= 19.62 Apply adjust 93)m= 19.47	al temperature 19.89 20 ment to the reconstruction 19.74 20 ating require	mean 0.03 ment	20.42 2 internal te 20.27 2	20.51 emperat 20.36	20.54 ture fro 20.39	20.54 m Table 20.39	20. 4e, 20.	- fLA) × T2 54 20.53 where appro 39 20.38	20.37 opriate 20.22	19.95	19.57		(92)
Mean interna (92)m= 19.62 Apply adjust (93)m= 19.47 8. Space hea	al temperature 19.89 20 ment to the recommend 19.74 20 ating require mean intern	mean 0.03 ment al tem	20.42 2 internal te 20.27 2 apperature	emperat 20.36	20.54 ture fro 20.39	20.54 m Table 20.39	20. 4e, 20.	- fLA) × T2 54 20.53 where appro 39 20.38	20.37 opriate 20.22	19.95	19.57		(92)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisation	factor for g	ains, hm	1:										
(94)m= 0.9		0.89	0.76	0.57	0.39	0.27	0.3	0.52	0.83	0.97	0.99		(94)
Useful gai	ns, hmGm	, W = (94	4)m x (8	4)m									
(95)m= 626.	71 785.4	878.01	854.02	697.44	470.38	309.17	324.58	506.83	678.07	635.62	580.91		(95)
Monthly a	erage exte	ernal tem	perature	from Ta	able 8								
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss	rate for me				Lm , W =	=[(39)m :	x [(93)m	– (96)m	ī —		1		
(97)m= 1277				715.29	472.29	309.36	324.94	514.7	794.71	1053.77	1269.27		(97)
	ting requir	1											
(98)m= 483.	97 309.61	189.98	62.56	13.28	0	0	0	0	86.78	301.06	512.14		_
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1959.38	(98)
Space hea	iting requir	ement in	kWh/m²	² /year								25.35	(99)
9a. Energy	requireme	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space he	_										r		_
Fraction of	f space hea	at from s	econdar	y/supple	mentary	system					Į	0	(201)
Fraction of	space hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction o	f total heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency	of main sp	ace heat	ing syste	em 1								90.3	(206)
Efficiency	of seconda	ry/suppl	ementar	y heating	g system	າ, %					Ī	0	(208)
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	– ar
Space hea	iting requir	ement (c	alculate	d above))	•	•		•				
483.	97 309.61	189.98	62.56	13.28	0	0	0	0	86.78	301.06	512.14		
(211)m = {[(98)m x (20	04)] } x 1	100 ÷ (20	06)									(211)
535.	96 342.87	210.38	69.28	14.71	0	0	0	0	96.1	333.4	567.15		
							Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	2169.86	(211)
Space hea	iting fuel (s	econdar	y), kWh/	month							_		_
$= \{[(98)m x]\}$													
(215)m= 0	0	0	0	0	0	0	0	0	0	0	0		_
							Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	= [0	(215)
Water heat	•												
Output from		182.13	ulated a 161.54	156.4	137.75	131.97	147.12	148.74	169.37	180.8	195.4		
Efficiency of		l .	101.01	100.1	107.70	101.07		1 10.11	100.01	100.0	100.1	81	(216)
(217)m= 87.3		85.5	83.4	81.66	81	81	81	81	83.93	86.57	87.52		(217)
Fuel for wa		l		01.00	0.	<u> </u>		<u> </u>	00.00	00.07	07.02		()
(219)m = (•												
(219)m= 229.	04 201.89	213.03	193.7	191.53	170.06	162.93	181.63	183.63	201.81	208.85	223.25		
							Tota	I = Sum(2	19a) ₁₁₂ =			2361.34	(219)
Annual tot									k'	Wh/year		kWh/year	¬
Space heat	ing fuel use	ed, main	system	1								2169.86	╛
Water heat	ng fuel use	ed										2361.34	
Electricity for	or pumps, f	ans and	electric	keep-ho	t								

mechanical ventilation - balanced, extract or p	ositive input from outside		168.69		(230a)
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a)	(230g) =		243.69	(231)
Electricity for lighting				336.46	(232)
12a. CO2 emissions – Individual heating syste	ems including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh	ctor	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	=	468.69	(261)

	Energy kWh/year	kg CO2/kWh	kg CO2/year
Space heating (main system 1)	(211) x	0.216	468.69 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	510.05 (264)
Space and water heating	(261) + (262) + (263) + (264) =		978.74 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	126.48 (267)
Electricity for lighting	(232) x	0.519	174.62 (268)
Total CO2, kg/year	sum	of (265) (271) =	1279.84 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =	16.56 (273)
El rating (section 14)			86 (274)

Assessor Name: Chris Hocknell Stroma Number: STRO016363 Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.12 Property Address: Apartment 4 Address: 1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³) Ground floor Go.9 (1a) x 2.7 (2a) = 169.83 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 62.9 (4) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 169.83 (5) 2. Ventilation rate: Number of chimneys Number of open flues 0 + 0 + 0 = 0 x 40 = 0 (6a) Number of intermittent fans
Software Version: Version: 1.0.4.12 Property Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Av. Height(m) Volume(m³) Ground floor 62.9 (1a) x 2.7 (2a) = 169.83 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 62.9 (4) Dwelling volume 2. Ventilation rate: Main heating heating heating other total heating m³ per hour heating Number of chimneys 0 + 0 + 0 = 0 x 40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x 20 = 0 (6b) Number of intermittent fans 0 x 40 = 0 (6b)
Address: 1. Overall dwelling dimensions: Area(m²)
1. Overall dwelling dimensions: Area(m²)
Area(m²)
Ground floor $ 62.9 $
Dwelling volume $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
2. Ventilation rate: main heating secondary heating other heating total m³ per hour Number of chimneys 0 + 0 + 0 = 0 x 40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x 20 = 0 (6b) Number of intermittent fans 0 x 10 = 0 (7a)
2. Ventilation rate: main heating secondary heating other heating total m³ per hour Number of chimneys 0 + 0 + 0 = 0 × 40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 × 20 = 0 (6b) Number of intermittent fans 0 × 10 = 0 (7a)
Number of chimneys 0 + 0 + 0 = 0 x40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x20 = 0 (6b) Number of intermittent fans
Number of chimneys 0 + 0 + 0 = 0 x 40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x 20 = 0 (6b) Number of intermittent fans 0 x 10 = 0 (7a)
Number of intermittent fans $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Number of passive vents $0 \times 10 = 0 $ (7b)
Number of flueless gas fires $0 \times 40 = 0 $ (7c)
Air changes per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$ $\div (5) = 0$ (8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)
Number of storeys in the dwelling (ns)
Additional infiltration $[(9)-1] \times 0.1 = 0 $ (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction o (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
If no draught lobby, enter 0.05, else enter 0
Percentage of windows and doors draught stripped $0.25 - [0.2 \times (14) \div 100] = 0 \tag{14}$ Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0 \tag{15}$
Vindow infiltration $0.25 - [0.2 \times (14) + 100] = 0$ (15) Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ 0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used
Number of sides sheltered $2 mtext{(19)}$ Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85 mtext{(20)}$
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ 0.13 (21)
Infiltration rate modified for monthly wind speed
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly average wind speed from Table 7
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7
Wind Factor (22a)m = (22)m ÷ 4
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18

Adjusted infiltra	ation rate (allowi	ng for sh	nelter an	nd wind s	speed) =	(21a) x	(22a)m				•	
0.16 Calculate effec		0.16 ange	0.14	0.14 he appli	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
If mechanica		_	rate for t	пс аррп	oabic oa	.00						0.5	(23
If exhaust air he	eat pump usir	ng Appe	endix N, (2	3b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recover	ry: effic	iency in %	allowing t	for in-use f	actor (fron	n Table 4h) =				75.65	(23
a) If balance	d mechani	ical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	
24a)m= 0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27		(24
b) If balance	d mechani	ical ve	entilation	without	heat red	covery (I	MV) (24b	o)m = (22	2b)m + (2	23b)	•	1	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole he if (22b)m	ouse extra ı < 0.5 × (2			•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	ventilation n = 1, then								0.5]			-	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change ra	te - er	nter (24a	or (24l	b) or (24	c) or (24	d) in bo	x (25)				-	
25)m= 0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27		(25
3. Heat losses	s and heat	loss	paramet	er:									
ELEMENT	Gross area (m	_	Openin m	gs	Net Ar A ,ı		U-val W/m2		A X U (W/F	<)	k-value kJ/m²·		X k J/K
Doors					2	x	1.3	=	2.6	,			(26
Vindows Type	1				3.7	x1	/[1/(1.3)+	0.04] =	4.57				(27
Vindows Type	2				0.91	x1	/[1/(1.3)+	0.04] =	1.12				(27
Vindows Type	3				6.29	x1	/[1/(1.3)+	0.04] =	7.77				(27
Vindows Type	4				8.37	x1	/[1/(1.3)+	0.04] =	10.34				(27
Vindows Type	5				6.29	x1	/[1/(1.3)+	0.04] =	7.77				(27
Valls Type1	51.43		29.2	3	22.17	7 X	0.15	= i	3.33	<u> </u>			(29
Valls Type2	36.05		2		34.0	5 X	0.13	-	4.55	= [(29
Roof	62.9		0		62.9	X	0.1	=	6.29				(30
Total area of e	lements, m	n²			150.3	8							(31
for windows and						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragrapl	n 3.2	
* include the area -abric heat los				ls and par	titions		(26) (30) + (32) =				50.00	(33
leat capacity		•	0)				(20) (00	((28)	(30) + (32	2) + <i>(</i> 32a)	(32e) =	52.92 11247.9	(34
hermal mass	,	,	⊃ = Cm ÷	- TFA) ir	ո kJ/m²K			***	itive Value:	, , ,	(020)	250	(35
or design assess	ments where	the de	tails of the	,			recisely the				able 1f	L 200	(3.
an be used instea hermal bridge				ısina Δr	nendiy I	K						14.40	(36
details of therma	,	•			•	•						14.48	(36
otal fabric hea				33 A (O	-/			(33) +	(36) =			67.41	(37
entilation hea	t loss calc	ulated	d monthly	/				(38)m	= 0.33 × (25)m x (5))	•	
omandi mod													

(38)m= 15.93	15.76	15.58	14.68	14.5	13.61	13.61	13.43	13.97	14.5	14.86	15.00		(38)
` ′			14.00	14.5	13.01	13.01	13.43				15.22		(30)
Heat transfer of 83.34	83.16	1t, VV/K 82.98	82.09	81.91	81.02	81.02	80.84	81.37	= (37) + (3 81.91	82.27	82.62		
(00)111- 00.04	00.10	02.00	02.00	01.01	01.02	01.02	00.04		Average =		<u> </u>	82.04	(39)
Heat loss para	meter (F	HLP), W/	m²K				_		= (39)m ÷				
(40)m= 1.32	1.32	1.32	1.31	1.3	1.29	1.29	1.29	1.29	1.3	1.31	1.31		_
Number of day	e in moi	nth (Tahl	(12 ما					/	Average =	Sum(40) ₁	12 /12=	1.3	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
` '							<u> </u>						
4. Water heat	ina ener	av reaui	rement:								kWh/ye	ear:	
Assumed occur if TFA > 13.9			[1 - exn	(<u>-</u> 0 0003	849 y (TE	Δ -13 0)2)1 + 0 ()013 x (1	ΓFΔ -13		06		(42)
if TFA £ 13.9		· 1.70 X	[I - CXP	(-0.0000	7-3 X (11	A - 10.0	<i>)</i> 2)] · O.() X 010 X	II A - 10.	3)			
Annual averag									o taraat a		3.18		(43)
Reduce the annua not more that 125	_				_	-	o acriieve	a water us	se largel o	I			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in				,				000					
(44)m= 91.5	88.17	84.84	81.52	78.19	74.86	74.86	78.19	81.52	84.84	88.17	91.5		
									Γotal = Su	· /		998.16	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	Tm / 3600	kWh/mon	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 135.69	118.67	122.46	106.77	102.44	88.4	81.92	94	95.12	110.86	121.01	131.41		_
If instantaneous w	ater heatii	na at point	of use (no	hot water	r storage).	enter 0 in	boxes (46		Γotal = Su	m(45) _{1 12} =	• [1308.75	(45)
(46)m= 20.35	17.8	18.37	16.01	15.37	13.26	12.29	14.1	14.27	16.63	18.15	19.71		(46)
Water storage	-	10.57	10.01	15.57	13.20	12.23	14.1	14.21	10.03	10.13	19.71		(10)
Storage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	•			•			` '						
Otherwise if no		hot wate	er (this in	cludes i	nstantar	eous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufact		eclared lo	oss facto	or is kno	wn (kWh	n/dav).					0		(48)
Temperature fa					(0		(49)
Energy lost fro				ear			(48) x (49)	· =			0		(50)
b) If manufact	urer's de	eclared o	ylinder l	oss fact									()
Hot water stora	•			e 2 (kWl	h/litre/da	ıy)					0		(51)
If community h	•		on 4.3										(52)
Temperature fa			2b							-	0		(53)
Energy lost fro				ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (-	,y.	-			, , (= ·)		•		0		(55)
		oulotod f	or each	month			((56)m = (55) × (41)r	m				
Water storage	loss cal	culated i	or cacin										
Water storage (56)m= 0	loss cal	0	0	0	0	0	0	0	0	0	0		(56)
	0	0	0	0			-	-			_	x H	(56)

Primary circuit loss (annual) from Table 3 0 (58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)
(59)m =
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m
(61)m= 46.63 40.58 43.24 40.2 39.84 36.92 38.15 39.84 40.2 43.24 43.48 46.63 (61)
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m
(62)m= 182.32 159.26 165.7 146.97 142.29 125.32 120.07 133.85 135.32 154.09 164.49 178.03 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (63)
Output from water heater
(64)m= 182.32 159.26 165.7 146.97 142.29 125.32 120.07 133.85 135.32 154.09 164.49 178.03
Output from water heater (annual) _{1 12} 1807.7 (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= 56.77 49.61 51.53 45.55 44.02 38.62 36.77 41.22 41.68 47.67 51.11 55.35 (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
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 16.06 14.27 11.6 8.78 6.57 5.54 5.99 7.79 10.45 13.27 15.49 16.51 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m= 180.2 182.07 177.35 167.32 154.66 142.76 134.81 132.94 137.65 147.68 160.35 172.25 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 (69)
Pumps and fans gains (Table 5a)
(70)m= 3 3 3 3 3 3 3 3 3 (70)
Losses e.g. evaporation (negative values) (Table 5)
(71)m= -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 (71)
Water heating gains (Table 5)
(72)m= 76.31 73.82 69.26 63.26 59.17 53.64 49.43 55.4 57.89 64.07 70.98 74.39 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$
(73)m= 329.51 327.09 315.15 296.31 277.33 258.88 247.16 253.06 262.92 281.96 303.75 320.09 (73)
6. Solar gains:
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
Orientation: Access Factor Area Flux g_ FF Gains
Table 6d m² Table 6a Table 6b Table 6c (W)
Southwest _{0.9x} 0.77 x 8.37 x 36.79 0.55 x 0.7 = 82.17 (79)
Southwest _{0.9x} 0.77 x 6.29 x 36.79 0.55 x 0.7 = 61.75 (79)

Southwest _{0.9x}	^ 77	1	0.07	1 .,	00.07	1	0.55	l	0.7	1 _	400.00	7(70)
Southwest _{0.9x}	0.77	X	8.37	X	62.67] 1	0.55	X	0.7] = 1	139.96	(79)
Southwest _{0.9x}	0.77	X	6.29	X	62.67] 1	0.55	X	0.7] = 1	105.18	(79)
<u> </u>	0.77	X	8.37	X	85.75] 1	0.55	X	0.7] = 1	191.5	(79)
Southwest _{0.9x}	0.77	∫ X ¬	6.29	X	85.75] 1	0.55	X	0.7] = 1	143.91	(79)
Southwest _{0.9x}	0.77	X	8.37	X	106.25	<u> </u>	0.55	X	0.7] =	237.28	(79)
Southwest _{0.9x}	0.77	X	6.29	X	106.25	<u> </u>	0.55	X	0.7] =	178.31	(79)
Southwest _{0.9x}	0.77	X	8.37	X	119.01		0.55	X	0.7] =	265.77	(79)
Southwest _{0.9x}	0.77	X	6.29	X	119.01	<u> </u>	0.55	X	0.7	=	199.72	(79)
Southwest _{0.9x}	0.77	X	8.37	X	118.15	<u> </u>	0.55	X	0.7] =	263.85	(79)
Southwest _{0.9x}	0.77	X	6.29	X	118.15	<u> </u>	0.55	X	0.7] =	198.28	(79)
Southwest _{0.9x}	0.77	X	8.37	X	113.91	[0.55	X	0.7	=	254.38	(79)
Southwest _{0.9x}	0.77	X	6.29	X	113.91	[0.55	X	0.7	=	191.16	(79)
Southwest _{0.9x}	0.77	X	8.37	X	104.39	<u> </u>	0.55	X	0.7	=	233.12	(79)
Southwest _{0.9x}	0.77	X	6.29	X	104.39	<u> </u>	0.55	X	0.7	=	175.19	(79)
Southwest _{0.9x}	0.77	X	8.37	X	92.85		0.55	X	0.7	=	207.35	(79)
Southwest _{0.9x}	0.77	X	6.29	x	92.85]	0.55	X	0.7	=	155.82	(79)
Southwest _{0.9x}	0.77	X	8.37	X	69.27]	0.55	X	0.7	=	154.69	(79)
Southwest _{0.9x}	0.77	X	6.29	X	69.27]	0.55	X	0.7	=	116.25	(79)
Southwest _{0.9x}	0.77	X	8.37	X	44.07]	0.55	X	0.7	=	98.42	(79)
Southwest _{0.9x}	0.77	X	6.29	X	44.07]	0.55	X	0.7	=	73.96	(79)
Southwest _{0.9x}	0.77	X	8.37	X	31.49]	0.55	X	0.7	=	70.32	(79)
Southwest _{0.9x}	0.77	X	6.29	x	31.49]	0.55	x	0.7	=	52.84	(79)
Northwest _{0.9x}	0.77	X	3.7	x	11.28	X	0.55	x	0.7	=	22.28	(81)
Northwest _{0.9x}	0.77	X	0.91	x	11.28	x	0.55	X	0.7	=	2.74	(81)
Northwest _{0.9x}	0.77	X	6.29	X	11.28	X	0.55	X	0.7	=	18.94	(81)
Northwest _{0.9x}	0.77	X	3.7	x	22.97	X	0.55	X	0.7	=	45.34	(81)
Northwest _{0.9x}	0.77	X	0.91	x	22.97	x	0.55	x	0.7] =	5.58	(81)
Northwest _{0.9x}	0.77	X	6.29	x	22.97	x	0.55	x	0.7	=	38.54	(81)
Northwest _{0.9x}	0.77	x	3.7	x	41.38	x	0.55	x	0.7	=	81.7	(81)
Northwest 0.9x	0.77	X	0.91	x	41.38	x	0.55	x	0.7] =	10.05	(81)
Northwest _{0.9x}	0.77	X	6.29	x	41.38	x	0.55	x	0.7] <u>=</u>	69.44	(81)
Northwest _{0.9x}	0.77	X	3.7	×	67.96	x	0.55	x	0.7] <u>=</u>	134.17	(81)
Northwest 0.9x	0.77	X	0.91	x	67.96	x	0.55	x	0.7	Ī =	16.5	(81)
Northwest 0.9x	0.77	X	6.29	x	67.96	x	0.55	x	0.7	j =	114.04	(81)
Northwest _{0.9x}	0.77	X	3.7	x	91.35	x	0.55	x	0.7	j =	180.35	(81)
Northwest _{0.9x}	0.77	X	0.91	x	91.35	x	0.55	x	0.7	j =	22.18	(81)
Northwest _{0.9x}	0.77	X	6.29	x	91.35	x	0.55	x	0.7	j =	153.3	(81)
Northwest _{0.9x}	0.77	X	3.7	x	97.38	x	0.55	x	0.7	j =	192.27	(81)
Northwest _{0.9x}	0.77	×	0.91	×	97.38	×	0.55	x	0.7	j =	23.64	(81)
Northwest _{0.9x}	0.77	X	6.29	x	97.38	x	0.55	x	0.7	j =	163.43	(81)
Northwest _{0.9x}	0.77	X	3.7	×	91.1	X	0.55	x	0.7	j =	179.87	(81)
L		_						ı				

Northwest 0.9	X 0.77	X	0.9	1	X	91.1	x	0.55	x	0.7	=	22.12	(81)
Northwest 0.9	0.77	x	6.2	9	X	91.1	×	0.55	x	0.7	=	152.89	(81)
Northwest 0.9	0.77	x	3.7	7	X	72.63	×	0.55	x	0.7		143.39	(81)
Northwest 0.9	X 0.77	X	0.9	1	X	72.63	x	0.55	x	0.7	=	17.63	(81)
Northwest 0.9	0.77	x	6.2	9	X	72.63	×	0.55	x	0.7	=	121.88	(81)
Northwest 0.9	0.77	x	3.7	7	X	50.42	x	0.55	х	0.7	=	99.55	(81)
Northwest 0.9	0.77	x	0.9	1	X	50.42	×	0.55	x	0.7		12.24	(81)
Northwest 0.9	0.77	x	6.2	9	X	50.42	x	0.55	x	0.7	=	84.62	(81)
Northwest 0.9	0.77	X	3.7	7	X	28.07	X	0.55	x	0.7	=	55.41	(81)
Northwest 0.9	0.77	x	0.9	1	X	28.07	×	0.55	x	0.7		6.81	(81)
Northwest 0.9	0.77	x	6.2	9	X	28.07	x	0.55	x	0.7		47.1	(81)
Northwest 0.9	0.77	x	3.7	7	X	14.2	x	0.55	x	0.7		28.03	(81)
Northwest 0.9	0.77	x	0.9	1	X	14.2	x	0.55	x	0.7	=	3.45	(81)
Northwest 0.9	0.77	x	6.2	.9	X	14.2	×	0.55	x	0.7		23.83	(81)
Northwest 0.9	0.77	x	3.7	7	X	9.21	x	0.55	x	0.7		18.19	(81)
Northwest 0.9	0.77	X	0.9	1	X	9.21	x	0.55	x	0.7	=	2.24	(81)
Northwest 0.9	0.77	x	6.2	9	X	9.21	x	0.55	x	0.7		15.46	(81)
Solar gains	in watts, calc	ulated	for each	n month	1		(83)n	n = Sum(74)m	(82)m				
(83)m= 187.8		96.59	680.3	821.32		41.47 800.41	691	.22 559.58	380.26	227.68	159.05		(83)
Total gains	 internal and 	l solar	(84)m =	: (73)m	+ (8	33)m , watts							
					_								
(84)m= 517.3	37 661.69 8	11.75	976.61	1098.65	11	00.36 1047.5	7 944	.27 822.51	662.22	531.43	479.14		(84)
						00.36 1047.5	7 944	.27 822.51	662.22	531.43	479.14		(84)
7. Mean in	ternal temper re during hea	ature (heating	seasor	ו)				662.22	531.43	479.14	21	(84)
7. Mean in Temperatu	ternal temper	ature (ating pe	heating eriods ir	seasor the livi	n) ing	area from Ta	able 9		662.22	531.43	479.14	21	
7. Mean in Temperatu	ternal temper re during hea factor for gain	ature (ating pe	heating eriods ir	seasor the livi	ing	area from Ta	able 9		662.22	9 531.43 Nov	479.14 Dec	21	
7. Mean in Temperatu	ternal temper re during hea factor for gain	ature (ating pe	heating eriods in ving are	seasor the livi ea, h1,m	ing n (s	area from Ta	able 9	, Th1 (°C)				21	
7. Mean in Temperatu Utilisation Jai (86)m= 0.99	ternal temper re during hea factor for gain n Feb	ature (ating pe as for li Mar 0.94	heating eriods in ving are Apr 0.83	season the livi ea, h1,n May	ing n (se	area from Ta ee Table 9a Jun Jul 0.46 0.34	able 9	, Th1 (°C) ug Sep 0.64	Oct	Nov	Dec	21	(85)
7. Mean in Temperatu Utilisation Jai (86)m= 0.99	ternal temper re during hea factor for gain Feb 0 0.98	ature (ating pe as for li Mar 0.94	heating eriods in ving are Apr 0.83	season the livi ea, h1,n May	ing n (se	area from Ta ee Table 9a Jun Jul 0.46 0.34	able 9	, Th1 (°C) ug Sep 39 0.64 Table 9c)	Oct	Nov	Dec	21	(85)
7. Mean in Temperatu Utilisation i Jai (86)m= 0.99 Mean inter (87)m= 19.7	ternal temper re during heafactor for gain n Feb 0.98 nal temperatus 20 2	ature (ating persons for li Mar 0.94 ure in li 20.36	heating eriods in ving are Apr 0.83 iving are 20.73	seasor the livies, h1,m May 0.65 ea T1 (for 20.93	ing (second)	area from Taee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21	able 9) A 0.:	s, Th1 (°C) ug Sep 39 0.64 Table 9c) 1 20.95	Oct 0.91	Nov 0.98	Dec 0.99	21	(85)
7. Mean in Temperatu Utilisation Jai (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea	ature (ating person of the state of the sta	heating eriods in ving are Apr 0.83 iving are 20.73	seasor the livi ea, h1,m May 0.65 ea T1 (f 20.93	ing (so	area from Talee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from	able 9 0.3 7 in 1 2 Table	sep	Oct 0.91 20.63	Nov 0.98	Dec 0.99	21	(85)
7. Mean in Temperatu Utilisation (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8	ternal temper re during hear factor for gain n Feb 0.98 nal temperatus 20 2 re during hear 2 19.82 1	ature (ating person of the state of the sta	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84	seasor the livi ea, h1,m May 0.65 ea T1 (f 20.93 rest of	ing (second)	area from Talee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 19.85 19.85	A 0.: 7 in 7 2 able 9	sep	Oct 0.91	Nov 0.98	Dec 0.99	21	(85)
7. Mean in Temperatu Utilisation [86]m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation	ternal temper re during heafactor for gain n Feb 0.98 nal temperatus 20 2 re during heafactor for gain factor for gain	ature (ating peas for li Mar 0.94 ure in li 20.36 ting peas for response for re-	heating eriods in ving are 0.83 iving are 20.73 eriods in 19.84 est of dy	seasor the livies, h1,m May 0.65 ea T1 (for 20.93 or rest of 19.84 welling,	1) ing 1 (see 1) follo 2 h2,	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl	able 9) 7 in 7 2 able 9 19 e 9a)	s, Th1 (°C) ug Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85	Oct 0.91 20.63	Nov 0.98 20.1	Dec 0.99 19.68	21	(85) (86) (87) (88)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99	ternal temper re during heafactor for gain n Feb no.98 nal temperatus 20 2 re during heafactor for gain no.97 no.97	ature (ating pens for li Mar 0.94 ure in li 20.36 uting pens for re 0.92	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78	seasor the livies, h1,m May 0.65 ea T1 (for 20.93 or rest of 19.84 welling, 0.58	1) (solid line) (s	area from Taee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl 0.38 0.25	able 9) 7 in 7 2 able 9 19 e 9a) 0.2	s, Th1 (°C) ug Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85	Oct 0.91 20.63 19.84 0.87	Nov 0.98	Dec 0.99	21	(85)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99 Mean inter	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97	ature (ating person of the second of the se	heating eriods in ving are 20.73 eriods in 19.84 est of do 0.78 he rest of the	seasor the livi ea, h1,m May 0.65 ea T1 (ff 20.93 rest of 19.84 welling, 0.58 of dwell	ing (sollow h2, h2, h2, h2)	area from Talee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 19.85 19.85 m (see Table 19.38 0.25 T2 (follow s	7 in 7 2 able 9 9. 19. 19. 10. 2 teps 3	Sep 99 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 29 0.55 to 7 in Table	Oct 0.91 20.63 19.84 0.87 e 9c)	Nov 0.98 20.1 19.83	Dec 0.99 19.68 19.83	21	(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97	ature (ating pens for li Mar 0.94 ure in li 20.36 uting pens for re 0.92	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78	seasor the livies, h1,m May 0.65 ea T1 (for 20.93 or rest of 19.84 welling, 0.58	ing (solloon) folloon h2, h2, collong in (solloon) generally h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong	area from Taee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl 0.38 0.25	able 9) 7 in 7 2 able 9 19 e 9a) 0.2	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 to 7 in Table 85 19.82	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99	21	(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99 Mean inter	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97	ature (ating person of the second of the se	heating eriods in ving are 20.73 eriods in 19.84 est of do 0.78 he rest of the	seasor the livi ea, h1,m May 0.65 ea T1 (ff 20.93 rest of 19.84 welling, 0.58 of dwell	ing (solloon) folloon h2, h2, collong in (solloon) generally h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong	area from Talee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 19.85 19.85 m (see Table 19.38 0.25 T2 (follow s	7 in 7 2 able 9 9. 19. 19. 10. 2 teps 3	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 to 7 in Table 85 19.82	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58	Nov 0.98 20.1 19.83	Dec 0.99 19.68 19.83 0.99	0.47	(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99 Mean inter (90)m= 18.6	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97	ature (ating person of the second of the se	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78 he rest of 19.64	seasor the living, have the sean to the sea to the season of the season	ing (second)	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85	able 9) 7 in 7 2 able 9 19 e 9a) 0.2 teps 3	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 29 0.55 4 to 7 in Table 85 19.82	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99		(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99 Mean inter (90)m= 18.6	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97 nal temperatu 9 18.96 1	ature (ating person of the second of the se	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78 he rest of 19.64	seasor the living, have the sean to the sea to the season of the season	n) ing (solid) colloperate dw h2, (ding) 1	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85	able 9) 7 in 7 2 able 9 19 e 9a) 0.2 teps 3	g Sep 99 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 10.55 10.7 in Table 19.82	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99		(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99 Mean inter (90)m= 18.6 Mean inter (92)m= 19.1	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97 nal temperatu 9 18.96 1	ature (ating persons for limiting persons for reconstruction) at the second sec	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of do 0.78 he rest of 19.64 rest of the whole 20.15	seasor the livies, h1,m May 0.65 ea T1 (fr 20.93 rest of 19.84 welling, 0.58 of dwell 19.8	ing (second)	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 elling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85 g) = fLA × T 0.38 20.38	able 9) 7 in 7 2 able 9 19 e 9a) 0.2 teps 3 19.	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 19 0.55 10 7 in Table 85 19.82 - fLA) × T2 38 20.35	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58 LA = Liv	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99 18.65 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperatu Utilisation i (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation i (89)m= 0.99 Mean inter (90)m= 18.6 Mean inter (92)m= 19.1	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97 nal temperatu 9 18.96 1 nal temperatu 7 19.44 stment to the	ature (ating persons for limiting persons for reconstruction) at the second sec	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of do 0.78 he rest of 19.64 rest of the whole 20.15	seasor the livies, h1,m May 0.65 ea T1 (fr 20.93 rest of 19.84 welling, 0.58 of dwell 19.8	ing (soliton) (solito	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 elling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85 g) = fLA × T 0.38 20.38	able 9) 7 in 7 2 able 9 19 e 9a) 0.2 teps 3 19.	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 19.85 19.82 - fLA) × T2 38 20.35 where appro	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58 LA = Liv	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99 18.65 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperature Utilisation 19 (86)m= 0.99 Mean inter (87)m= 19.7 Temperature (88)m= 0.99 Mean inter (90)m= 18.6 Mean inter (92)m= 19.1 Apply adjure (93)m= 19.0	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97 nal temperatu 9 18.96 1 nal temperatu 7 19.44 stment to the	ature (ating persons for reconstruction) ating persons for reconstruction to the persons for reconstruction	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78 he rest of 19.64 rest of the whole 20.15 internal	season the livi ea, h1,m May 0.65 ea T1 (fi 20.93 rest of 19.84 welling, 0.58 of dwell 19.8 ole dwe 20.32 temper	ing (soliton) (solito	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 elling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85 g) = fLA × T 0.38 20.38 re from Tab	A 0.3 7 in 7 2 Table 9 0.3 19 1+(1) 20 1e 4e,	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 19.85 19.82 - fLA) × T2 38 20.35 where appro	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58 LA = Liv	Nov 0.98 20.1 19.83 0.98 19.07 ing area ÷ (4	Dec 0.99 19.68 19.83 0.99 18.65 4) =		(85) (86) (87) (88) (89) (90) (91) (92)
7. Mean in Temperature Utilisation in Utilisation i	ternal temper re during hear factor for gain not be not seen as a	ature (ating pens for li Mar 0.94 ure in li 20.36 iting pens for re 0.92 ure in t 19.31 ure (for 19.8 mean 19.65 ement nal tern	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78 he rest of 19.64 rest of the whole 20.15 internal 20 inperature	seasor the livies, h1,m May 0.65 ea T1 (for 20.93) rest of 19.84 welling, 0.58 of dwell 19.8 ole dwell 20.32 temper 20.17	follo fo	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 elling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85 g) = fLA × T 0.38 20.38 re from Tab 0.23 20.23	A 0.3 7 in 2 2 2 2 2 2 2 2 2	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 19.85 19.82 - fLA) × T2 38 20.35 where appro	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58 LA = Liv	Nov 0.98 20.1 19.83 0.98 19.07 ing area ÷ (4	Dec 0.99 19.68 19.83 0.99 18.65 4) = 19.13	0.47	(85) (86) (87) (88) (89) (90) (91) (92)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisati	on factor for	gains, hn	n:										
	0.99 0.97	0.92	0.79	0.6	0.41	0.28	0.33	0.58	0.87	0.97	0.99		(94)
Useful (gains, hmGr	n , W = (9	4)m x (8	4)m	ı		l		l	l			
(95)m= 5	511.15 640.3	4 743.59	771.73	659.83	451.21	293.83	308.72	475.47	578.1	517.46	474.89		(95)
Monthly	y average ex	ternal ten	nperature	from Ta	able 8								
(96)m=	4.3 4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	ss rate for m	1	1	î e	ı		 		<u> </u>			1	
` ′	227.14 1196.			694.05	455.9	294.45	309.96	496.16	763.35	1011.72	1221.01		(97)
_	heating requ	1	1										
(98)m=	532.7 374.0	1 258.41	100.42	25.45	0	0	0	0	137.82	355.86	555.11		7,000
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2339.78	(98)
Space I	heating requ	irement ir	n kWh/m²	²/year								37.2	(99)
9a. Ener	gy requirem	ents – Inc	lividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	heating:										,		_
Fraction	n of space h	eat from s	econdar	y/supple	mentary	system						0	(201)
Fraction	n of space h	eat from r	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction	n of total hea	iting from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficien	cy of main s	pace hea	ting syste	em 1								90.3	(206)
Efficien	cy of second	dary/supp	lementar	y heating	g systen	າ, %						0	(208)
	Jan Fel	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	– ar
Space I	heating requ	irement (calculate	d above)	•							
	532.7 374.0	1 258.41	100.42	25.45	0	0	0	0	137.82	355.86	555.11		
(211)m =	= {[(98)m x (204)] } x	100 ÷ (20	06)									(211)
5	589.92 414.1	3 286.17	111.2	28.19	0	0	0	0	152.62	394.09	614.74		
							Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}		2591.11	(211)
Space I	heating fuel	(seconda	ry), kWh/	month									
· · · · ·	n x (201)] } x		 	i	i	i		i			i	1	
(215)m=	0 0	0	0	0	0	0	0	0	0	0	0		7
							Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	Ē	0	(215)
Water h	_												
	rom water he		146.97	142.29	125.32	120.07	133.85	135.32	154.09	164.49	178.03		
	y of water h		110.07	1 12:20	120.02	120.01	100.00	100.02	101.00	101.10	170.00	81	(216)
(217)m=	-		84.53	82.29	81	81	81	81	85.14	87.14	87.85	01	(217)
` ′ ∟	water heatin		Į			<u> </u>			00.11		07.00		()
	= (64)m x 1	-											
(219)m= 2	207.81 182.4	1 191.73	173.85	172.92	154.72	148.23	165.24	167.07	180.99	188.77	202.66		
							Tota	I = Sum(2	19a) ₁₁₂ =			2136.39	(219)
Annual									k'	Wh/year		kWh/year	_
Space h	eating fuel u	sed, mair	system	1								2591.11	_
Water he	eating fuel u	sed										2136.39	
Electricit	y for pumps	fans and	electric	keep-ho	t								

mechanical ventilation - balanced, extract or pos	tive input from outside		137.27		(230a)
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a)) (230g) =		212.27	(231)
Electricity for lighting				283.71	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
		F			
	Energy kWh/year	Emission factoring kg CO2/kWh	ctor	Emissions kg CO2/yea	r
Space heating (main system 1)			etor = [r](261)

Total CO2, kg/year **Dwelling CO2 Emission Rate**

Electricity for pumps, fans and electric keep-hot

Space and water heating

El rating (section 14)

Electricity for lighting

Water heating

(274)

84

		User D	etails:						
Assessor Name:	Chris Hocknell		Strom	a Num	ber:		STRO	016363	
Software Name:	Stroma FSAP 2012		Softwa	are Ve	rsion:		Versio	n: 1.0.4.12	
		Property .	Address	: Apartm	ent 5				
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			a(m²) 75.8	(1a) x		2.7	(2a) =	Volume(m³)) (3a)
	a)+(1b)+(1c)+(1d)+(1e)+(75.8	(1 <i>a</i>)		2.1		204.00	
Dwelling volume	a) · (15) · (16) · (14) · (15) ·(,	7 3.0)+(3c)+(3c	d)+(3e)+	.(3n) =	204.66	(5)
								204.00	
2. Ventilation rate:	main seconda		other		total			m³ per hou	r
Number of chimneys	heating heating	+ [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0 + 0	╡ + ト	0	=	0	x	20 =	0	(6b)
Number of intermittent fa	ns				0	x	10 =	0	(7a)
Number of passive vents	;			Ī	0	x -	10 =	0	(7b)
Number of flueless gas fi	ires			Ī	0	x	40 =	0	(7c)
				_			A ! I-		
				_			Air cn	anges per ho	_
	ys, flues and fans = (6a)+(6b)+ neen carried out or is intended, proce			continuo fr	0		÷ (5) =	0	(8)
Number of storeys in the		eu 10 (17), 1	ourei wise (Jonanae II	om (s) to	(10)		0	(9)
Additional infiltration	3 (1)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame	or 0.35 fo	r masoni	ry constr	ruction			0	(11)
	resent, use the value corresponding	to the great	ter wall are	a (after			'		_
deducting areas of openii	floor, enter 0.2 (unsealed) or	0.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	,	`	,,					0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic met	es per ho	our per s	quare m	etre of e	envelope	area	3	(17)
If based on air permeabil	lity value, then (18) = [(17) ÷ 20]-	(8), otherwi	ise (18) =	(16)				0.15	(18)
	es if a pressurisation test has been d	one or a deg	gree air pe	rmeability	is being u	sed	ı		_
Number of sides sheltere	ed		(20) = 1 -	[0 075 v /	10)] -			1	(19)
Shelter factor	line abaltan fastan		` '	•	19)] –			0.92	(20)
Infiltration rate incorporat	-		(21) = (18) X (20) -				0.14	(21)
Infiltration rate modified f	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	1 ' 1 ' 1	1 001			1 000	1 1101	1 200		
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
		1	1	I	1	1	I	I	
Wind Factor (22a)m = (23a)m =		T 0.05	L 0.00		1 4 00	1 4 40	140]	
(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		

0.18 0.1	7 0.17	ing for sh 0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16]	
Calculate effective	•	rate for t	he appli	cable ca	se					<u>!</u>	<u></u>	
If mechanical ver											0.5	(2:
If exhaust air heat pur) = (23a)			0.5	(2:
If balanced with heat	-	-	_								75.65	(23
a) If balanced me		1	.		- `	- ^ ` -	í `	-) ÷ 100]	
24a)m= 0.3 0.3		0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(2
b) If balanced me			ı —			, 	ŕ	 	- 	1	1	
24b)m= 0 0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole house if (22b)m < 0.			•	•				.5 × (23b	o)		_	
24c)m= 0 0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural ventil if (22b)m = 1			•	•				0.5]			_	
24d)m= 0 0	0	0	0	0	0	0	0	0	0	0		(2
Effective air chan	ge rate - ei	nter (24a) or (24l	o) or (24	c) or (24	ld) in bo	x (25)				_	
25)m= 0.3 0.3	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(2
3. Heat losses and	heat loss	paramet	er:									
LEMENT G	iross ea (m²)	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²·		X k J/K
.				, -		V V / I I I Z	.11	(V V / I	rv)	NJ/III -	1 100	
oors				2	x	1.3	=	2.6		KJ/III 1		
					x		=	,		KJ/III		(2
Vindows Type 1				2	x x1	1.3	0.04] =	2.6		KJ/III ·	i i	(2
Ooors Vindows Type 1 Vindows Type 2 Vindows Type 3				1.27	x1 x1	1.3 /[1/(1.3)+	0.04] = 0.04] =	2.6		KJ/III		(2
Vindows Type 1 Vindows Type 2				2 1.27 2.7	x x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+	0.04] = 0.04] = 0.04] =	2.6 1.57 3.34		KJ/III		(2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4				2 1.27 2.7 2.22 2.78	x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	0.04] = 0.04] = 0.04] = 0.04] =	2.6 1.57 3.34 2.74 3.44		KJ/III		(2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5				2 1.27 2.7 2.22	x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	2.6 1.57 3.34 2.74		KJ/III		(2 (2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6				2 1.27 2.7 2.22 2.78 7.75	x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	= 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	2.6 1.57 3.34 2.74 3.44 9.58		KJ/III		(2 (2 (2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7				2 1.27 2.7 2.22 2.78 7.75 1.19	x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47		KJ/III		(2 (2 (2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Rooflights	58 4 5	19 9	1	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05	x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.6)+	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47		KJ/III		(2 (2 (2 (2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Rooflights Valls Type1	68.45 4.38	19.9	1	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.6)+	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28		KJ/III		(2 (2 (2 (2 (2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Rooflights Valls Type1	4.38	2		2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28		KJ/III		(22 (22 (22 (22 (22 (22 (22 (22 (22 (22
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Rooflights Valls Type1 Valls Type2	4.38 75.8			2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.6)+	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28		KJ/III		(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Rooflights Valls Type1 Valls Type2 Fotal area of eleme	4.38 75.8 nts, m²	1.05	indow U-va	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75 148.6	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28 0.22 7.48				(2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Rooflights	4.38 75.8 nts, m² rindows, use elepth sides of in	1.05	indow U-va	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75 148.6	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.6)+ 0.15 0.09 0.1	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28 0.22 7.48				(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (3 (3)
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Rooflights Valls Type1 Valls Type2 Roof Total area of element of windows and roof with include the areas on the vindows and roof with include the areas on the vindows and roof with include the areas on the vindows and roof with include the areas on the vindows and roof with include the areas on the vindows and roof with include the areas on the vindows and roof with include the areas on the vindows and roof with include the areas on the vindows and roof with include the areas on the vindows area.	4.38 75.8 nts, m² rindows, use e ooth sides of iii	1.05	indow U-va	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75 148.6	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.6)+ 0.15 0.09 0.1	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28 0.22 7.48	as given in	n paragrapl	n 3.2	(22 (22 (22 (22 (22 (22 (22 (22 (22 (22
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Rooflights Valls Type1 Valls Type2 Roof Votal area of element of windows and roof windows and windows and windows and windows and windows and windows and windows and windows and windows and windows and windo	4.38 75.8 Ints, m² Intindows, use of intindows of inti	1.05 effective winternal wal	indow U-va	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75 148.6 alue calculatitions	X X1 X1 X1 X1 X1 X1 X1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.6)+ 0.15 0.09 0.1	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28 0.22 7.48	as given in (2) + (32a)	n paragrapl	n 3.2	(2 (2 (2 (2 (2 (2 (2 (2 (3 (3 (3

	heat loss							(33) +	(36) =			60.02	(3
entilation l	heat loss c	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5)			
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
3)m= 20.1	17 19.94	19.7	18.53	18.3	17.13	17.13	16.89	17.59	18.3	18.76	19.23		(3
eat transfe	er coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
9)m= 80.1	19 79.96	79.72	78.55	78.32	77.15	77.15	76.91	77.62	78.32	78.79	79.26		
	•							,	Average =	Sum(39) ₁	12 /12=	78.49	(;
	arameter (l	HLP), W/	m²K				,		= (39)m ÷	(4)	1		
)m= 1.00	6 1.05	1.05	1.04	1.03	1.02	1.02	1.01	1.02	1.03	1.04	1.05		-
umber of o	days in mo	nth (Tabl	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.04	(4
Ja	- i	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
				ı	ı					ı			
Water h	eating ene	rav reaui	rement:								kWh/ye	ear:	
· valor n	oaming one	igy roqui									ice viii y c	, c., r.	
	ccupancy,										38		(-
	13.9, N = 1 13.9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13.	9)			
	rage hot wa	ater usac	ne in litre	es ner da	av Vd av	erage =	(25 x N)	+ 36		00	.69		(
	nual average								se target o		.69		(
more that	125 litres per	person per	day (all w	ater use, l	hot and co	ld)							
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t water usag	ge in litres per	r day for ea				Table 1c x				<u>I</u>	l		
)m= 99.7	75 96.13	92.5	88.87	85.24	81.62	81.62	85.24	88.87	92.5	96.13	99.75		
				I	l						<u> </u>		— ,
									lotal = Su	m(44) _{1 12} =		1088.23	16
ergy conten	nt of hot water	used - cal	culated me	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600			. ,	L	1088.23	(•
, —		used - calc	culated mo	onthly = 4.	1 <i>90 x Vd,r</i> 96.38	89.31	0Tm / 3600 102.48			. ,	L	1088.23	(
<i></i>					· ·			103.71	nth (see Ta	131.93	c, 1d)	1426.84	`
)m= 147.9		133.51	116.4	111.69	96.38	89.31	102.48	103.71	120.86	131.93	c, 1d)		`
)m= 147.9 nstantaneou	93 129.38 us water heati 19 19.41	133.51	116.4	111.69	96.38	89.31	102.48	103.71	120.86	131.93	c, 1d)		(
)m= 147.s	93 129.38 us water heati 19 19.41 19 19.81	133.51 ing at point 20.03	116.4 of use (no	111.69 hot water 16.75	96.38 storage),	89.31 enter 0 in	102.48 boxes (46)	103.71 106.71 107.71 10 to (61)	120.86 Total = Su 18.13	131.93 m(45) _{1 12} =	c, 1d)		(
)m= 147. nstantaneou)m= 22.1 ater stora prage vol	93 129.38 us water heati 19 19.41 19e loss: ume (litres)	133.51 ing at point 20.03) includin	116.4 of use (no 17.46 ag any so	111.69 hot water 16.75 Dlar or W	96.38 storage), 14.46	89.31 enter 0 in 13.4 storage	102.48 boxes (46) 15.37 within sa	103.71 106.71 107.71 10 to (61)	120.86 Total = Su 18.13	131.93 m(45) _{1 12} =	c, 1d)		(<i>(</i>
nstantaneou)m= 22.1 ater stora prage volucion	93 129.38 us water heati 19 19.41 ge loss: ume (litres) ty heating a	133.51 ing at point 20.03 includin	of use (no 17.46 ag any so	111.69 hot water 16.75 clar or W	96.38 storage), 14.46 /WHRS nter 110	enter 0 in 13.4 storage	102.48 boxes (46, 15.37 within sa (47)	103.71 105.71 106.61) 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} =	c, 1d) 143.26 21.49		(<i>(</i>
mstantaneou mstantaneou m= 22.1 ater stora prage volucionmunit	93 129.38 us water heati 19 19.41 uge loss: ume (litres) ty heating a f no stored	133.51 ing at point 20.03 includin	of use (no 17.46 ag any so	111.69 hot water 16.75 clar or W	96.38 storage), 14.46 /WHRS nter 110	enter 0 in 13.4 storage	102.48 boxes (46, 15.37 within sa (47)	103.71 105.71 106.61) 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} =	c, 1d) 143.26 21.49		(,
mstantaneou mstantaneou m= 22.1 ater stora orage vol communit herwise it	129.38 Is water heati 19 19.41 Ige loss: Imme (litres) Ity heating a If no stored Ige loss:	133.51 ing at point 20.03) including and no ta hot wate	of use (no 17.46 ag any so nk in dw er (this in	111.69 hot water 16.75 Dlar or W velling, e	96.38 storage), 14.46 /WHRS nter 110 nstantar	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47)	103.71 105.71 106.61) 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	c, 1d) 143.26 21.49		(4
m= 147.s instantaneou instan	129.38 us water heati 19 19.41 19e loss: 19 ume (litres) 19 ty heating a 19 f no stored 19 ge loss: 19 acturer's de	ing at point 20.03) including and no tale hot water	of use (no 17.46 ag any se ank in dw er (this ir	111.69 hot water 16.75 Dlar or W velling, e	96.38 storage), 14.46 /WHRS nter 110 nstantar	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47)	103.71 105.71 106.61) 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	c, 1d) 143.26 21.49 0		(4)
nstantaneou)m= 22.1 ater stora orage vol- communit herwise it ater stora If manuf- mperatur	129.38 Is water heating a form stored age loss: acturer's description of the factor from the stored age loss: acturer's description of the factor from the stored age loss:	133.51 ing at point 20.03) includin and no ta hot wate	116.4 of use (not) 17.46 ag any so ank in dwer (this in oss factors)	111.69 hot water 16.75 clar or W velling, encludes i	96.38 storage), 14.46 /WHRS nter 110 nstantar	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	c, 1d) 143.26 21.49		(4)
nstantaneous)m= 22.1 ater stora orage volucionmunit herwise it ater stora of manufater imperatur dergy lost	129.38 Is water heating a fino stored ge loss: facturer's desired from water	133.51 ing at point 20.03) including and no tale hot water eclared learn Table or storage	of use (not) 17.46 Ing any seank in dwer (this in oss factor) 2b , kWh/ye	111.69 hot water 16.75 plar or W velling, encludes i	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage 0 litres in neous co	102.48 boxes (46, 15.37 within sa (47)	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	c, 1d) 143.26 21.49 0		(4)
m= 147.4 mstantaneou m= 22.1 ater stora prage vol communit herwise if ater stora If manuf mperatur ergy lost If manuf	129.38 Is water heati 19 19.41 Ige loss: Imme (litres) Ity heating a If no stored Ige loss: Ideacturer's de Ige factor from water Ige facturer's de	133.51 ing at point 20.03) including and no tale hot water water and reclared learn Table ar storage eclared of	of use (not) 17.46 ag any so onk in dwer (this in oss factors) 2b , kWh/yo	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage 0 litres in neous con/day):	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	c, 1d) 143.26 = 21.49 0 0 0		(4)
nstantaneous me 22.1 ater stora orage volution communit herwise it ater stora of manufater mergy lost of manufater of water s	129.38 Is water heatiful 19.41 Ige loss: ume (litres) ty heating a fino stored lige loss: acturer's dere factor from water acturer's detorage loss	ing at point 20.03) including and no tale hot water eclared learn Table or storage eclared of a factor fr	of use (not) 17.46 ag any so ank in dwer (this in oss factor 2b , kWh/ye cylinder to make the com Table (not)	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage 0 litres in neous con/day):	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	c, 1d) 143.26 21.49 0		(4)
estantaneous estan	129.38 Is water heati 19 19.41 Ige loss: Imme (litres) Ity heating a If no stored Ige loss: Ideacturer's de Ige factor from water Ige facturer's de	133.51 ing at point 20.03) including and no tale hot water eclared learn Table ar storage eclared of factor from the see sections.	of use (not) 17.46 ag any so ank in dwer (this in oss factor 2b , kWh/ye cylinder to make the com Table (not)	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage 0 litres in neous con/day):	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	c, 1d) 143.26 21.49 0 0 0 0		(4)
m= 147.4 mstantaneous m= 22.1 ater stora orage volue communit herwise it ater stora If manufater stora urgy lost If manufater stora orage volue it manufater stora it	129.38 Is water heating a service from water from water from storage loss: If the factor from water from wat	133.51 20.03) including and no tale hot water the colored for storage eclared of a factor from the colored factor from the	of use (not) 17.46 ag any so ank in dwer (this in coss factor 2b by kWh/yo by keylinder from Table on 4.3	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage 0 litres in neous con/day):	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	c, 1d) 143.26 = 21.49 0 0 0		(4)
nstantaneous me 22.1 ater stora orage volicommunit herwise if ater stora of manuficater stora of manuficater stora of manuficater stora of manuficater stora of water stora of manuficater stora of ma	129.38 Is water heati 19 19.41 Ige loss: Imme (litres) Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a Ity heating a	133.51 ing at point 20.03) including and no tale hot water the colored learned lear	of use (not) 17.46 ag any so onk in dwer (this in coss factors, kWh/yo coylinder to m Table on 4.3	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage 0 litres in neous con/day): known:	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 103.71 15.56 ame vesters) enter	120.86 Total = Su 18.13 sel er '0' in (131.93 m(45) _{1 12} = 19.79	c, 1d) 143.26 21.49 0 0 0 0 0		

Water	storage	loss cal	culated 1	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	ry circuit	loss (an	nual) fro	m Table	3							0		(58)
	•	•				59)m = ((58) ÷ 36	65 × (41)	m					
(mo	dified by	factor fr	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	i loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m	-	-	-	-		
(61)m=	50.83	44.24	47.14	43.83	43.44	40.25	41.59	43.44	43.83	47.14	47.41	50.83		(61)
Total h	neat requ	uired for	water h	eating ca	alculated	for eacl	n month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	198.77	173.63	180.65	160.23	155.13	136.63	130.9	145.92	147.53	168	179.33	194.1		(62)
Solar DI	HW input of	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	l lines if	FGHRS	and/or \	wwhrs	applies	, see Ap	pendix (3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	t from w	ater hea	ter	•		•		•		•	•	•		
(64)m=	198.77	173.63	180.65	160.23	155.13	136.63	130.9	145.92	147.53	168	179.33	194.1		
								Outp	out from w	ater heate	r (annual) ₁	12	1970.8	(64)
Heat g	gains fro	m water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	ל 0.8 + [ו	x [(46)m	+ (57)m	+ (59)m	1	-
(65)m=	61.9	54.08	56.18	49.66	48	42.11	40.09	44.94	45.44	51.97	55.72	60.34	_	(65)
inclu	ude (57)	m in cald	culation o	of (65)m	only if c	vlinder i	s in the o	dwellina	or hot w	ater is fr	om com	munity h	eating	
	ternal ga				•	,		J				,	3	
	Ĭ	·			<i>,</i> •									
MELAD	olic gain Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92	118.92		(66)
			ļ			ion L9 o								. ,
(67)m=	18.76	16.66	13.55	10.26	7.67	6.47	7	9.09	12.21	15.5	18.09	19.28		(67)
						uation L		l			10.00	10.20		(- /
(68)m=		212.62	207.12	195.41	180.62	166.72	157.43	155.25	160.75	172.47	187.26	201.15		(68)
` '			!	l .				!	ļ	ļ	107.20	201.13		(00)
(69)m=	ng gains 34.89	34.89	34.89	34.89	L, equa	34.89	34.89), also se	34.89	34.89	34.89	34.89		(69)
` '				<u> </u>	04.00	04.00	04.00	04.00	04.00	04.00	04.00	04.00		(00)
(70)m=	s and fai	3	3	3 3	3	3	3	3	3	3	3	3		(70)
														(10)
	s e.g. ev		<u> </u>				05.40	05.40	05.40	1 05 42	05.40	05.40	1	(71)
(71)m=		-95.13	-95.13	-95.13	-95.13	-95.13	-95.13	-95.13	-95.13	-95.13	-95.13	-95.13		(71)
	heating	<u> </u>	·	00.5=	0		F0.6-		00.55	00.5=				(70)
	83.19	80.48	75.51	68.97	64.51	58.48	53.89	60.4	63.11	69.85	77.38	81.11		(72)
(72)m=				•										
Total i	internal		r			· · · ·		n + (68)m +		(70)m + (7	<u> </u>		' 	
		gains = 371.44	357.85	336.31	314.47	(66) 293.35	m + (67)m 279.99	286.42	+ (69)m + 297.74	(70)m + (7 319.49	1)m + (72) 344.4)m 363.22		(73)

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

Orientation: Access Factor Table 6d	Area Flux m² Table 6a				g_ FF Table 6b Table 6c			Gains (W)			
Northeast 0.9x 0.77	x	7.75	x	11.28	x	0.55	x	0.7	=	23.33	(75)
Northeast 0.9x 0.77	x	1.19	x	11.28	x	0.55	x	0.7	=	3.58	(75)
Northeast 0.9x 0.77	x	7.75	x	22.97	x	0.55	x	0.7	=	47.49	(75)
Northeast 0.9x 0.77	x	1.19	x	22.97	x	0.55	x	0.7] =	7.29	(75)
Northeast 0.9x 0.77	х	7.75	x	41.38	x	0.55	x	0.7	=	85.56	(75)
Northeast 0.9x 0.77	X	1.19	x	41.38	x	0.55	x	0.7	=	13.14	(75)
Northeast 0.9x 0.77	x	7.75	x	67.96	x	0.55	x	0.7	=	140.51	(75)
Northeast _{0.9x} 0.77	x	1.19	x	67.96	x	0.55	X	0.7	=	21.58	(75)
Northeast 0.9x 0.77	x	7.75	x	91.35	x	0.55	x	0.7	=	188.88	(75)
Northeast 0.9x 0.77	x	1.19	x	91.35	x	0.55	x	0.7	=	29	(75)
Northeast _{0.9x} 0.77	x	7.75	x	97.38	x	0.55	x	0.7	=	201.37	(75)
Northeast _{0.9x} 0.77	x	1.19	x	97.38	x	0.55	x	0.7	=	30.92	(75)
Northeast 0.9x 0.77	x	7.75	x	91.1	x	0.55	X	0.7	=	188.37	(75)
Northeast 0.9x 0.77	x	1.19	x	91.1	x	0.55	X	0.7	=	28.92	(75)
Northeast 0.9x 0.77	x	7.75	x	72.63	x	0.55	x	0.7	=	150.17	(75)
Northeast 0.9x 0.77	x	1.19	x	72.63	x	0.55	x	0.7	=	23.06	(75)
Northeast 0.9x 0.77	x	7.75	x	50.42	x	0.55	x	0.7	=	104.26	(75)
Northeast 0.9x 0.77	x	1.19	x	50.42	x	0.55	x	0.7	=	16.01	(75)
Northeast 0.9x 0.77	x	7.75	x	28.07	x	0.55	x	0.7	=	58.04	(75)
Northeast 0.9x 0.77	X	1.19	x	28.07	x	0.55	x	0.7	=	8.91	(75)
Northeast 0.9x 0.77	x	7.75	x	14.2	x	0.55	x	0.7	=	29.36	(75)
Northeast 0.9x 0.77	x	1.19	x	14.2	x	0.55	x	0.7	=	4.51	(75)
Northeast _{0.9x} 0.77	x	7.75	x	9.21	x	0.55	x	0.7	=	19.05	(75)
Northeast 0.9x 0.77	x	1.19	x	9.21	x	0.55	x	0.7	=	2.93	(75)
Southeast 0.9x 0.77	x	2	x	36.79	x	0.55	X	0.7	=	19.63	(77)
Southeast 0.9x 0.77	x	2	x	62.67	x	0.55	x	0.7	=	33.44	(77)
Southeast 0.9x 0.77	x	2	x	85.75	x	0.55	x	0.7	=	45.76	(77)
Southeast 0.9x 0.77	x	2	x	106.25	x	0.55	x	0.7	=	56.7	(77)
Southeast 0.9x 0.77	X	2	x	119.01	x	0.55	x	0.7	=	63.51	(77)
Southeast 0.9x 0.77	x	2	x	118.15	x	0.55	x	0.7	=	63.05	(77)
Southeast 0.9x 0.77	x	2	x	113.91	x	0.55	X	0.7	=	60.78	(77)
Southeast 0.9x 0.77	x	2	x	104.39	x	0.55	x	0.7	=	55.7	(77)
Southeast 0.9x 0.77	x	2	x	92.85	x	0.55	x	0.7	=	49.55	(77)
Southeast 0.9x 0.77	x	2	x	69.27	x	0.55	X	0.7	=	36.96	(77)
Southeast 0.9x 0.77	x	2	x	44.07	x	0.55	x	0.7	=	23.52	(77)
Southeast 0.9x 0.77	x	2	x	31.49	x	0.55	x	0.7] =	16.8	(77)
Southwest _{0.9x} 0.77	x	1.27	x	36.79]	0.55	x	0.7] =	12.47	(79)
Southwest _{0.9x} 0.77	x	2.7	x	36.79]	0.55	x	0.7] =	26.51	(79)
Southwest _{0.9x} 0.77	X	2.22	x	36.79]	0.55	X	0.7	=	21.79	(79)

О. И Г		1		1					1		_
Southwest _{0.9x}	0.77	X	2.78	Х	36.79	0.55	X	0.7] =	27.29	(79)
Southwest _{0.9x}	0.77	X	1.27	X	62.67	0.55	X	0.7	=	21.24	(79)
Southwest _{0.9x}	0.77	X	2.7	X	62.67	0.55	X	0.7	=	45.15	(79)
Southwest _{0.9x}	0.77	X	2.22	X	62.67	0.55	X	0.7	=	37.12	(79)
Southwest _{0.9x}	0.77	X	2.78	X	62.67	0.55	X	0.7	=	46.49	(79)
Southwest _{0.9x}	0.77	X	1.27	X	85.75	0.55	X	0.7	=	29.06	(79)
Southwest _{0.9x}	0.77	X	2.7	X	85.75	0.55	X	0.7	=	61.77	(79)
Southwest _{0.9x}	0.77	X	2.22	X	85.75	0.55	X	0.7	=	50.79	(79)
Southwest _{0.9x}	0.77	X	2.78	X	85.75	0.55	X	0.7	=	63.6	(79)
Southwest _{0.9x}	0.77	X	1.27	x	106.25	0.55	X	0.7	=	36	(79)
Southwest _{0.9x}	0.77	X	2.7	X	106.25	0.55	X	0.7	=	76.54	(79)
Southwest _{0.9x}	0.77	X	2.22	X	106.25	0.55	X	0.7	=	62.93	(79)
Southwest _{0.9x}	0.77	X	2.78	x	106.25	0.55	x	0.7	=	78.81	(79)
Southwest _{0.9x}	0.77	X	1.27	X	119.01	0.55	x	0.7	=	40.33	(79)
Southwest _{0.9x}	0.77	X	2.7	X	119.01	0.55	X	0.7	=	85.73	(79)
Southwest _{0.9x}	0.77	x	2.22	x	119.01	0.55	x	0.7	=	70.49	(79)
Southwest _{0.9x}	0.77	x	2.78	x	119.01	0.55	x	0.7	=	88.27	(79)
Southwest _{0.9x}	0.77	X	1.27	x	118.15	0.55	x	0.7] =	40.03	(79)
Southwest _{0.9x}	0.77	X	2.7	x	118.15	0.55	x	0.7] =	85.11	(79)
Southwest _{0.9x}	0.77	X	2.22	x	118.15	0.55	x	0.7	=	69.98	(79)
Southwest _{0.9x}	0.77	X	2.78	x	118.15	0.55	x	0.7] =	87.63	(79)
Southwest _{0.9x}	0.77	x	1.27	x	113.91	0.55	x	0.7] =	38.6	(79)
Southwest _{0.9x}	0.77	X	2.7	x	113.91	0.55	x	0.7] =	82.06	(79)
Southwest _{0.9x}	0.77	X	2.22	x	113.91	0.55	x	0.7	=	67.47	(79)
Southwest _{0.9x}	0.77	x	2.78	x	113.91	0.55	x	0.7	=	84.49	(79)
Southwest _{0.9x}	0.77	x	1.27	x	104.39	0.55	x	0.7	=	35.37	(79)
Southwest _{0.9x}	0.77	X	2.7	x	104.39	0.55	x	0.7] =	75.2	(79)
Southwest _{0.9x}	0.77	x	2.22	x	104.39	0.55	x	0.7	=	61.83	(79)
Southwest _{0.9x}	0.77	X	2.78	x	104.39	0.55	x	0.7	=	77.43	(79)
Southwest _{0.9x}	0.77	X	1.27	x	92.85	0.55	x	0.7] =	31.46	(79)
Southwest _{0.9x}	0.77	x	2.7	x	92.85	0.55	x	0.7] <u>=</u>	66.89	(79)
Southwest _{0.9x}	0.77	x	2.22	x	92.85	0.55	x	0.7	Ī =	55	(79)
Southwest _{0.9x}	0.77	x	2.78	x	92.85	0.55	x	0.7	j =	68.87	(79)
Southwest _{0.9x}	0.77	x	1.27	x	69.27	0.55	x	0.7] <u>-</u>	23.47	(79)
Southwest _{0.9x}	0.77	x	2.7	x	69.27	0.55	x	0.7	j =	49.9	(79)
Southwest _{0.9x}	0.77	x	2.22	x	69.27	0.55	x	0.7	j =	41.03	(79)
Southwest _{0.9x}	0.77	x	2.78	x	69.27	0.55	x	0.7	j =	51.38	(79)
Southwest _{0.9x}	0.77	x	1.27	x	44.07	0.55	x	0.7	j =	14.93	(79)
Southwest _{0.9x}	0.77	x	2.7	x	44.07	0.55	x	0.7	j =	31.75	(79)
Southwest _{0.9x}	0.77	x	2.22	x	44.07	0.55	x	0.7	j =	26.1	(79)
Southwest _{0.9x}	0.77	x	2.78	x	44.07	0.55	x	0.7	j =	32.69	(79)
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Southwest _{0.9x}	0.77	X	1.2	27	X	3	31.49		0.55	X	0.7	=	10.67	(79)
Southwest _{0.9x}	0.77	х	2.	7	X	3	31.49		0.55	X	0.7	=	22.68	(79)
Southwest _{0.9x}	0.77	x	2.2	22	X	3	31.49]	0.55	X	0.7	=	18.65	(79)
Southwest _{0.9x}	0.77	X	2.7	78	X	3	31.49]	0.55	X	0.7	=	23.36	(79)
Rooflights 0.9x	1	x	1.0)5	X		26	X	0.55	x	0.8	=	10.81	(82)
Rooflights 0.9x	1	x	1.0)5	X		54	x	0.55	x	0.8	=	22.45	(82)
Rooflights 0.9x	1	x	1.0)5	X		96	x	0.55	x	0.8	=	39.92	(82)
Rooflights 0.9x	1	X	1.0)5	X		150	x	0.55	x	0.8	<u> </u>	62.37	(82)
Rooflights 0.9x	1	x	1.0)5	X		192	x	0.55	x	0.8	=	79.83	(82)
Rooflights 0.9x	1	X	1.0)5	X		200	X	0.55	X	0.8	=	83.16	(82)
Rooflights 0.9x	1	x	1.0)5	X		189	X	0.55	x	0.8	=	78.59	(82)
Rooflights 0.9x	1	X	1.0)5	X		157	x	0.55	x	0.8	=	65.28	(82)
Rooflights 0.9x	1	x	1.0)5	X		115	x	0.55	x	0.8		47.82	(82)
Rooflights 0.9x	1	X	1.0)5	X		66	x	0.55	x	0.8	=	27.44	(82)
Rooflights 0.9x	1	x	1.0)5	X		33	X	0.55	x	0.8	=	13.72	(82)
Rooflights 0.9x	1	x	1.0)5	X		21	x	0.55	x	0.8		8.73	(82)
_														
Solar gains in	watts ca	alculated	for eac	h month	า			(83)m	n = Sum(74)m	(82)m				
(83)m= 145.41	260.67	389.6	535.44	646.04	\neg	61.25	629.28	544		297.1		122.87	1	(83)
Total gains – ir							<u> </u>		100 100.00		1	1	J	` '
(84)m= 519.48	632.11	747.45	871.75	960.51	-	954.6	909.27	830	.46 737.59	616.6	2 520.98	486.09	1	(84)
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7 Maan inter	aal tamn	oroturo	(hooting	00000	<u>م ۱</u>									
7. Mean inter			•			oron f	from Tol	olo O	Th1 (°C)				04	7/05)
Temperature	during h	eating p	eriods ir	n the liv	ing			ole 9	, Th1 (°C)				21	(85)
Temperature Utilisation fac	during h	eating p	eriods ir iving are	n the liv ea, h1,n	ing n (s	ее Та	ble 9a)		. ,				21	(85)
Temperature Utilisation fac	during h tor for ga Feb	eating pains for I	eriods ir iving are Apr	n the liv ea, h1,n May	ing n (s	ee Ta Jun	ble 9a) Jul	Α	ug Sep	Oct	+	Dec	21	
Temperature Utilisation fac	during h	eating p	eriods ir iving are	n the liv ea, h1,n	ing n (s	ее Та	ble 9a)		ug Sep	Oct 0.94	. Nov 0.99	Dec 1	21	(85)
Temperature Utilisation fac	during h tor for ga Feb 0.99	eating p ains for I Mar 0.96	eriods ir iving are Apr 0.88	n the livea, h1,n May	ing n (s	ee Ta Jun ^{0.51}	Jul 0.37	A 0.4	ug Sep 12 0.69	 	+	-	21	
Temperature Utilisation fac Jan (86)m= 1	during h tor for ga Feb 0.99	eating p ains for I Mar 0.96	eriods ir iving are Apr 0.88	n the livea, h1,n May	ing n (s	ee Ta Jun ^{0.51}	Jul 0.37	A 0.4	ug Sep 12 0.69 Table 9c)	 	+	-	21	
Temperature Utilisation fac Jan (86)m= 1 Mean internal	during h tor for ga Feb 0.99 tempera 20.17	eating p ains for I Mar 0.96 ature in I	eriods ir iving are Apr 0.88 iving are 20.77	n the livea, h1,n May 0.71 ea T1 (f	ing n (s follo	ee Ta Jun 0.51 ow ste	Jul 0.37 ps 3 to 7	7 in T	ug Sep 12 0.69 Table 9c) 1 20.96	0.94	0.99	1	21	(86)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96	during h tor for ga Feb 0.99 tempera 20.17	eating p ains for I Mar 0.96 ature in I	eriods ir iving are Apr 0.88 iving are 20.77	n the livea, h1,n May 0.71 ea T1 (f	ing n (s follo	ee Ta Jun 0.51 ow ste	Jul 0.37 ps 3 to 7	7 in T	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C)	0.94	0.99	1	21	(86)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04	during h tor for ga Feb 0.99 tempera 20.17 during h 20.04	eating pains for I Mar 0.96 ature in I 20.45 eating p 20.04	eriods ir iving are Apr 0.88 iving are 20.77 eriods ir 20.05	n the livea, h1,n May 0.71 ea T1 (from 20.94 n rest of 20.06	ing (s) (s) (following following fol	ee Ta Jun 0.51 ow ste 20.99 velling	Jul 0.37 ps 3 to 7 21 from Ta 20.07	A 0.47 in T 2 able 9 20.	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C)	20.7	0.99	19.93	21	(86)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature	during h tor for ga Feb 0.99 tempera 20.17 during h 20.04	eating pains for I Mar 0.96 ature in I 20.45 eating p 20.04	eriods ir iving are Apr 0.88 iving are 20.77 eriods ir 20.05	n the livea, h1,n May 0.71 ea T1 (from 20.94 n rest of 20.06	ing m (s	ee Ta Jun 0.51 ow ste 20.99 velling	Jul 0.37 ps 3 to 7 21 from Ta 20.07	A 0.47 in T 2 able 9 20.	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06	20.7	0.99	19.93	21	(86)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99	during h tor for ga Feb 0.99 tempera 20.17 during h 20.04 tor for ga 0.99	eating p ains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95	eriods ir iving are 0.88 iving are 20.77 eriods ir 20.05 est of do	n the livea, h1,n May 0.71 ea T1 (frame 20.94 n rest of 20.06 welling, 0.65	ing m (s	ee Ta Jun 0.51 ow ste 20.99 velling 20.07 ,m (se 0.44	ps 3 to 7 21 from Ta 20.07 ee Table 0.29	A 0.47 in T 2 able 9 20.	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06	20.7 20.06	20.27	19.93	21	(86) (87) (88)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99 Mean internal	during heter for gase of temperaturing heter for gase of temperature for gase of temperature for for gase of temperature for gase of gase of temperature for gase of temperature for gase of g	eating p ains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95 ature in t	Apr 0.88 iving are 20.77 eriods ir 20.05 est of dr 0.85 the rest	m the livea, h1,n May 0.71 ea T1 (frame 20.94 n rest of 20.06 welling, 0.65 of dwel	n (s follo	ee Ta Jun 0.51 ow ste 20.99 velling 20.07 ,m (se 0.44 T2 (fo	Jul 0.37 ps 3 to 7 21 from Ta 20.07 ee Table 0.29 ollow ste	A 0.27 in T 2 able 9 20. 9a) 0.3	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 4 0.61	0.94 20.7 20.06 0.91 le 9c)	0.99 20.27 20.05 0.99	1 19.93 20.05		(86) (87) (88) (89)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99	during h tor for ga Feb 0.99 tempera 20.17 during h 20.04 tor for ga 0.99	eating p ains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95	eriods ir iving are 0.88 iving are 20.77 eriods ir 20.05 est of do	n the livea, h1,n May 0.71 ea T1 (frame 20.94 n rest of 20.06 welling, 0.65	n (s follo	ee Ta Jun 0.51 ow ste 20.99 velling 20.07 ,m (se 0.44	ps 3 to 7 21 from Ta 20.07 ee Table 0.29	A 0.47 in T 2 able 9 20.	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 84 0.61 8 to 7 in Tab 07 20.05	0.94 20.7 20.06 0.91 le 9c)	0.99 20.27 20.05 0.99	1 19.93 20.05		(86) (87) (88) (89)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99 Mean internal (90)m= 19.1	during h tor for ga Feb 0.99 tempera 20.17 during h 20.04 tor for ga 0.99 tempera 19.3	eating p ains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95 ature in t 19.58	eriods ir iving are 0.88 iving are 20.77 eriods ir 20.05 est of do 0.85 the rest 19.88	n the livea, h1,n May 0.71 ea T1 (frame 20.94 n rest of 20.06 welling, 0.65 of dwel 20.02	ing (s) (s) (s) (s) (s) (s) (s) (s) (s) (s)	ee Ta Jun 0.51 ow ste 20.99 velling 20.07 ,m (se 0.44 T2 (fo	Jul 0.37 pps 3 to 7 21 from Ta 20.07 ee Table 0.29 follow ste 20.07	A 0.4 7 in 1 2 20. 9a) 0.3 eps 3	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 84 0.61 6 to 7 in Tab 07 20.05	0.94 20.7 20.06 0.91 le 9c)	0.99 20.27 20.05 0.99	1 19.93 20.05	0.39	(86) (87) (88) (89)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99 Mean internal (90)m= 19.1 Mean internal	temperate	eating p ains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95 ature in t 19.58 ature (fo	eriods ir iving are Apr 0.88 iving are 20.77 eriods ir 20.05 est of dr 0.85 the rest 19.88	n the livea, h1,n May 0.71 ea T1 (f 20.94 n rest of 20.06 welling, 0.65 of dwel 20.02	ing (s) (s) (s) (s) (s) (s) (s) (s) (s) (s)	ee Ta Jun 0.51 ow ste 20.99 /elling 20.07 ,m (se 0.44 T2 (fo 20.07	Jul 0.37 ps 3 to 7 21 from Ta 20.07 ee Table 0.29 collow ste 20.07	A 0.4 7 in 1 2 able 9 20. 9a) 0.3 + (1	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 4 0.61 4 to 7 in Tab 07 20.05 - fLA) × T2	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Liv	0.99 20.27 20.05 0.99 19.41 ving area ÷ (-	1 19.93 20.05 1 19.07 4) =		(86) (87) (88) (89) (90) (91)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99 Mean internal (90)m= 19.1 Mean internal (92)m= 19.43	during heter for gase of temperature of the second	eating pains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95 ature in t 19.58 ature (fo	eriods ir iving are Apr 0.88 iving are 20.77 eriods ir 20.05 est of do 0.85 the rest 19.88 er the wh 20.23	n the livea, h1,n May 0.71 ea T1 (frame 20.94 n rest of 20.06 welling, 0.65 of dwel 20.02 ole dwere 20.38	ing (second second ee Ta Jun 0.51 ow ste 20.99 velling 20.07 ,m (se 0.44 T2 (fo 20.07	Jul 0.37 pps 3 to 7 21 from Ta 20.07 ee Table 0.29 follow ste 20.07 LA × T1 20.43	A 0.4 7 in 1 2 20. 9a) 0.3 20. + (1 20.	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 34 0.61 5 to 7 in Tab 07 20.05 - fLA) × T2 43 20.4	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Li	0.99 20.27 20.05 0.99 19.41 ving area ÷ (4)	1 19.93 20.05		(86) (87) (88) (89)	
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99 Mean internal (90)m= 19.1 Mean internal (92)m= 19.43 Apply adjustm	during heter for gase of temperature	eating pains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95 ature in 1 19.58 ature (fo 19.92 ne mean	eriods ir iving are Apr 0.88 iving are 20.77 eriods ir 20.05 est of do 0.85 the rest 19.88 r the wh 20.23 internal	n the livea, h1,n May 0.71 ea T1 (frame 20.94 n rest of 20.06 welling, 0.65 of dwel 20.02 ole dwere 20.38 I tempe	ing m (s follow	ee Ta Jun 0.51 ow ste 20.99 /elling 20.07 ,m (se 20.07 T2 (fo 20.07 g) = fl 20.43 ure fro	ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 3 to 7 ps 4 to 7 ps 3 to 7 ps 4 to 7 ps 4 to 7 ps 4 to 7 ps 4 to 7 ps 5 to 7 ps 5 to 7 ps 5 to 7 ps 6 to 7 ps 6 to 7 ps 6 to 7 ps 6 to 7 ps 7 to 7 ps 8 to 7 ps 7 to 7 ps 8 to 7 ps 7 to 7 ps 8 to 7 ps 7 to 7 ps 8 to 7 ps 7 t	A 0.4 7 in 1 2 able 9 20. 9a) 0.3 eps 3 20. + (1 20. 2 4e,	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 4 0.61 4 to 7 in Tab 07 20.05 - fLA) × T2 43 20.4 where appre	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Li ^o 20.17 opriate	0.99 20.27 20.05 0.99 19.41 ving area ÷ (1 19.93 20.05 1 19.07 4) =		(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99 Mean internal (90)m= 19.1 Mean internal (92)m= 19.43 Apply adjustm (93)m= 19.28	during heter for gase of temperature	eating pains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95 ature in 1 19.58 ature (fo 19.92 ne mean 19.77	eriods ir iving are Apr 0.88 iving are 20.77 eriods ir 20.05 est of do 0.85 the rest 19.88 er the wh 20.23	n the livea, h1,n May 0.71 ea T1 (frame 20.94 n rest of 20.06 welling, 0.65 of dwel 20.02 ole dwere 20.38	ing m (s follow	ee Ta Jun 0.51 ow ste 20.99 velling 20.07 ,m (se 0.44 T2 (fo 20.07	Jul 0.37 pps 3 to 7 21 from Ta 20.07 ee Table 0.29 follow ste 20.07 LA × T1 20.43	A 0.4 7 in 1 2 20. 9a) 0.3 20. + (1 20.	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 4 0.61 4 to 7 in Tab 07 20.05 - fLA) × T2 43 20.4 where appre	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Li	0.99 20.27 20.05 0.99 19.41 ving area ÷ (1 19.93 20.05 1 19.07 4) =		(86) (87) (88) (89) (90) (91)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99 Mean internal (90)m= 19.1 Mean internal (92)m= 19.43 Apply adjustm (93)m= 19.28 8. Space hear	during heter for garage for for for garage for for for garage for for for garage for for for garage for for for garage for for for garage for for for garage for for for garage for for for garage for for for garage for for for garage for for garage for for for garage for garage for	eating pains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95 ature in I 19.58 ature (fo 19.92 ne mean 19.77 uirement	eriods ir iving are Apr 0.88 iving are 20.77 eriods ir 20.05 est of do 0.85 the rest 19.88 r the wh 20.23 internal 20.08	n the livea, h1,n May 0.71 ea T1 (frame 20.94 n rest of 20.06 welling, 0.65 of dwel 20.02 ole dwere 20.38 tempe 20.23	ing m (s	ee Ta Jun 0.51 ow ste 20.99 /elling 20.07 ,m (se 0.44 T2 (fo 20.07 g) = fl 20.43 ure fro 20.28	ble 9a) Jul 0.37 ps 3 to 7 21 from Ta 20.07 ee Table 0.29 follow ste 20.07 LA × T1 20.43 m Table 20.28	A 0.4 7 in 1 2 able 9 20. 9a) 0.3 eps 3 20. + (1 20.	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 34 0.61 5 to 7 in Tab 07 20.05 - fLA) × T2 43 20.4 where appre	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Li 20.17 opriate 20.02	0.99 20.27 20.05 0.99 19.41 ving area ÷ (4) 19.74	1 19.93 20.05 1 19.07 4) =	0.39	(86) (87) (88) (89) (90) (91) (92)
Temperature Utilisation fac Jan (86)m= 1 Mean internal (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fac (89)m= 0.99 Mean internal (90)m= 19.1 Mean internal (92)m= 19.43 Apply adjustm (93)m= 19.28	during heter for garage for for for garage for for for garage for for for garage for for for garage for for garage for for for garage for for for garage for for for garage for for for garage for for for garage for for for garage for for garage for for for garage for garage fo	eating pains for I Mar 0.96 ature in I 20.45 eating p 20.04 ains for r 0.95 ature in t 19.58 ature (fo 19.92 ne mean 19.77 uirement ernal ten	eriods ir iving are Apr 0.88 iving are 20.77 eriods ir 20.05 est of do 0.85 the rest 19.88 r the wh 20.23 internal 20.08	n the livea, h1,n May 0.71 ea T1 (frame 20.94 n rest of 20.06 welling, 0.65 of dwel 20.02 ole dwere 20.38 tempe 20.23 re obtain	ing m (s	ee Ta Jun 0.51 ow ste 20.99 /elling 20.07 ,m (se 0.44 T2 (fo 20.07 g) = fl 20.43 ure fro 20.28	ble 9a) Jul 0.37 ps 3 to 7 21 from Ta 20.07 ee Table 0.29 follow ste 20.07 LA × T1 20.43 m Table 20.28	A 0.4 7 in 1 2 able 9 20. 9a) 0.3 eps 3 20. + (1 20.	ug Sep 42 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 34 0.61 5 to 7 in Tab 07 20.05 - fLA) × T2 43 20.4 where appre	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Li 20.17 opriate 20.02	0.99 20.27 20.05 0.99 19.41 ving area ÷ (4) 19.74	1 19.93 20.05 1 19.07 4) =	0.39	(86) (87) (88) (89) (90) (91) (92)

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Mar

Jan

Feb

Utilisatio	on factor for g	ains, hm	n:										
	0.99 0.98	0.95	0.85	0.66	0.46	0.31	0.36	0.63	0.91	0.99	1		(94)
Useful g	ains, hmGm	, W = (94	4)m x (8	4)m				l	l				
(95)m= 5°	16.22 621.22	709.76	739.51	637.26	434.73	283.63	297.88	461.35	561.47	513.22	483.88		(95)
Monthly	average exte	ernal tem	perature	from Ta	able 8								
(96)m=	4.3 4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	s rate for me	1	T				 		ř –				
` ′	01.63 1166.17		<u> </u>	667.97	437.88	283.93	298.53	477.57	737.65	984.39	1193.23		(97)
	eating requir	1									I 1		
(98)m= 50	09.95 366.21	258.88	99.59	22.84	0	0	0	0	131.08	339.24	527.76		7,000
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2255.55	(98)
Space h	eating requir	ement in	kWh/m²	² /year								29.76	(99)
9a. Energ	gy requireme	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space h	_												_
Fraction	of space hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fraction	of space hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction	of total heat	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficienc	cy of main sp	ace heat	ing syste	em 1								90.3	(206)
Efficienc	cy of seconda	ary/suppl	ementar	y heating	g system	າ, %						0	(208)
Γ,	Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	– ar
Space h	eating requir	ement (c	alculate	d above))	•	•						
50	09.95 366.21	258.88	99.59	22.84	0	0	0	0	131.08	339.24	527.76		
(211)m =	{[(98)m x (20	04)] } x 1	100 ÷ (20	06)									(211)
56	64.72 405.55	286.69	110.29	25.3	0	0	0	0	145.16	375.68	584.45		
							Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	2497.84	(211)
Space h	eating fuel (s	econdar	y), kWh/	month									
	x (201)] } x 1			i	i	i				i			
(215)m=	0 0	0	0	0	0	0	0	0	0	0	0		7
							Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
Water he	•												
	om water hea	180.65	160.23	155.13	136.63	130.9	145.92	147.53	168	179.33	194.1		
	of water hea		100.20	100.10	100.00	100.0	1 10.02	117.00		170.00	10111	81	(216)
(217)m= 8		86.23	84.33	82.09	81	81	81	81	84.83	86.85	87.6		(217)
` '	vater heating	<u> </u>	Į	02.00	<u> </u>				01.00	00.00	07.0		()
	(64)m x 10												
(219)m= 22	27.21 199.38	209.49	190	188.98	168.68	161.6	180.15	182.14	198.04	206.48	221.58		
							Tota	I = Sum(2	19a) ₁₁₂ =			2333.74	(219)
Annual to									k'	Wh/year	•	kWh/year	_
Space he	eating fuel us	ed, main	system	1								2497.84	_
Water he	ating fuel use	ed										2333.74	
Electricity	for pumps, f	ans and	electric	keep-ho	t								

mechanical ventilation - balanced, extract or pos	sitive input from outside		165.42		(230a)
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a) (230g) =		240.42	(231)
Electricity for lighting				331.32	(232)
12a. CO2 emissions – Individual heating systen	ns including micro-CHP				
	Energy kWh/year	Emission fa		Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.216	=	539.53	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)

Water heating Space and water heating

Electricity for pumps, fans and electric keep-hot

Electricity for lighting

Total CO2, kg/year

Dwelling CO2 Emission Rate

El rating (section 14)

(219) x

(261) + (262) + (263) + (264) =

(231) x

(232) x

0.519 sum of (265) (271) =

0.216

0.519

 $(272) \div (4) =$

504.09 (264)

1043.62 (265)

124.78 (267)(268)171.96

(272) 1340.35

(273)17.68

> (274)85

eight associates

Appendix Energy Assessment 34A-36 Kilburn High Road

GREEN Scenario

		l Isor F	Details:						
Assessor Name:	Chris Hocknell	– USE ITL	Strom	a Nium	her:		STDO	016363	
Software Name:	Stroma FSAP 2012		Softwa	_				on: 1.0.4.12	
	F	Property	Address	Apartm	ent 1				
Address :									
1. Overall dwelling dime	nsions:	۸ro	a(m²)		Λ ₁ , μ _ο	ight(m)		Volume(m ³	3)
Ground floor				(1a) x		2.7	(2a) =	138.51	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1	n)		(4)]		
Dwelling volume		′ <u> </u>	01.0)+(3c)+(3c	d)+(3e)+	.(3n) =	138.51	(5)
							,	130.31	
2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	r
Number of chimneys	heating heating beauting heating	- + -	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	╡ + 片	0	 	0	x	20 =	0	(6b)
Number of intermittent fa	ns				0	x -	10 =	0	(7a)
Number of passive vents				F	0	x -	10 =	0	(7b)
Number of flueless gas fi	res			F	0	X	40 =	0	(7c)
0.1				L					((* 5)
							Air ch	anges per ho	our
•	ys, flues and fans = $(6a)+(6b)+(6b)$				0		÷ (5) =	0	(8)
If a pressurisation test has b Number of storeys in the	een carried out or is intended, proced ne dwelling (ns)	ed to (17),	otherwise (continue fr	om (9) to	(16)		0	(9)
Additional infiltration	ie dweimig (ne)					[(9)	-1]x0.1 =	0	(10)
	25 for steel or timber frame o			•	ruction			0	(11)
if both types of wall are pu deducting areas of openir	resent, use the value corresponding t nas): if equal user 0.35	o the grea	ter wall are	a (after					
•	loor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
<u>-</u>	s and doors draught stripped		0.25 - [0.2	v (14) ± 1	1001 -			0	(14)
Window infiltration Infiltration rate			(8) + (10)		_	+ (15) =		0	(15)
	q50, expressed in cubic metro	es per ho					area	3	(17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20] +$	(8), otherw	rise (18) = (16)				0.15	(18)
Air permeability value applie Number of sides sheltere	s if a pressurisation test has been do	ne or a de	gree air pe	rmeability	is being u	sed			7(10)
Shelter factor	u		(20) = 1 -	[0.0 75 x (1	19)] =			0.92	(19) (20)
Infiltration rate incorporat	ing shelter factor		(21) = (18) x (20) =				0.14	(21)
Infiltration rate modified for	or monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp								1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	2)m ÷ 4								
(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		

· —	ation rate (al		1	1	` 	`	`	T		1	1	
0.18 Calculate effec	0.17 0.1		0.15 the appli	0.13 cable ca	0.13 ise	0.13	0.14	0.15	0.16	0.16	İ	
If mechanica											0.5	(23
If exhaust air he	eat pump using	Appendix N, (2	23b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b	o) = (23a)			0.5	(23
If balanced with	heat recovery:	efficiency in %	allowing	for in-use t	actor (fron	n Table 4h) =				75.65	(23
a) If balance	d mechanica	al ventilatior	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24a)m= 0.3	0.3 0.2	9 0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(24
b) If balance	d mechanica	al ventilation	without	heat red	covery (I	MV) (24b)m = (22	2b)m + (2	23b)		,	
24b)m= 0	0 0	0	0	0	0	0	0	0	0	0		(2
c) If whole he if (22b)m	ouse extract o < 0.5 × (23		•	•				.5 × (23b))			
24c)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	ventilation or n = 1, then (2							0.5]		•	1	
24d)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24
Effective air	change rate	- enter (24a	a) or (24l	b) or (24	c) or (24	d) in bo	x (25)	-		-		
25)m= 0.3	0.3 0.2	9 0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(2
3. Heat losses	s and heat lo	ss paramet	er:									
LEMENT	Gross area (m²)	Openir		Net Aı A ,ı		U-val W/m2		A X U (W/ł	〈)	k-value kJ/m²·l		XX k J/K
Doors				2	х	1.3		2.6				(2
Vindows Type	1			9.56	x1	/[1/(1.3)+	0.04] =	11.81				(2
Vindows Type	2			4.62	x1	/[1/(1.3)+	0.04] =	5.71				(2
Vindows Type	3			4.17	x1	/[1/(1.3)+	0.04] =	5.15				(2
Rooflights Type	e 1			1.05	x1	/[1/(1.6) +	0.04] =	1.68				(2
Rooflights Type	e 2			1.79	x1	/[1/(1.6) +	0.04] =	2.864				(2
Valls Type1	35.48	22.5	i2	12.90	3 X	0.15	= i	1.94	<u> </u>			(2
Valls Type2	30.48	2		28.48	3 X	0.13	<u> </u>	3.8			= = = = = = = = = = = = = = = = = = =	(2
Roof	51.3	2.8	4	48.40	3 X	0.1	<u> </u>	4.85			= =	(3
otal area of e	lements, m²			117.2	6							(3
for windows and					ated using	g formula 1	/[(1/U-valu	ue)+0.04] a	s given in	paragraph	1 <i>3.2</i>	
* include the area			lls and par	titions		(26) (20) + (22) -					—,,
abric heat los	`	,				(26) (30) + (32) =	(20) + (20	2) + (225)	(220) -	45.29	(3
leat capacity (Thermal mass	•	•	- ΤΕΛ\ iı	n k l/m²k			((28)	(30) + (32 ative Value:	, , ,	(326) -	8309.74	(3
or design assess	•		,			recisely the				able 1f	250	(3
an be used instea			. condition		pr	- 5.551y till			11110			
hermal bridge	es : S (L x Y)	calculated	using Aր	pendix	K						11.73	(3
details of therma		ot known (36)	= 0.15 x (3	31)			(22)	(26) -				— ,_
atal tahria ha	41 1055						(33) +	(30) =			57.03	(3
otal fabric hea entilation hea		atad manth	.,					i = 0.33 × (25)m v: (5)	\	37.03	

(00)	10.10	40.00	40.54	40.00	44.50	44.50	14.40	44.04	10.00	40.7	10.00		(20)
(38)m= 13.65	13.49	13.33	12.54	12.38	11.59	11.59	11.43	11.91	12.38	12.7	13.02		(38)
Heat transfer c	70.52	nt, W/K 70.36	69.57	69.41	68.62	68.62	68.46	(39)m 68.93	69.41	38)m 69.73	70.04		
(39)111- 10.00	70.52	70.30	09.57	09.41	00.02	00.02	00.40			Sum(39) ₁	<u> </u>	69.53	(39)
Heat loss para	meter (F	HLP), W	/m²K				_		= (39)m ÷				 `
(40)m= 1.38	1.37	1.37	1.36	1.35	1.34	1.34	1.33	1.34	1.35	1.36	1.37		_
Number of day	s in moi	nth (Tab	le 1a)					/	Average =	Sum(40) ₁	12 /12=	1.36	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
											<u>. </u>		
4. Water heat	ing enei	rgy requi	irement:								kWh/ye	ar:	
Assumed occu	nancy I	N									70		(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		73		(42)
if TFA £ 13.9 Annual average	,	ator usac	no in litro	ne por de	w Vd av	orago =	(25 v NI)	T 36					(42)
Reduce the annua	l average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		5.25		(43)
not more that 125	litres per p	person per	day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage ir			ı	· · · · · · · · · · · · · · · · · · ·	ı	ı	. /						
(44)m= 82.77	79.76	76.75	73.74	70.73	67.72	67.72	70.73	73.74	76.75	79.76 m(44) _{1 12} =	82.77	903	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x C	OTm / 3600			` '	<u> </u>	903	(++)
(45)m= 122.75	107.36	110.79	96.59	92.68	79.97	74.11	85.04	86.05	100.29	109.47	118.88		
#:	-111		/				h (40		Γotal = Su	m(45) _{1 12} =		1183.97	(45)
If instantaneous w			· ·	1		1		, ,					(40)
(46)m= 18.41 Water storage	16.1 loss:	16.62	14.49	13.9	12	11.12	12.76	12.91	15.04	16.42	17.83		(46)
Storage volume) includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	eating a	ınd no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufacti		eclared l	oss facto	or is kno	wn (kWł	n/dav):					0		(48)
Temperature fa					`	J /					0		(49)
Energy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	=			0		(50)
b) If manufacti			-										
Hot water stora If community h	•			e 2 (KVV	n/litre/da	ıy)					0		(51)
Volume factor	_		011 1.0								0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (, ,	,									0		(55)
Water storage	loss cal	culated f	for each	month			((56)m = (55) × (41)r	n				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0	. 11	(56)
If cylinder contains				1	I	1						: н	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	0	(58)
(modified by factor from Table H5 if there is solar water heating and a cylinder thermo		(50)
(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	<u>. </u>	
(61)m= 42.18 36.71 39.11 36.37 36.05 33.4 34.51 36.05 36.37 39.11	39.34 42.18	(61)
Total heat required for water heating calculated for each month (62) m = $0.85 \times (45)$ m +	(46)m + (57)m + (59)r	n + (61)m
(62)m= 164.93 144.07 149.9 132.95 128.72 113.37 108.62 121.08 122.42 139.4	148.81 161.06	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribut	tion to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)		
(63)m= 0 0 0 0 0 0 0 0 0 0	0 0	(63)
Output from water heater	· · · · · · · · · · · · · · · · · · ·	
(64)m= 164.93 144.07 149.9 132.95 128.72 113.37 108.62 121.08 122.42 139.4	148.81 161.06	
Output from water heate	er (annual) _{1 12}	1635.35 (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= 51.36 44.88 46.61 41.21 39.83 34.94 33.27 37.29 37.7 43.12	46.23 50.07	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is fi	rom community heatin	a
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= 86.42 86.42 86.42 86.42 86.42 86.42 86.42 86.42 86.42 86.42 86.42	86.42 86.42	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	302	, ,
(67)m= 13.43 11.93 9.7 7.34 5.49 4.63 5.01 6.51 8.74 11.09	12.95 13.8	(67)
	12.00	(01)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 150.61 152.17 148.23 139.85 129.27 119.32 112.67 111.11 115.05 123.43	124.02 442.00	(68)
	134.02 143.96	(00)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	T T T	(00)
(69)m= 31.64 31.64 31.64 31.64 31.64 31.64 31.64 31.64 31.64 31.64	31.64 31.64	(69)
Pumps and fans gains (Table 5a)		
(70)m= 3 3 3 3 3 3 3 3 3 3	3 3	(70)
Losses e.g. evaporation (negative values) (Table 5)		
(71)m= -69.14 -69.14 -69.14 -69.14 -69.14 -69.14 -69.14 -69.14 -69.14 -69.14	-69.14 -69.14	(71)
Water heating gains (Table 5)		
(72)m= 69.03 66.78 62.65 57.23 53.53 48.53 44.72 50.12 52.37 57.96	64.21 67.3	(72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m$	71)m + (72)m	
(73)m= 285 282.8 272.51 256.35 240.21 224.41 214.32 219.66 228.08 244.41	263.1 276.99	(73)
6. Solar gains:		
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applical	ble orientation.	
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b T		iins W)
Noticed [
Northeast 0.9x		28.78 (75)
Northeast 0.9x 0.77 x 4.62 x 11.28 x 0.55 x	0.7	13.91 (75)

Northogat a a		7		1		1		ı		1		¬
Northeast 0.9x	0.77	」 ^X	9.56] X	22.97] X]	0.55	X	0.7] =	58.58	(75)
Northeast 0.9x	0.77	X	4.62	X	22.97	X	0.55	X	0.7] =	28.31	(75)
Northeast 0.9x	0.77	X	9.56	X	41.38	X	0.55	X	0.7] =	105.54	(75)
Northeast 0.9x	0.77	X	4.62	X	41.38	X	0.55	X	0.7] =	51.01	(75)
Northeast _{0.9x}	0.77	X	9.56	X	67.96	X	0.55	X	0.7] =	173.33	(75)
Northeast _{0.9x}	0.77	X	4.62	X	67.96	X	0.55	X	0.7] =	83.77	(75)
Northeast _{0.9x}	0.77	X	9.56	X	91.35	X	0.55	X	0.7] =	232.99	(75)
Northeast _{0.9x}	0.77	X	4.62	X	91.35	X	0.55	X	0.7	=	112.6	(75)
Northeast _{0.9x}	0.77	X	9.56	X	97.38	X	0.55	X	0.7	=	248.39	(75)
Northeast _{0.9x}	0.77	X	4.62	X	97.38	X	0.55	X	0.7	=	120.04	(75)
Northeast _{0.9x}	0.77	X	9.56	X	91.1	X	0.55	X	0.7	=	232.37	(75)
Northeast _{0.9x}	0.77	X	4.62	X	91.1	X	0.55	X	0.7	=	112.29	(75)
Northeast _{0.9x}	0.77	X	9.56	X	72.63	X	0.55	X	0.7] =	185.25	(75)
Northeast _{0.9x}	0.77	X	4.62	X	72.63	X	0.55	X	0.7	=	89.52	(75)
Northeast _{0.9x}	0.77	X	9.56	X	50.42	X	0.55	X	0.7	=	128.61	(75)
Northeast _{0.9x}	0.77	x	4.62	X	50.42	x	0.55	x	0.7] =	62.15	(75)
Northeast _{0.9x}	0.77	x	9.56	X	28.07	x	0.55	X	0.7] =	71.59	(75)
Northeast _{0.9x}	0.77	x	4.62	X	28.07	x	0.55	X	0.7	=	34.6	(75)
Northeast _{0.9x}	0.77	X	9.56	X	14.2	X	0.55	X	0.7	=	36.21	(75)
Northeast _{0.9x}	0.77	x	4.62	X	14.2	x	0.55	x	0.7	=	17.5	(75)
Northeast _{0.9x}	0.77	X	9.56	X	9.21	x	0.55	x	0.7	=	23.5	(75)
Northeast _{0.9x}	0.77	X	4.62	x	9.21	x	0.55	x	0.7	j =	11.36	(75)
Northwest 0.9x	0.77	×	4.17	x	11.28	x	0.55	x	0.7	Ī =	25.11	(81)
Northwest 0.9x	0.77	X	4.17	x	22.97	x	0.55	x	0.7	Ī =	51.1	(81)
Northwest _{0.9x}	0.77	X	4.17	x	41.38	x	0.55	x	0.7	j =	92.07	(81)
Northwest _{0.9x}	0.77	x	4.17	x	67.96	x	0.55	x	0.7	Ī =	151.21	(81)
Northwest 0.9x	0.77	X	4.17	x	91.35	x	0.55	x	0.7	Ī =	203.26	(81)
Northwest _{0.9x}	0.77	X	4.17	x	97.38	x	0.55	x	0.7	j =	216.7	(81)
Northwest _{0.9x}	0.77	x	4.17	x	91.1	x	0.55	x	0.7	j =	202.71	(81)
Northwest 0.9x	0.77	x	4.17	x	72.63	x	0.55	x	0.7] =	161.61	(81)
Northwest _{0.9x}	0.77	x	4.17	x	50.42	x	0.55	x	0.7	j =	112.19	(81)
Northwest _{0.9x}	0.77	x	4.17	x	28.07	x	0.55	x	0.7	j =	62.45	(81)
Northwest 0.9x	0.77	x	4.17	x	14.2	x	0.55	x	0.7	j =	31.59	(81)
Northwest _{0.9x}	0.77	x	4.17	x	9.21	x	0.55	x	0.7	j =	20.5	(81)
Rooflights 0.9x	1	x	1.05	x	26	x	0.55	x	0.8	j =	10.81	(82)
Rooflights 0.9x	1	Īx	1.79	x	26	x	0.55	x	0.8	j =	18.43	(82)
Rooflights _{0.9x}	1	j x	1.05	x	54	x	0.55	x	0.8] =	22.45	(82)
Rooflights _{0.9x}	1	×	1.79	x	54	x	0.55	x	0.8] =	38.28	(82)
Rooflights _{0.9x}	1	i x	1.05	X	96	X	0.55	X	0.8	j =	39.92	(82)
Rooflights _{0.9x}	1	i x	1.79	X	96	x	0.55	x	0.8	j =	68.05	(82)
Rooflights _{0.9x}	1] x	1.05	X	150	X	0.55	X	0.8	j =	62.37	(82)
L		_				1		1	•	1		

Rooflights 0.	9x 1	X	1.79	9	x	150	x	0.55	X	0.8	=	106.33	(82)
Rooflights 0.	9x 1	x	1.05	5	x	192	x	0.55	x	0.8	=	79.83	(82)
Rooflights 0.	9x 1	x	1.79	9	x	192	x	0.55	x	0.8	=	136.1	(82)
Rooflights 0.	9x 1	X	1.05	5	x	200	x	0.55	X	0.8	=	83.16	(82)
Rooflights 0.	9x 1	X	1.79	9	x	200	x	0.55	x	0.8	=	141.77	(82)
Rooflights 0.	9x 1	x	1.05	5	x	189	x	0.55	x	0.8	=	78.59	(82)
Rooflights 0.	9x 1	X	1.79	9	x	189	x	0.55	x	0.8	=	133.97	(82)
Rooflights 0.	9x 1	X	1.05	5	x	157	x	0.55	x	0.8	=	65.28	(82)
Rooflights 0.	9x 1	X	1.79	9	x	157	x	0.55	X	0.8	=	111.29	(82)
Rooflights 0.	9x 1	X	1.05	5	X	115	x	0.55	x	0.8	=	47.82	(82)
Rooflights 0.	9x 1	X	1.79	9	X	115	x	0.55	X	0.8	=	81.52	(82)
Rooflights 0.	9x 1	X	1.05	5	x	66	X	0.55	x	0.8	=	27.44	(82)
Rooflights 0.	9x 1	X	1.79	9	x	66	x	0.55	x	0.8	=	46.78	(82)
Rooflights 0.	9x 1	X	1.05	5	X	33	x	0.55	x	0.8	=	13.72	(82)
Rooflights 0.	9x 1	X	1.79	9	x	33	x	0.55	X	0.8	=	23.39	(82)
Rooflights 0.	9x 1	X	1.05	5	x	21	x	0.55	X	0.8	=	8.73	(82)
Rooflights 0.	9x 1	X	1.79	9	X	21	x	0.55	X	0.8	=	14.89	(82)
Solar gains	in watts, calc	ulated	for each	month			(83)m	= Sum(74)m	(82)m				
(83)m= 97.	03 198.73 3	56.59	577.01	764.78	81	10.06 759.93	612	.94 432.28	242.87	7 122.41	78.98		(83)
Total gains	– internal and	d solar	(84)m =	(73)m	+ (8	33)m , watts						_	
	1 1												
(84)m= 382	.03 481.53 6	529.1	833.36	1004.99	10	34.47 974.26	832	.61 660.36	487.28	385.52	355.97		(84)
` ′	.03 481.53 6					34.47 974.26	832	.61 660.36	487.28	385.52	355.97		(84)
7. Mean in		ature (heating	season)				487.28	3 385.52	355.97	21	(84)
7. Mean in	nternal temper	rature (heating eriods in	season the livi	ng a	area from Tal			487.28	385.52	355.97	21	
7. Mean in Temperat	nternal temper ure during hea	rature (heating eriods in	season the livi	ng a	area from Tal	ole 9		487.28 Oct		355.97 Dec	21	
7. Mean in Temperat	nternal temper ure during hea factor for gair an Feb	rature (ating pe	heating eriods in ving are	season the livi a, h1,m	ng a	area from Tal	ole 9	Th1 (°C)				21	
7. Mean in Temperat Utilisation [86]m= 1	nternal temper ure during hea factor for gair an Feb	rature (ating pens for li Mar 0.95	heating eriods in ving area Apr	season the living a, h1,m May 0.61	ng a	area from Tal ee Table 9a) Jun Jul 0.42 0.31	ole 9	Th1 (°C) ug Sep 8 0.66	Oct	Nov	Dec	21	(85)
7. Mean in Temperat Utilisation Ja (86)m=	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperate	rature (ating pens for li Mar 0.95	heating eriods in ving area Apr	season the living a, h1,m May 0.61	ng a	area from Tal ee Table 9a) Jun Jul 0.42 0.31	ole 9	Th1 (°C) ug Sep 18 0.66 Table 9c)	Oct	Nov 0.99	Dec	21	(85)
7. Mean in Temperat Utilisation [86]m= 1 Mean inte (87)m= 19.	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperatu 59 19.84 2	ature (ating pens for limited Mar 0.95 ure in limited 20.26	heating eriods in ving area Apr 0.82 iving are 20.72	the living the living	ng a (Se	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7	ole 9 A 0.3 7 in T	Th1 (°C) ug Sep 18 0.66 Table 9c) 1 20.93	Oct 0.94	Nov 0.99	Dec 1	21	(85)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperatu 59 19.84 2 ure during hea	ature (ating pens for limited Mar 0.95 ure in limited 20.26	heating eriods in ving area Apr 0.82 iving are 20.72	the living the living	ng a (se constitution)	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7	ole 9 A 0.3 7 in T	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 9, Th2 (°C)	Oct 0.94	Nov 0.99	Dec 1	21	(85)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19.	rnal temperature during heat of the factor for gair an Feb 0.99 rnal temperature during heat 19.78 19.78	ature (ating pens for li Mar 0.95 ure in li 20.26 ating pens 19.79	heating eriods in ving are Apr 0.82 iving are 20.72 eriods in 19.8	the living a, h1,m May 0.61 rest of 19.8	ng a (se color) of the color of	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81	ole 9 A 0.3 7 in T 2 able 9	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 9, Th2 (°C)	Oct 0.94 20.53	Nov 0.99	Dec 1	21	(85) (86) (87)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation	rnal temperature during heat factor for gair no 199 no 19.84 20 no 19.84 20 no 19.84 20 no 19.84 20 no 19.78 19.78 19.78 factor for gair	ature (ating pens for li Mar 0.95 ure in li 20.26 ating pens for restrictions for restrictions at the second se	heating eriods in ving are 0.82 iving are 20.72 eriods in 19.8 est of dw	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling,	ng a (se color) of the color of	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table	A 0.37 in T 2 19. 19. 9a)	Th1 (°C) ug Sep 18 0.66 Table 9c) 1 20.93 10, Th2 (°C) 81 19.81	Oct 0.94 20.53	Nov 0.99 19.96	Dec 1 19.55	21	(85) (86) (87) (88)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9	rnal temperature during hear factor for gair no.99 rnal temperature during hear 19.78 19.78 factor for gair no.98	ature (ating pens for limited	heating eriods in ving area 0.82 iving are 20.72 eriods in 19.8 est of dw	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54	mg (second of the second of th	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23	A 0.3 on T 19. on T 1	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81	Oct 0.94 20.53 19.8 0.91	Nov 0.99	Dec 1	21	(85) (86) (87)
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7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9	rnal temperature during heat of temperature duri	ature (ating pens for limited	heating eriods in ving area 0.82 iving are 20.72 eriods in 19.8 est of dw	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54	ng a (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) are colors) and (see colors) are	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23	A 0.3 on T 19. on T 1	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 10.57 to 7 in Table 81 19.78	Oct 0.94 20.53 19.8 0.91 e 9c)	Nov 0.99 19.96 19.79 0.99	Dec 1 19.55 19.79 1		(85) (86) (87) (88) (89)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte	rnal temperature during heat of temperature duri	ature (ating persons for li Mar 0.95 ure in li 20.26 ating persons for re 0.93 ure in t	heating eriods in ving are 20.72 eriods in 19.8 est of dw 0.77 he rest of	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling)	ng a (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) and (see colors) are colors) and (see colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) and (see colors) are colors) and (see colors) are colors) are colors) are colors) and (see colors) are	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste	A 0.37 in T 2 able (19. 9a) 0.2 eps 3	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 10.57 to 7 in Table 81 19.78	Oct 0.94 20.53 19.8 0.91 e 9c)	Nov 0.99 19.96 19.79	Dec 1 19.55 19.79 1	0.57	(85) (86) (87) (88) (89)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18.	rnal temperature during heat of temperature duri	ature (ating pens for limited	heating eriods in ving area (a.82) diving area (a.72) eriods in 19.8 est of dw (a.77) he rest of 19.6	the living the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 rest of dwelling, 0.54 bf dwelling, 19.76	ng a (see) (collor) (dw 1 1 1 1	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81	9a) 0.2 eps 3	Th1 (°C) ug Sep 18 0.66 Table 9c) 1 20.93 19, Th2 (°C) 81 19.81 10.57 10 7 in Table 11 19.78	Oct 0.94 20.53 19.8 0.91 e 9c)	Nov 0.99 19.96 19.79 0.99	Dec 1 19.55 19.79 1		(85) (86) (87) (88) (89)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19.	rnal temperature during hear factor for gair for gair for gair for gair for gair factor for gair for gair for gair factor for gair factor for gair	ature (ating pens for limited for limited for real limited for lim	heating eriods in ving area (a.82) iving area (a.72) eriods in (a.77) he rest of the who (a.20.23)	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling) of dwelling 19.76 of dwelling 20.43	ng a (see color) oblio dw 1 h2, cling 1	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 19.78 to 7 in Tabl 81 19.78 f	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1		(85) (86) (87) (88) (89)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19. Apply adjuite 19.	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperatu 59 19.84 2 ure during hea 78 19.78 factor for gair 99 0.98 rnal temperatu 52 18.77 rnal temperatu 13 19.38 ustment to the	ature (ating persons for li Mar 0.95 ure in li 20.26 ating persons for re 0.93 ure in t 19.17 ure (for 19.79 mean	heating eriods in ving are 0.82 iving are 20.72 eriods in 19.8 est of dw 0.77 he rest of 19.6 the who 20.23 internal	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling, 19.76 ole dwe 20.43 temper	ng a collor of the collor of t	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48 re from Table	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 88 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 19.78 to 7 in Tabl 81 19.78 f	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1 18.49		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19.	nternal temper ure during hea factor for gair an Feb 0.99 rnal temperatu 59 19.84 2 ure during hea 78 19.78 factor for gair 99 0.98 rnal temperatu 52 18.77 rnal temperatu 13 19.38 ustment to the	ature (ating pens for limited for limited for real limited for lim	heating eriods in ving area (a.82) iving area (a.72) eriods in (a.77) he rest of the who (a.20.23)	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling) of dwelling 19.76 of dwelling 20.43	ng a collor of the collor of t	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 9, Th2 (°C) 81 19.81 19.77 to 7 in Tabl 81 19.78 f - fLA) × T2 48 20.43 where approximation of the second o	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1 18.49		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19. Apply adju (93)m= 18. 8. Space	rnal temperature during heating require during heating require to the properature during heating require during heating require during heating require during heating require during heating require during heating require	ature (ating persons for real parts) ating persons for real parts	heating eriods in ving are Apr 0.82 iving are 20.72 eriods in 19.8 est of dw 0.77 he rest of 19.6 the who 20.23 internal 20.08	the living a, h1,m May 0.61 a T1 (for 20.94 rest of 19.8 velling, 0.54 of dwelling 19.76 ble dwe 20.43 temper 20.28	ng a collor of the collor of t	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48 re from Table 0.33 20.33	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 0, Th2 (°C) 81 19.81 19.81 19.78 to 7 in Tabl 81 19.78 f - fLA) × T2 48 20.43 where approximates a second	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv 20.06 ppriate 19.91	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1 18.49 4) =	0.57	(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperat Utilisation (86)m= 1 Mean inte (87)m= 19. Temperat (88)m= 19. Utilisation (89)m= 0.9 Mean inte (90)m= 18. Mean inte (92)m= 19. Apply adjute (93)m= 18. 8. Space Set Ti to to to to to to to to to to to to to	rnal temperature during hear factor for gair for gair for gair for gair for gair factor for gair for gair factor for gair factor for gair	ature (ating pens for in 10.95 ating pens for reconstruction of 19.79 at 19.17 at 19.17 at 19.17 at 19.17 at 19.64 at 19	heating eriods in ving area (a.82) iving area (a.72) eriods in (a.77) he rest of the who (a.73) internal (a.0.8) internal (a.0.8)	the living a, h1,m May 0.61 ea T1 (for 20.94) rest of 19.8 velling, 0.54 of dwelling, 19.76 ble dwe 20.43 temper 20.28 e obtain	ng a collor of the collor of t	area from Talee Table 9a) Jun Jul 0.42 0.31 w steps 3 to 7 0.99 21 elling from Ta 9.81 19.81 m (see Table 0.34 0.23 T2 (follow ste 9.81 19.81 g) = fLA × T1 0.48 20.48 re from Table 0.33 20.33	9a) 0.2 eps 3 19. + (1 20.	Th1 (°C) ug Sep 8 0.66 Table 9c) 1 20.93 0, Th2 (°C) 81 19.81 19.81 19.78 to 7 in Tabl 81 19.78 f - fLA) × T2 48 20.43 where approximates a second	Oct 0.94 20.53 19.8 0.91 e 9c) 19.45 LA = Liv 20.06 ppriate 19.91	Nov 0.99 19.96 19.79 0.99 18.9 ring area ÷ (4	Dec 1 19.55 19.79 1 18.49 4) =	0.57	(85) (86) (87) (88) (89) (90) (91)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisation fa	actor for o	ains, hm	1:										
(94)m= 0.99	0.98	0.93	0.79	0.57	0.38	0.26	0.32	0.61	0.91	0.98	0.99		(94)
Useful gain:	s, hmGm	, W = (94	4)m x (8	4)m					Į.	Į.			
(95)m= 378.92	2 471.43	586.4	655.24	570.01	389.8	255.75	268.12	402.46	443.43	379.08	353.79		(95)
Monthly ave	erage exte	ernal tem	perature	from Ta	able 8								
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	-	an interr	al tempe	erature,		=[(39)m :	x [(93)m	– (96)m	ī —	•			
(97)m= 1037.5		924.41	778.07	595.49	393.07	256.24	269.29	426.24	646.45	854.48	1032.6		(97)
Space heat		1											
(98)m= 490.0	5 362.05	251.48	88.44	18.96	0	0	0	0	151.05	342.28	505.03		-
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2209.34	(98)
Space heat	ing requir	ement in	kWh/m²	² /year								43.07	(99)
9a. Energy re	equireme	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heat	•										Ī		_
Fraction of	space hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fraction of	space hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction of	total heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency o	f main sp	ace heat	ing syste	em 1								90.3	(206)
Efficiency o	f seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heat	ing requir	ement (c	alculate	d above))			•					
490.0	5 362.05	251.48	88.44	18.96	0	0	0	0	151.05	342.28	505.03		
(211)m = {[(9	98)m x (20	04)] } x 1	100 ÷ (20	06)									(211)
542.69	9 400.94	278.49	97.94	20.99	0	0	0	0	167.27	379.05	559.28		
							Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}		2446.67	(211)
Space heat	ing fuel (s	econdar	y), kWh/	month									
$= \{[(98)m \times (2)]\}$													
(215)m= 0	0	0	0	0	0	0	0	0	0	0	0		_
							Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
Water heating	•												
Output from		149.9	ulated a 132.95	128.72	113.37	108.62	121.08	122.42	139.4	148.81	161.06		
Efficiency of		l .	102.00	120.72	110.07	100.02	121.00	122.72	100.4	140.01	101.00	81	(216)
(217)m= 87.76	-	86.59	84.48	82.09	81	81	81	81	85.58	87.26	87.86		(217)
Fuel for wate		L		02.00	0.			<u> </u>	00.00	07.20	07.00		()
(219)m = (64)	•						_						
(219)m= 187.93	3 164.77	173.12	157.39	156.82	139.96	134.1	149.49	151.14	162.88	170.53	183.31		
							Tota	I = Sum(2	19a) ₁₁₂ =			1931.43	(219)
Annual total									k\	Wh/year	•	kWh/year	_
Space heatir	ng fuel us	ed, main	system	1								2446.67	_
Water heatin	g fuel use	ed										1931.43	
Electricity for	pumps, f	ans and	electric	keep-ho	t								

mechanical ventilation - balanced, extract or positive input from o	outside		111.95		(230a)
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a)	(230g) =		186.95	(231)
Electricity for lighting				237.12	(232)
Electricity generated by PVs				-821.33	(233)
12a. CO2 emissions – Individual heating systems including micro	-CHP				

12d. 002 citii33i0fi3 – ilidividdai ficatirig 3ysterik	s morading more or ii		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	528.48 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216	417.19 (264)
Space and water heating	(261) + (262) + (263) + (264) =		945.67 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	97.03 (267)
Electricity for lighting	(232) x	0.519 =	123.07 (268)
Energy saving/generation technologies Item 1		0.519 =	-426.27 (269)
Total CO2, kg/year	sum	of (265) (271) =	739.49 (272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	14.42 (273)
El rating (section 14)			90 (274)

User Details: STRO016363 **Assessor Name:** Chris Hocknell Stroma Number: Stroma FSAP 2012 **Software Version:** Version: 1.0.4.12 **Software Name:** Property Address: Apartment 2 Address: 1. Overall dwelling dimensions Area(m²) Av. Height(m) Volume(m³) Ground floor 61.1 (1a) x 2.7 (2a) =164.97 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)61.1 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =164.97 (5) other total main secondary m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 0 O 0 0 (6b) Number of intermittent fans x 10 =(7a) 0 0 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = \div (5) = (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)n Additional infiltration (10)[(9)-1]x0.1 =0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)Λ if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35 If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)If no draught lobby, enter 0.05, else enter 0 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =n (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)3 If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise (18) = (16)0.15 (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)3 $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78 $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.12 Infiltration rate modified for monthly wind speed Jan Feb Jul Sep Oct Nov Mar Apr Mav Jun Aug Dec Monthly average wind speed from Table 7 (22)m=4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor $(22a)m = (22)m \div 4$ (22a)m 1.27 1.25 1.23 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18 1.1

Adjusted infiltra	ation rate (a	allowii	ng for sh	ielter an	d wind s	speed) =	(21a) x	(22a)m				1	
0.15 Calculate effec).14 ange r	0.13	0.12 he appli	0.11	0.11	0.11	0.12	0.12	0.13	0.14]	
If mechanica		_	ale for t	те арри	ouble of	.00						0.5	(23
If exhaust air he	eat pump using	g Appe	endix N, (2	3b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recovery	y: effici	ency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				75.65	(23
a) If balance	d mechanio	cal ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24a)m= 0.27	0.27 0).26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(24
b) If balance	d mechanio	cal ve	ntilation	without	heat red	covery (I	MV) (24b)m = (22	2b)m + (2	23b)	,	1	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
c) If whole h if (22b)n	ouse extrac n < 0.5 × (2			•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)n	ventilation on the second								0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change rate	e - en	ter (24a) or (24h	o) or (24	c) or (24	d) in bo	x (25)					
25)m= 0.27	0.27 0).26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(25
3. Heat losse	s and heat	loss p	aramete	er:									
LEMENT	Gross area (m²		Openin m	gs	Net Aı A ,ı		U-val W/m2		A X U (W/ł	〈)	k-value kJ/m²-		A X k J/K
Doors					2	х	1.3		2.6				(26
Vindows Type	1				8.26	x1	/[1/(1.3)+	0.04] =	10.21				(27
Vindows Type	2				4.21	x1	/[1/(1.3)+	0.04] =	5.2				(27
Vindows Type	3				3.21	x1	/[1/(1.3)+	0.04] =	3.97				(27
Vindows Type	4				4.37	x1	/[1/(1.3)+	0.04] =	5.4				(2
Rooflights					1.61	x1	/[1/(1.6) +	0.04] =	2.576				(27
Valls Type1	38.95		20.0	5	18.9	X	0.15	=	2.84				(29
Valls Type2	45.47		2		43.4	7 X	0.13	=	5.81				(29
Roof	61.1		1.61		59.49) x	0.1	=	5.95				(30
otal area of e	lements, m	2			145.5	2							(3
for windows and						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	1 3.2	
* include the area abric heat los				s and par	titions		(26) (30) + (32) =					
leat capacity		•	0)				(20) (00	((28)	(30) + (32	2) + <i>(</i> 32a)	(32e) =	12385.71	(3:
hermal mass	•	,) = Cm ÷	- TFA) ir	n kJ/m²K			***	itive Value:	, , ,	(020)	250	(3!
or design assess	•	•		,			recisely the				able 1f		
an be used instea													
hermal bridge	,	•		• .	•	K						12.49	(3
details of thermatoric head		not kn	own (36) =	: U.15 x (3	11)			(33) +	(36) =			56.87	(3
								()	()			30.07	
entilation hea	it loss calci	ulated	monthly	/				(38)m	= 0.33 × (25)m x (5))		

_								,					•	
(38)m=	14.7	14.54	14.38	13.59	13.43	12.64	12.64	12.48	12.96	13.43	13.75	14.06		(38)
Heat tra	ınsfer c	oefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	71.57	71.41	71.25	70.46	70.31	69.51	69.51	69.36	69.83	70.31	70.62	70.94		_
Heat los	ss para	meter (H	HLP), W/	/m²K	_	_		_		Average = = (39)m ÷	Sum(39) ₁	12 /12=	70.42	(39)
(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.16	1.16		_
Number	of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.15	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	-		-	-	-	-	-	-	-	-	-	-	•	
4. Wate	er heat	ing ener	rgy requi	irement:								kWh/ye	ear:	
Assume	אל טכנוו	nancy I	NI									04	Ī	(42)
if TFA), N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		.01		(42)
Annual a	averag	e hot wa										32		(43)
Reduce the		•		0 ,		•	Ū	to achieve	a water us	se target o	f			
Г			<i>'</i>	<u> </u>			<u> </u>	Ι Δα	Con	Oat	Nov	l Doo		
Hot water	Jan usage in	Feb litres per	Mar day for ea	Apr ach month	May Vd,m = fa	Jun ctor from 7	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	90.2	86.92	83.64	80.36	77.08	73.8	73.8	77.08	80.36	83.64	86.92	90.2		
(11)	00.2	00.02	00.01	00.00	77.00	70.0	7 0.0	177.00			m(44) _{1 12} =	<u> </u>	983.98	(44)
Energy co	ontent of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	133.76	116.99	120.72	105.25	100.99	87.14	80.75	92.66	93.77	109.28	119.29	129.54		
If instants	22222	atar baatii	na at naint	of was (no	hot water	r otorogo)	antar O in	boxes (46		Total = Su	m(45) _{1 12} =	=	1290.15	(45)
_			· ·		1		ı		` '	40.00	17.00	10.40		(46)
(46)m= Water si	20.06 torage	17.55 loss:	18.11	15.79	15.15	13.07	12.11	13.9	14.07	16.39	17.89	19.43		(46)
	_		includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comm	unity h	eating a	nd no ta	ınk in dw	elling, e	nter 110	litres in	(47)					1	
			hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water st	•		eclared l	oce fact	or ic kno	wo (k\\/k	a/dayı):						İ	(40)
Tempera					טווא פו וכ	wii (Kvvi	i/uay).					0		(48) (49)
Energy					ear			(48) x (49)) =			0		(50)
			eclared o	-		or is not		(10) X (10)	,			0		(30)
Hot water		_			e 2 (kW	h/litre/da	ay)					0		(51)
If comm Volume	-	_		on 4.3								_	1	(50)
Tempera				2h							-	0		(52) (53)
Energy					aar			(47) x (51)	\ v (52) v (53) =				
Enter (5			-	, KVVII/ yt	zai			(41) X (31)	/ X (32) X (55) =	-	0		(54) (55)
Water s	, ,	, ,	,	for each	month			((56)m = (55) × (41)ı	m				(,
(56)m=	0 1	0	0	0	0	0	0	0	0	0	0	0		(56)
		-	_			-	-	0), else (5			-	-	I ix H	. ,
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
<u> </u>					•	•	•	•			•	•	•	

Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	0 (58)
(modified by factor from Table H5 if there is solar water heating and a cylinder therr	
(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	<u></u>
(61)m= 45.96 40.01 42.62 39.63 39.28 36.39 37.61 39.28 39.63 42.62	2 42.86 45.96 (61)
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m	+ (46)m + (57)m + (59)m + (61)m
(62)m= 179.73 156.99 163.34 144.88 140.27 123.54 118.36 131.94 133.4 151.	9 162.15 175.5 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contril	bution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	
(63)m= 0 0 0 0 0 0 0 0 0 0	0 0 (63)
Output from water heater	
(64)m= 179.73 156.99 163.34 144.88 140.27 123.54 118.36 131.94 133.4 151.	9 162.15 175.5
Output from water hea	ater (annual) _{1 12} 1782.01 (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= 55.97 48.9 50.8 44.9 43.4 38.07 36.25 40.63 41.09 46.9	9 50.38 54.56 (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 Oc	t Nov Dec
(66)m= 100.63 100.63 100.63 100.63 100.63 100.63 100.63 100.63 100.63 100.63	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 15.66 13.91 11.32 8.57 6.4 5.41 5.84 7.59 10.19 12.9	4 15.1 16.1 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 175.71 177.54 172.94 163.16 150.81 139.21 131.45 129.63 134.23 144.0	01 156.35 167.96 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 33.06 33.06 33.06 33.06 33.06 33.06 33.06 33.06 33.06 33.06 33.06	6 33.06 33.06 (69)
Pumps and fans gains (Table 5a)	0 00.00 00.00
(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3	3 3 (70)
	3 3 (70)
Losses e.g. evaporation (negative values) (Table 5) (71)m= -80.5	5 -80.5 -80.5 (71)
	3 -80.5 -80.5
Water heating gains (Table 5)	0 00 07 70 04 (72)
(72)m= 75.22 72.77 68.27 62.36 58.33 52.88 48.73 54.61 57.06 63.10	
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m +	
(73)m= 322.79 320.41 308.72 290.28 271.73 253.68 242.21 248.02 257.67 276.	3 297.62 313.59 (73)
6. Solar gains:	aghla ariantation
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applications.	
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b	FF Gains Table 6c (W)
Northeast 0.9x 0.77 x 4.21 x 11.28 x 0.55 x	0.7 = 12.67 (75)
Northeast 0.9x	0.7 = 25.8 (75)
	20.0

Northeast _{0.9x}	^ 77	1		1 .,	14.00	1 .,	0.55	l		1 _	10.40	7(75)
Northeast 0.9x	0.77	X	4.21	X	41.38	X	0.55	X	0.7	= 	46.48	(75)
Northeast 0.9x	0.77	X	4.21	X	67.96	X	0.55	X	0.7	=	76.33	(75)
<u> </u>	0.77	X	4.21	X	91.35	X	0.55	X	0.7	= 	102.6	(75)
Northeast 0.9x	0.77] X]	4.21	X	97.38	X	0.55	X	0.7	= 	109.39	(75)
Northeast 0.9x	0.77	X	4.21	X	91.1	X	0.55	X	0.7	= 	102.33	(75)
Northeast _{0.9x}	0.77	X	4.21	X	72.63	X	0.55	X	0.7	=	81.58	<u> </u> (75)
Northeast 0.9x	0.77	X	4.21	X	50.42	X	0.55	X	0.7	=	56.63	(75)
Northeast _{0.9x}	0.77	X	4.21	X	28.07	X	0.55	X	0.7	=	31.53	(75)
Northeast _{0.9x}	0.77	X	4.21	X	14.2	X	0.55	X	0.7	=	15.95	(75)
Northeast 0.9x	0.77	X	4.21	X	9.21	X	0.55	X	0.7	=	10.35	(75)
Northwest 0.9x	0.77	X	8.26	X	11.28	X	0.55	X	0.7	=	24.87	(81)
Northwest _{0.9x}	0.77	X	3.21	X	11.28	X	0.55	X	0.7	=	9.66	(81)
Northwest _{0.9x}	0.77	X	4.37	X	11.28	X	0.55	X	0.7	=	13.16	(81)
Northwest 0.9x	0.77	X	8.26	X	22.97	X	0.55	X	0.7	=	50.61	(81)
Northwest 0.9x	0.77	X	3.21	X	22.97	X	0.55	X	0.7	=	19.67	(81)
Northwest 0.9x	0.77	X	4.37	x	22.97	x	0.55	x	0.7	=	26.78	(81)
Northwest 0.9x	0.77	X	8.26	X	41.38	X	0.55	X	0.7	=	91.19	(81)
Northwest 0.9x	0.77	X	3.21	X	41.38	x	0.55	x	0.7	=	35.44	(81)
Northwest _{0.9x}	0.77	X	4.37	X	41.38	X	0.55	X	0.7	=	48.25	(81)
Northwest _{0.9x}	0.77	X	8.26	X	67.96	x	0.55	X	0.7	=	149.76	(81)
Northwest _{0.9x}	0.77	X	3.21	x	67.96	x	0.55	x	0.7	=	58.2	(81)
Northwest 0.9x	0.77	x	4.37	x	67.96	x	0.55	x	0.7	j =	79.23	(81)
Northwest 0.9x	0.77	x	8.26	x	91.35	x	0.55	x	0.7	j =	201.31	(81)
Northwest 0.9x	0.77	x	3.21	x	91.35	x	0.55	x	0.7	j =	78.23	(81)
Northwest 0.9x	0.77	x	4.37	x	91.35	x	0.55	x	0.7	j =	106.5	(81)
Northwest 0.9x	0.77	x	8.26	x	97.38	x	0.55	x	0.7	j =	214.62	(81)
Northwest _{0.9x}	0.77	x	3.21	x	97.38	х	0.55	x	0.7	j =	83.4	(81)
Northwest 0.9x	0.77	x	4.37	x	97.38	x	0.55	x	0.7	j =	113.54	(81)
Northwest 0.9x	0.77	x	8.26	x	91.1	х	0.55	x	0.7	j =	200.77	(81)
Northwest 0.9x	0.77	X	3.21	x	91.1	x	0.55	x	0.7	j =	78.02	(81)
Northwest 0.9x	0.77	x	4.37	x	91.1	x	0.55	x	0.7	j =	106.22	(81)
Northwest 0.9x	0.77	X	8.26	x	72.63	x	0.55	x	0.7	j =	160.06	(81)
Northwest 0.9x	0.77	X	3.21	x	72.63	x	0.55	x	0.7	j =	62.2	(81)
Northwest _{0.9x}	0.77	X	4.37	x	72.63	x	0.55	x	0.7	j =	84.68	(81)
Northwest _{0.9x}	0.77	x	8.26	×	50.42	x	0.55	x	0.7	=	111.12	(81)
Northwest _{0.9x}	0.77	X	3.21	X	50.42	X	0.55	x	0.7	=	43.18	(81)
Northwest _{0.9x}	0.77	X	4.37	X	50.42	X	0.55	x	0.7	 =	58.79	(81)
Northwest _{0.9x}	0.77	X	8.26	X	28.07	X	0.55	x	0.7	 =	61.85	(81)
Northwest _{0.9x}	0.77) x	3.21	X	28.07	X	0.55	x	0.7	 =	24.04	(81)
Northwest _{0.9x}	0.77	X	4.37	X	28.07	X	0.55	x	0.7	 =	32.72	(81)
Northwest _{0.9x}	0.77	X	8.26	X	14.2) x	0.55	x	0.7	 =	31.29	(81)
_		1		1		1		I	<u> </u>	ı		

Northwest 0.	9x 0.77	X	3.2	1	X	14.2	X	0.55	X	0.7	=	12.16	(81)
Northwest 0.	0.77	x	4.3	7	X	14.2	X	0.55	×	0.7	=	16.55	(81)
Northwest 0.	0.77	X	8.2	6	X	9.21	X	0.55	x	0.7	=	20.31	(81)
Northwest 0.	0.77	X	3.2	1	x	9.21	X	0.55	x	0.7	=	7.89	(81)
Northwest 0.	0.77	X	4.3	7	x	9.21	X	0.55	×	0.7	=	10.74	(81)
Rooflights 0.9	9x 1	X	1.6	1	X	26	X	0.55	x	0.8	=	16.58	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	54	X	0.55	×	0.8	=	34.43	(82)
Rooflights 0.9	9x 1	x	1.6	1	X	96	Īx	0.55	x	0.8		61.21	(82)
Rooflights 0.	9x 1	X	1.6	1	x	150	X	0.55	x	0.8	=	95.63	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	192	x	0.55	x	0.8	=	122.41	(82)
Rooflights 0.9	9x 1	X	1.6	1	X	200	X	0.55	x	0.8	=	127.51	(82)
Rooflights 0.9	9x 1	X	1.6	1	X	189	X	0.55	X	0.8	=	120.5	(82)
Rooflights 0.9	9x 1	X	1.6	1	X	157	X	0.55	x	0.8	=	100.1	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	115	X	0.55	X	0.8	=	73.32	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	66	X	0.55	X	0.8	=	42.08	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	33	X	0.55	X	0.8	=	21.04	(82)
Rooflights 0.9	9x 1	X	1.6	1	x	21	X	0.55	X	0.8	=	13.39	(82)
Solar gains in watts, calculated for each month (83)m = Sum(74)m (82)m													
(83)m= 76.93 157.29 282.56 459.16 611.06 648.46 607.84 488.61 343.04 192.22 96.98 62.68 (83)													
Total gains	 internal and 	d solar	(84)m =	(73)m	+ (8	33)m , watts						_	
Total gains – internal and solar (84) m = (73) m + (83) m , watts (84) m= 399.72 477.69 591.28 749.44 882.8 902.15 850.05 736.63 600.71 468.52 394.6 376.27 (84)													
(84)m= 399.	72 477.69 5	91.28	749.44	882.8	90	02.15 850.05	736	.63 600.71	468.5	2 394.6	376.27]	(84)
` '	72 477.69 5 ternal temper)2.15 850.05	736	.63 600.71	468.5	2 394.6	376.27		(84)
7. Mean in		ature (heating	season	1)				468.5	2 394.6	376.27	21	(84)
7. Mean in	ternal temper	rature (ating pe	heating eriods in	season the livi	n) ing	area from Ta			468.5	2 394.6	376.27	21	
7. Mean in	ternal temper ure during hea factor for gair	rature (ating pe	heating eriods in	season the livi	ing a	area from Ta	ble 9		468.5		376.27	21	
7. Mean in Temperate Utilisation	ternal temper ure during hea factor for gair n Feb	rature (ating pe	heating eriods in ving are	season the livi a, h1,m	ng (so	area from Ta	ble 9	, Th1 (°C)				21	
7. Mean in Temperate Utilisation Ja (86)m= 1	ternal temper ure during hea factor for gair n Feb	rature (ating pe ns for li Mar 0.97	heating eriods in ving are Apr	season the livi a, h1,m May	n) ing in (se	area from Ta ee Table 9a) Jun Jul 0.49 0.36	ble 9	, Th1 (°C) ug Sep	Oct	Nov	Dec	21	(85)
7. Mean in Temperate Utilisation Ja (86)m= 1	ternal temper ure during hea factor for gair n Feb 0.99	rature (ating pe ns for li Mar 0.97	heating eriods in ving are Apr	season the livi a, h1,m May	ing (so	area from Ta ee Table 9a) Jun Jul 0.49 0.36	ble 9	Th1 (°C) Sep 0.73 able 9c)	Oct	Nov 0.99	Dec	21	(85)
7. Mean in Temperate Utilisation [86]m= 1 Mean interest [87]m= 19.7	ternal temper ure during hea factor for gair n Feb 0.99 rnal temperatu	ature (ating pens for limited Mar 0.97 ure in limited 20.3	heating eriods in ving are Apr 0.88 iving are 20.71	season the livi a, h1,m May 0.69 ea T1 (fo	ing (sollo	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21	A 0.47 in 1 2	Sep 13 0.73 Table 9c) 1 20.93	Oct 0.96	Nov 0.99	Dec 1	21	(85)
7. Mean in Temperatu Utilisation Ja (86)m= 1 Mean inter (87)m= 19.7	ternal temper ure during hea factor for gair n Feb 0.99 rnal temperature 19.97 ure during hea	ature (ating pens for limited Mar 0.97 ure in limited 20.3	heating eriods in ving are Apr 0.88 iving are 20.71	season the livi a, h1,m May 0.69 ea T1 (fo	n (se collo	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21	A 0.47 in 1 2	Sep 3 0.73 able 9c) 1 20.93 9, Th2 (°C)	Oct 0.96	Nov 0.99	Dec 1	21	(85)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.3 Temperatu (88)m= 19.9	ternal temperater during heat factor for gair n Feb 0.99 rnal temperater 19.97 ure during heat 19.95	ating pens for limber of l	heating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96	ng (sollo ollo dw	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97	A 0.2 7 in 1 2 able 9	Sep 3 0.73 able 9c) 1 20.93 9, Th2 (°C)	Oct 0.96	Nov 0.99	Dec 1	21	(86)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation	ternal temper ure during hea factor for gair n Feb 0.99 cmal temperature during hea 19.95 cm factor for gair	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re	heating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling,	ollo h2,	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table	A 0.4 7 in 1 2 able 9 19.	Sep 13 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97	Oct 0.96 20.57	Nov 0.99 20.09	Dec 1 19.75	21	(85) (86) (87) (88)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.9 Utilisation (89)m= 1	ternal temper ure during hea factor for gair n Feb 0.99 cmal temperature during hea 19.95 cm factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63	(sollo ollo 1 h2,	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28	A 0.4 7 in 1 2 able 9 19. 9a) 0.3	Sep 13 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97	Oct 0.96 20.57 19.96 0.94	Nov 0.99	Dec 1	21	(86)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.9 Utilisation (89)m= 1 Mean inter	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96 ure in t	heating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of	season the livi ta, h1,m 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell	n (secollo 2 dw 1 h2, ing	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st	A 0.2 7 in T 2 able 9 19. e 9a) 0.3 eps 3	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Table	Oct 0.96 20.57 19.96 0.94 e 9c)	Nov 0.99 20.09 19.96	Dec 1 19.75 19.95	21	(85) (86) (87) (88)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.9 Utilisation (89)m= 1	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63	n (secollo 2 dw 1 h2, ing	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28	A 0.4 7 in 1 2 able 9 19. 9a) 0.3	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 to 7 in Table 97 19.93	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63	Nov 0.99 20.09 19.96 0.99	Dec 1 19.75 19.95		(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.9 Utilisation (89)m= 1 Mean inter	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96 ure in t	heating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of	season the livi ta, h1,m 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell	n (secollo 2 dw 1 h2, ing	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st	A 0.2 7 in T 2 able 9 19. e 9a) 0.3 eps 3	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 to 7 in Table 97 19.93	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63	Nov 0.99 20.09 19.96	Dec 1 19.75 19.95	21	(85) (86) (87) (88)
7. Mean in Temperate Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1 Mean inter (90)m= 18.8	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 factor for gair 0.99	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96 ure in t	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell	ollo 1 1 1 1 1 1 1 1 1	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97	A 0.4 7 in 1 2 able 9 19. e 9a) 0.3 eps 3	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 to 7 in Table 97 19.93	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63	Nov 0.99 20.09 19.96 0.99	Dec 1 19.75 19.95		(85) (86) (87) (88) (89)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1 Mean interest (90)m= 18.8	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 factor for gair 0.99 That temperature during heat 19.95 factor for gair 19.95 That temperature during heat 19.95 That temperature during heat 19.95 That temperature during heat 19.95	ature (ating pens for li Mar 0.97 ure in li 20.3 ating pens for re 0.96 ure in t	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74	season the livina, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell	ollo (sollo 2 de la la la la la la la la la la la la la	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97	A 0.4 7 in 1 2 able 9 19. e 9a) 0.3 eps 3	Th1 (°C) ug Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Table 97 19.93 f - fLA) × T2	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63	Nov 0.99 20.09 19.96 0.99 19.16 ving area ÷ (4	Dec 1 19.75 19.95		(85) (86) (87) (88) (89)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1 Mean interest (90)m= 18.8 Mean interest (92)m= 19.5	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 factor for gair 0.99 That temperature during heat 19.95 factor for gair 19.95 That temperature during heat 19.95 That temperature during heat 19.95 That temperature during heat 19.95	ature (ating pens for limited for limited for red) ating pens for red for limited for limi	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74 results the whole 20.18	season the livi a, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell 19.92 ole dwe 20.38	ollo 2 1 h2, (see 1 1 1 1 1 1 2 2 2 (see 1 1 1 1 1 1 1 1 1	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97 g) = fLA × T1 0.43 20.43	A 0.4 7 in 1 2 able 9 19. e 9a) 0.3 eps 3 19. + (1 20.	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Table 97 19.93 f - fLA) × T2 43 20.39	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63 LA = Liv	Nov 0.99 20.09 19.96 0.99	Dec 1 19.75 19.95		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperate Utilisation (86)m= 1 Mean interest (87)m= 19.5 Temperate (88)m= 19.5 Utilisation (89)m= 1 Mean interest (90)m= 18.8 Mean interest (92)m= 19.5	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 That temperature during heat	ature (ating pens for limited for limited for red) ating pens for red for limited for limi	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74 results the whole 20.18	season the livi a, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell 19.92 ole dwe 20.38	ollo 2 fing (sollo 2) find (area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97 g) = fLA × T1 0.43 20.43	A 0.4 7 in 1 2 able 9 19. e 9a) 0.3 eps 3 19. + (1 20.	Th1 (°C) ug Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Tabl 97 19.93 f - fLA) × T2 43 20.39 where approximates	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63 LA = Liv	Nov 0.99 20.09 19.96 0.99	Dec 1 19.75 19.95		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.5 Utilisation (89)m= 1 Mean inter (90)m= 18.8 Mean inter (92)m= 19.2 Apply adju (93)m= 19.5	ternal temperature during heat factor for gair n Feb 0.99 That temperature during heat 19.95 That temperature during heat	ature (ating pens for limited	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74 rest of the who 20.18 internal	season the livi ta, h1,m May 0.69 ta T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell 19.92 tole dwe 20.38 temper	ollo 2 fing (sollo 2) find (area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97 g) = fLA × T1 0.43 20.43 re from Table	A 0.4 7 in T 2 able 9 19. eps 3 19. + (1 20. e 4e,	Th1 (°C) ug Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Tabl 97 19.93 f - fLA) × T2 43 20.39 where approximates	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63 LA = Liv	Nov 0.99 20.09 19.96 0.99 19.16 ving area ÷ (4	Dec 1 19.75 19.95 1 18.81 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperatu Utilisation (86)m= 1 Mean inter (87)m= 19.5 Temperatu (88)m= 19.5 Utilisation (89)m= 1 Mean inter (90)m= 18.6 Mean inter (92)m= 19.2 Apply adju (93)m= 19.5 Set Ti to the	ternal temper ure during hear factor for gair n Feb 0.99 cmal temperature during hear 19.95 cmal temperature during hear	ature (ating pens for line 20.3 ating pens for record 20.9 ating pens for record 20.0 ating pens for record 20.0 ating pens for record 20.0 ating pens for record 20.0 ating pens for record 20.0 ating pens for record 20.0 ating pens for r	cheating eriods in ving are Apr 0.88 iving are 20.71 eriods in 19.96 est of dv 0.85 he rest of 19.74 the who 20.18 internal 20.03	season the livi a, h1,m May 0.69 ea T1 (for 20.93 rest of 19.96 velling, 0.63 of dwell 19.92 cole dwe 20.38 temper 20.23 e obtain	ollo 2 h2, (ting 1 h2, (ting 1 traiting 2 ratu 2	area from Ta ee Table 9a) Jun Jul 0.49 0.36 w steps 3 to 0.99 21 elling from T 9.97 19.97 m (see Table 0.41 0.28 T2 (follow st 9.97 19.97 g) = fLA × T1 0.43 20.43 re from Table 0.28 20.28	A 0.4 7 in T 2 able 9 19. eps 3 19. + (1 20. e 4e, 20.	Sep 3 0.73 Table 9c) 1 20.93 9, Th2 (°C) 97 19.97 4 0.65 to 7 in Table 97 19.93 f - fLA) × T2 43 20.39 where approx 28 20.24	Oct 0.96 20.57 19.96 0.94 e 9c) 19.63 LA = Liv	Nov 0.99 20.09 19.96 0.99 19.16 ving area ÷ (4	Dec 1 19.75 19.95 1 18.81 4) =	0.45	(85) (86) (87) (88) (89) (90) (91)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisation factor for gains, hm:		
(94)m= 1 0.99 0.96 0.85 0.64 0.43 0.3 0.36 0.67 0.94 0.99 1		(94)
Useful gains, hmGm , W = (94)m x (84)m		
(95)m= 397.73 471.93 567.49 638.48 568.98 391.41 255.74 268.39 402.89 439.77 390.47 374.85		(95)
Monthly average external temperature from Table 8		
(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]		
(97)m= 1060.27 1028.3 935.53 783.99 599.48 394.79 256.15 269.42 428.51 653.9 871.04 1055.96		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m		
(98)m= 492.93 373.88 273.82 104.77 22.69 0 0 0 159.31 346.01 506.74		,
Total per year (kWh/year) = Sum(98) _{15,912} =	2280.15	(98)
Space heating requirement in kWh/m²/year	37.32	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		_
Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 - (201) =	1	(202)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$	1	(204)
Efficiency of main space heating system 1	90.3	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	kWh/yea	ar
Space heating requirement (calculated above)		
492.93 373.88 273.82 104.77 22.69 0 0 0 159.31 346.01 506.74		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$		(211)
545.88 414.04 303.23 116.03 25.12 0 0 0 0 176.43 383.18 561.17		
Total (kWh/year) =Sum(211) _{15,10. 12} =	2525.08	(211)
Space heating fuel (secondary), kWh/month		_
= {[(98)m x (201)] } x 100 ÷ (208)		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0		_
Total (kWh/year) =Sum(215) _{15,10. 12} =	0	(215)
Water heating		
Output from water heater (calculated above)		
179.73 156.99 163.34 144.88 140.27 123.54 118.36 131.94 133.4 151.9 162.15 175.5	0.4	7(040)
Efficiency of water heater	81	(216)
(217)m= 87.61 87.33 86.59 84.66 82.18 81 81 81 81 85.51 87.11 87.71		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m		
(219)m= 205.14 179.76 188.65 171.13 170.69 152.52 146.12 162.89 164.69 177.65 186.15 200.1		
Total = Sum(219a) ₁₁₂ =	2105.48	(219)
Annual totals kWh/year	kWh/year	_
Space heating fuel used, main system 1	2525.08]
Water heating fuel used	2105.48]
Electricity for pumps, fans and electric keep-hot		_

mechanical ventilation - balanced, extract or positive	ve input from outside	ſ	133.34		(230a)
central heating pump:		Ī	30		(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a)	(230g) =		208.34	(231)
Electricity for lighting				276.65	(232)
Electricity generated by PVs				-821.33	(233)
12a. CO2 emissions – Individual heating systems i	including micro-CHP				
	Energy kWh/year	Emission factors kg CO2/kWh	or	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x	0.216	= [545.42	(261)

(215) x

Energy saving/generation technologies

Electricity for pumps, fans and electric keep-hot

Item 1

Total CO2, kg/year

Space heating (secondary)

Space and water heating

Electricity for lighting

Water heating

Dwelling CO2 Emission Rate

El rating (section 14)

(219) x	0.216	=	454.78	(264)
(261) + (262) + (263) + (264) =			1000.2	(265)
(231) x	0.519	=	108.13	(267)
(232) x	0.519	=	143.58	(268)
	0.519	=	-426.27	(269)

sum of (265) (271) =

 $(272) \div (4) =$

0.519

(263)

(272)

(273)

(274)

825.64

13.51

90

		User [Details:						
Assessor Name:	Chris Hocknell		Strom	a Num	ber:		STRO	016363	
Software Name:	Stroma FSAP 2012		Softwa					n: 1.0.4.12	
		Property	Address	: Apartm	nent 3				
Address :									
1. Overall dwelling dime	ensions:	_	4 0						
Ground floor			a(m²) 77.3	(1a) x		2.7	(2a) =	Volume(m³)	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(77.3	(14) (4)		2.1	(24)	200.71	
Dwelling volume	a, (.a, (.a, (.a,(,	11.0	J)+(3c)+(3c	d)+(3e)+	(3n) =	208.71	(5)
2. Ventilation rate:									
2. Ventilation rate.	main second		other		total			m³ per hou	r
Number of chimneys	heating heating) 	0] = [0	X ·	40 =	0	(6a)
Number of open flues	0 + 0	-	0	j = [0	x	20 =	0	(6b)
Number of intermittent fa	ins				0	x	10 =	0	(7a)
Number of passive vents	;			Ī	0	x	10 =	0	(7b)
Number of flueless gas fi	ires			Ī	0	x -	40 =	0	(7c)
				_			A : I-		_
				_				nanges per ho	_
	ys, flues and fans = (6a)+(6b)- neen carried out or is intended, proce			continue fr	0		÷ (5) =	0	(8)
Number of storeys in the		sea to (17),	ourer wide (oonanac n	0111 (0) 10	(10)		0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame	or 0.35 fo	r masoni	ry constr	ruction			0	(11)
if both types of wall are padeducting areas of openia	resent, use the value corresponding	to the grea	ter wall are	ea (after					_
•	floor, enter 0.2 (unsealed) or	0.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic met	res per h	our per s	quare m	etre of e	envelope	area	3	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20]$	+(8), otherw	vise (18) = ((16)				0.15	(18)
	es if a pressurisation test has been c	lone or a de	gree air pe	rmeability	is being u	sed			_
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0 075 x (*	19\1 =			3	(19)
Infiltration rate incorporat	ting sholter factor		(21) = (18	•	10)]			0.78	(20)
·	-		(21) (10) X (20)				0.12	(21)
Infiltration rate modified f	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		-1	<u>, </u>	<u>'</u>	•	1		Ī	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Easter (222) = - (2)	2)m ÷ 4	•	•	•	•	-	-	•	
Wind Factor $(22a)m = (22a)m = 1.27$ 1.25	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18		
(/	3 1 00 0.00		1	<u> </u>		<u> </u>	1	I	

Adjusted infiltra	ation rate (a	allowin	g for sh	elter an	d wind s	speed) =	(21a) x	(22a)m				-	
0.15 Calculate effec		.14 Inge ra	0.13	0.12 he appli	0.11	0.11	0.11	0.12	0.12	0.13	0.14]	
If mechanica		_	210 101 1	по аррп	00010 00							0.5	(23
If exhaust air he	eat pump using	g Apper	ndix N, (2	3b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recovery	: efficie	ency in %	allowing f	for in-use f	actor (fron	n Table 4h) =				75.65	(23
a) If balance	d mechanic	al ver	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24a)m= 0.27	0.27 0	.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(24
b) If balance	d mechanic	al ver	ntilation	without	heat red	covery (I	ИV) (24t	o)m = (22	2b)m + (2	23b)	•	1	
24b)m= 0		0	0	0	0	0	0	0	0	0	0]	(24
c) If whole he if (22b)m	ouse extrac ı < 0.5 × (20			•	•				.5 × (23b)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)m	ventilation on the second seco								0.5]				
24d)m= 0		0	0	0	0	0	0	0	0	0	0		(24
Effective air	change rate	e - ent	er (24a	or (24b	o) or (24	c) or (24	d) in bo	x (25)			•	•	
25)m= 0.27	0.27 0	.26	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.25	0.26		(25
3. Heat losses	s and heat l	loss pa	aramete	er:									
ELEMENT	Gross area (m²		Openin m	gs	Net Ar A ,ı		U-valı W/m2		A X U (W/ł	〈)	k-value kJ/m²·l		XXk J/K
Doors					2	x	1.3	=	2.6				(26
Vindows Type	: 1				7.1	x1	/[1/(1.3)+	0.04] =	8.77				(27
Vindows Type	2				9.86	x1	/[1/(1.3)+	0.04] =	12.18				(27
Vindows Type	3				7.48	x1	/[1/(1.3)+	0.04] =	9.24				(2
Vindows Type	4				1.53	x1	/[1/(1.3)+	0.04] =	1.89				(2
Rooflights					1.14	. x1	/[1/(1.6) +	0.04] =	1.824				(2
Valls Type1	40.58	7 [25.97	7	14.6	1 X	0.15	= İ	2.19			\neg	(2
Valls Type2	56.98	ī i	2		54.98	3 X	0.13	-	7.34			= =	(29
Roof	77.3	Īi	1.14		76.16	3 X	0.1	<u> </u>	7.62			= =	(30
otal area of e	lements, m	2			174.8	6							(3
for windows and						lated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	1 <i>3.2</i>	
* include the area				s and par	titions		(26) (30) + (32) =					
abric heat los leat capacity		•)				(20) (30)	((28)	(30) + (32	2) + (32a)	(32e) =	53.56	(33
hermal mass	,	,	= Cm ÷	· TFA) ir	n k.l/m²K	•		***	tive Value:	, , ,	(020) -	13907.54	(34
or design assess	•	`		,			ecisely the				able 1f	250	(0,
an be used instea						,							
hermal bridge	,	•			•	K						12.02	(3
details of therma otal fabric he		not kno	wn (36) =	0.15 x (3	31)			(33) ±	(36) =			05.50	
oral rapide He	at 1033							(33) +	(50) -			65.58	(3
entilation hea	it loss calcu	ıla t adı	monthly	,				(38)m	= 0.33 × (25)m v (5)	١	00.00	`

<i>(</i> 20). Г	40.50	40.00	10.10	47.40	40.00	45.00	45.00	1.5.70	40.00	40.00	17.00	17.70		(20)
(38)m=	18.59	18.39	18.19	17.19	16.99	15.99	15.99	15.79	16.39	16.99	17.39	17.79		(38)
Heat tra	84.17	83.97	1t, VV/K 83.77	82.77	82.57	81.57	81.57	81.37	(39)m 81.97	= (37) + (3 82.57	82.97	83.37		
(00)111	04.17		00.77	02.77	02.07	01.07	01.07	01.07			Sum(39) ₁	1	82.72	(39)
Heat los	ss para	meter (H	HLP), W	m²K						= (39)m ÷				
(40)m=	1.09	1.09	1.08	1.07	1.07	1.06	1.06	1.05	1.06	1.07	1.07	1.08		7
Number	r of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.07	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wat	er heat	ing enei	rgy requi	rement:								kWh/ye	ar:	
Assume	ed occu	pancy. I	N								2	.41		(42)
if TFA	A > 13.9), N = 1		[1 - exp	(-0.0003	49 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.				()
	A £ 13.9 averag	•	ater usad	ae in litre	s per da	ıv Vd,av	erage =	(25 x N)	+ 36		91	.43		(43)
Reduce th	he annua	l average		usage by	5% if the a	welling is	designed t	to achieve		se target o				, ,
not more			· ·			_		Ι Δ	0.5.7	0-4	N	Daa		
Hot water	Jan r usage ir	Feb	Mar day for ea	Apr ach month	May Vd,m = fa	Jun ctor from 7	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
Г	100.57	96.91	93.26	89.6	85.94	82.29	82.29	85.94	89.6	93.26	96.91	100.57		
(11)			00.20	00.0		02.20	02.20	1 00.0	l		m(44) _{1 12} =		1097.15	(44)
Energy co	ontent of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	149.14	130.44	134.61	117.35	112.6	97.17	90.04	103.32	104.56	121.85	133.01	144.44		_
If instanta	aneous w	ater heati	na at point	of use (no	hot water	storage).	enter 0 in	boxes (46		Γotal = Su	m(45) _{1 12} =	<u> </u>	1438.53	(45)
_	22.37	19.57	20.19	17.6	16.89	14.58	13.51	15.5	15.68	18.28	19.95	21.67		(46)
Water s			20.10	17.0	10.00	11.00	10.01	10.0	10.00	10.20	10.00	21.07		(- /
Storage	volum	e (litres)) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	-	-	ind no ta		•			. ,	\4-	· · · (0) : (47)			
Water s			not wate	er (tnis ir	iciuaes i	nstantar	ieous co	mbi boil	ers) ente	er o in (47)			
	-		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temper	ature fa	actor fro	m Table	2b								0		(49)
			storage	-				(48) x (49)) =			0		(50)
•			eclared of factor fr	-								0		(51)
		•	ee secti		0 2 (• • • • • • • • • • • • • • • • • • • •					<u> </u>		(01)
Volume												0		(52)
Temper	ature fa	actor fro	m Table	2b								0		(53)
			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	0		(54)
,	, ,	54) in (5	culated f	or each	month			((56)m = (55) x (41);	m		0		(55)
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	•							-		_	-	m Appendix	кH	(00)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
` / - L		-						<u> </u>						

Primary circu	it loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circu				,	,	` '	` '						
(modified b	y factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)		1	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0	I	(59)
Combi loss ca	alculated	for each	month ((61)m =	(60) ÷ 30	65 × (41)m						
(61)m= 50.96	44.61	47.52	44.19	43.8	40.58	41.93	43.8	44.19	47.52	47.79	50.96		(61)
Total heat red	quired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 200.1	175.05	182.13	161.54	156.4	137.75	131.97	147.12	148.74	169.37	180.8	195.4		(62)
Solar DHW input	calculated	using App	endix G o	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	r heating)		
(add addition	al lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from v	vater hea	ter					•	•					
(64)m= 200.1	175.05	182.13	161.54	156.4	137.75	131.97	147.12	148.74	169.37	180.8	195.4		
				Į.		l	Outp	out from wa	ater heate	r (annual)₁	12	1986.37	(64)
Heat gains fro	om water	heating.	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	ı + (61)m	א 0.8 + [ר	([(46)m	+ (57)m	+ (59)m	1	•
(65)m= 62.33		56.64	50.07	48.39	42.45	40.42	45.3	45.81	52.4	56.17	60.77		(65)
include (57		L culation (L of (65)m	only if c	l vlinder i	s in the (l Iwelling	or hot w	ater is fr	om com	munity h	eating	
· ·	•		. ,	-	yiiilaci i		aweiling	OI HOLW	ator io ii	0111 00111	indinity ii	Calling	
5. Internal g).									
Metabolic gai				May	lun	11	۸۰۰۰	Con	Oct	Nov	Doo		
Jan 120.49	Feb	Mar	Apr	May 120.48	Jun	Jul 120.48	Aug 120.48	Sep	120.48	Nov	Dec		(66)
(66)m= 120.48		120.48	120.48	<u> </u>	120.48	<u> </u>	<u> </u>	120.48	120.46	120.48	120.48	1	(00)
Lighting gains	<u> </u>								45.74	40.07	10.50	1	(07)
(67)m= 19.05		13.76	10.42	7.79	6.57	7.1	9.23	12.39	15.74	18.37	19.58	I	(67)
Appliances ga	<u> </u>				i							1	
(68)m= 213.71	215.92	210.33	198.44	183.42	169.31	159.88	157.66	163.25	175.14	190.16	204.28	I	(68)
Cooking gain	s (calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also se	ee Table	5	•		•	
(69)m= 35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05	35.05		(69)
Pumps and fa	ans gains	(Table 5	5a)										
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m= -96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39	-96.39		(71)
Water heating	g gains (1	able 5)											
(72)m= 83.78	81.14	76.13	69.54	65.04	58.96	54.33	60.89	63.63	70.42	78.02	81.67		(72)
Total interna	ıl gains =		Į.	!	(66)	m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72)	m		
(73)m= 378.68		362.37	340.54	318.39	296.99	283.46	289.93	301.41	323.45	348.69	367.68		(73)
6. Solar gair													
Solar gains are		using sola	r flux from	Table 6a	and assoc	iated equa	itions to co	nvert to th	e applicab	le orientat	ion.		
Orientation:	Access F	actor	Area		Flu	Χ		g_		FF		Gains	
	Table 6d		m²			ble 6a	Т	able 6b	Ta	able 6c		(W)	
Northeast 0.9x	0.77	x	1.5	53	x 1	1.28	x	0.55	x	0.7		4.61	(75)
Northeast 0.9x		X	1.5			22.97) <u> </u>	0.55		0.7	=	9.38](75)
	<u> </u>												J, ,

Northoast a ou		1		1		1		l		1		7(75)
Northeast 0.9x	0.77	X	1.53	X	41.38	X	0.55	X	0.7] = 1	16.89	(75)
Northeast _{0.9x}	0.77	X	1.53	X	67.96	X	0.55	X	0.7] =	27.74	(75)
Northeast 0.9x	0.77	X	1.53	X	91.35	X	0.55	X	0.7] =	37.29	(75)
Northeast 0.9x	0.77	X	1.53	X	97.38	X	0.55	X	0.7] =	39.75	(75)
Northeast _{0.9x}	0.77	X	1.53	X	91.1	X	0.55	X	0.7] =	37.19	(75)
Northeast _{0.9x}	0.77	X	1.53	X	72.63	X	0.55	X	0.7	=	29.65	(75)
Northeast _{0.9x}	0.77	X	1.53	X	50.42	X	0.55	X	0.7	=	20.58	(75)
Northeast _{0.9x}	0.77	X	1.53	X	28.07	X	0.55	X	0.7	=	11.46	(75)
Northeast _{0.9x}	0.77	X	1.53	X	14.2	X	0.55	X	0.7	=	5.8	(75)
Northeast _{0.9x}	0.77	X	1.53	X	9.21	X	0.55	X	0.7	=	3.76	(75)
Southeast _{0.9x}	0.77	X	7.1	X	36.79	X	0.55	X	0.7	=	69.7	(77)
Southeast _{0.9x}	0.77	X	9.86	X	36.79	X	0.55	X	0.7	=	96.79	(77)
Southeast _{0.9x}	0.77	X	7.48	X	36.79	X	0.55	X	0.7	=	73.43	(77)
Southeast 0.9x	0.77	X	7.1	X	62.67	X	0.55	X	0.7	=	118.72	(77)
Southeast _{0.9x}	0.77	X	9.86	X	62.67	X	0.55	x	0.7	=	164.87	(77)
Southeast 0.9x	0.77	X	7.48	x	62.67	x	0.55	x	0.7	=	125.08	(77)
Southeast 0.9x	0.77	X	7.1	x	85.75	x	0.55	X	0.7	=	162.44	(77)
Southeast 0.9x	0.77	X	9.86	x	85.75	x	0.55	X	0.7	=	225.59	(77)
Southeast _{0.9x}	0.77	x	7.48	x	85.75	x	0.55	x	0.7	=	171.14	(77)
Southeast _{0.9x}	0.77	x	7.1	x	106.25	x	0.55	x	0.7	=	201.27	(77)
Southeast _{0.9x}	0.77	X	9.86	x	106.25	x	0.55	X	0.7] =	279.52	(77)
Southeast 0.9x	0.77	x	7.48	x	106.25	x	0.55	x	0.7] =	212.05	(77)
Southeast 0.9x	0.77	x	7.1	x	119.01	x	0.55	x	0.7	=	225.44	(77)
Southeast _{0.9x}	0.77	X	9.86	x	119.01	x	0.55	x	0.7	=	313.08	(77)
Southeast _{0.9x}	0.77	x	7.48	x	119.01	x	0.55	x	0.7	=	237.51	(77)
Southeast _{0.9x}	0.77	x	7.1	x	118.15	x	0.55	x	0.7	=	223.81	(77)
Southeast 0.9x	0.77	×	9.86	x	118.15	x	0.55	x	0.7	j =	310.82	(77)
Southeast 0.9x	0.77	x	7.48	x	118.15	x	0.55	x	0.7] =	235.79	(77)
Southeast 0.9x	0.77	×	7.1	x	113.91	x	0.55	x	0.7	Ī =	215.78	(77)
Southeast 0.9x	0.77	X	9.86	x	113.91	x	0.55	x	0.7	j =	299.66	(77)
Southeast 0.9x	0.77	x	7.48	x	113.91	x	0.55	x	0.7] =	227.33	(77)
Southeast 0.9x	0.77	x	7.1	x	104.39	х	0.55	x	0.7	j =	197.75	(77)
Southeast 0.9x	0.77	x	9.86	x	104.39	x	0.55	X	0.7	j =	274.62	(77)
Southeast 0.9x	0.77	x	7.48	x	104.39	x	0.55	x	0.7] =	208.33	(77)
Southeast 0.9x	0.77	x	7.1	x	92.85	х	0.55	x	0.7	j =	175.89	(77)
Southeast 0.9x	0.77	x	9.86	×	92.85	x	0.55	x	0.7	j =	244.27	(77)
Southeast 0.9x	0.77	×	7.48	×	92.85	x	0.55	x	0.7	j =	185.3	(77)
Southeast 0.9x	0.77	×	7.1	×	69.27	x	0.55	x	0.7	i =	131.21	(77)
Southeast _{0.9x}	0.77	X	9.86	X	69.27	X	0.55	X	0.7	j =	182.22	(77)
Southeast _{0.9x}	0.77	X	7.48	X	69.27	X	0.55	X	0.7] =	138.24	(77)
Southeast _{0.9x}	0.77	X	7.1	X	44.07	X	0.55	X	0.7	=	83.48	(77)
<u> </u>		1		1		1		l	<u> </u>	1		

Southeast _{0.9x}	0.77	x	9.86	х	4	4.07	x	0.55	X	0.7	=	115.94	(77)
Southeast _{0.9x}	0.77	x	7.48	x	4	4.07	x	0.55	x	0.7	=	87.95	(77)
Southeast _{0.9x}	0.77	x	7.1	x	3	1.49	x	0.55	x	0.7	=	59.65	(77)
Southeast _{0.9x}	0.77	×	9.86	x	3	1.49	x	0.55	x	0.7	=	82.83	(77)
Southeast _{0.9x}	0.77	X	7.48	x	3	1.49	x	0.55	X	0.7	=	62.84	(77)
Rooflights _{0.9x}	1	×	1.14	x		26	x	0.55	x	0.8	=	11.74	(82)
Rooflights 0.9x	1	×	1.14	x		54	x	0.55	x	0.8	=	24.38	(82)
Rooflights _{0.9x}	1	×	1.14	x		96	x	0.55	x	0.8	=	43.34	(82)
Rooflights _{0.9x}	1	X	1.14	×		150	x	0.55	x	0.8	=	67.72	(82)
Rooflights 0.9x	1	x	1.14	x		192	x	0.55	X	0.8	=	86.68	(82)
Rooflights _{0.9x}	1	X	1.14	x		200	x	0.55	X	0.8	=	90.29	(82)
Rooflights _{0.9x}	1	X	1.14	x		189	X	0.55	x	0.8	=	85.32	(82)
Rooflights _{0.9x}	1	X	1.14	x		157	x	0.55	x	0.8	=	70.88	(82)
Rooflights _{0.9x}	1	X	1.14	х		115	x	0.55	x	0.8	=	51.92	(82)
Rooflights _{0.9x}	1	X	1.14	X		66	x	0.55	X	0.8	=	29.8	(82)
Rooflights _{0.9x}	1	X	1.14	х		33	x	0.55	X	0.8	=	14.9	(82)
Rooflights _{0.9x}	1	x	1.14	х		21	x	0.55	X	0.8	=	9.48	(82)
Solar gains in	watts, calcu	lated	for each r	nonth			(83)m	n = Sum(74)m	(82)m			_	
(<mark>83</mark>)m= 256.27	442.43 61	19.4	788.29	900	900.46	865.28	781	.22 677.96	492.93	308.06	218.56		(83)
Total gains –	internal and	solar	(84)m = (7)	73)m +	(83)m	, watts						_	
(84)m= 634.94	818.56 98	1.76	1128.83 12	218.39	1197.45	1148.74	1071	1.15 979.37	816.38	656.76	586.24		(84)
7. Mean inte	rnal tempera	ature (heating se	eason)									
Temperature	during heat	ing pe	eriods in th	ne living	g area	rom Tal	ole 9	, Th1 (°C)				21	(85)
Utilisation fa	ctor for gains	s for li	ving area,	h1,m (see Ta	ble 9a)							
Jan	Feb I	Mar	Apr	May	Jun	Jul	Α	ug Sep	Oct	Nov	Dec		
(<mark>86</mark>)m= 0.99	0.97 0	.92	0.79	0.61	0.43	0.31	0.3	0.56	0.86	0.98	0.99		(86)
Mean interna	al temperatu	re in li	iving area	T1 (foll	low ste	ps 3 to 7	7 in T	able 9c)		•	•	•	
(87)m= 20.05	 	0.61		20.97	21	21	2		20.81	20.37	19.99]	(87)
Temperature	during heat	ina na	ariode in re	est of d	welling	from Ta	hla (Th2 (°C)				1	
(88)m= 20.01	, , , , , , , , , , , , , , , , , , , 	0.01		20.03	20.04	20.04	20.	` 	20.03	20.02	20.02	1	(88)
` '	<u>!</u>						ļ			1]	, ,
Utilisation fa			-	o.55	2,m (se 0.37	e Table 0.24	–	00 0 40	0.00	0.07	0.00	1	(89)
(89)m= 0.99	0.96 0	.89	0.75	0.55	0.37	0.24	0.2	28 0.49	0.82	0.97	0.99]	(09)
Mean interna	 	-	-		• •		·		e 9c)			7	
	19.42 1	9.7	19.93	20.01	20.04	20.04	20.		19.89		19.11		(90)
(90)m= 19.16	1 .0 1											0.52	(91)
(90)m= 19.16	1	'	•	•				f	LA = Liv	ing area ÷ (4	4) =	0.53	` ` ′
(90)m= 19.16 Mean interna	1	re (for	the whole	e dwelli	ng) = fl	_A × T1	+ (1		LA = Liv	ing area ÷ (4	4) =	0.53	` ′
`	al temperatui	re (for		e dwelli 20.51	ng) = fl 20.54	_A × T1 20.54	+ (1	– fLA) × T2	20.37		19.57	0.55	(92)
Mean interna	al temperatui	0.18	20.42	20.51	20.54	20.54	20.	– fLA) × T2 54 20.53	20.37	19.95	, 	0.55	
Mean interna (92)m= 19.62 Apply adjust	al temperature 19.89 20 ment to the r	0.18	20.42 2 internal te	20.51	20.54	20.54	20.	– fLA) × T2 54 20.53 where appro	20.37	19.95	,]	
Mean interna (92)m= 19.62 Apply adjust	19.89 20 ment to the r	0.18 mean 0.03	20.42 2 internal te	20.51 emperat	20.54 ture fro	20.54 m Table	20. 4e,	– fLA) × T2 54 20.53 where appro	20.37 opriate	19.95	19.57]	(92)
Mean interna 92)m= 19.62 Apply adjust 93)m= 19.47	al temperature 19.89 20 ment to the reconstruction 19.74 20 ating require	mean 0.03 ment	20.42 2 internal te 20.27 2	20.51 emperat 20.36	20.54 ture fro 20.39	20.54 m Table 20.39	20. 4e, 20.	- fLA) × T2 54 20.53 where appro 39 20.38	20.37 opriate 20.22	19.95	19.57		(92)
Mean interna (92)m= 19.62 Apply adjust (93)m= 19.47 8. Space hea	al temperature 19.89 20 ment to the recommend 19.74 20 ating require mean intern	mean 0.03 ment al tem	20.42 2 internal te 20.27 2 apperature	emperat 20.36	20.54 ture fro 20.39	20.54 m Table 20.39	20. 4e, 20.	- fLA) × T2 54 20.53 where appro 39 20.38	20.37 opriate 20.22	19.95	19.57		(92)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisation	factor for g	ains, hm	1:										
(94)m= 0.9		0.89	0.76	0.57	0.39	0.27	0.3	0.52	0.83	0.97	0.99		(94)
Useful gai	ns, hmGm	, W = (94	4)m x (8	4)m									
(95)m= 626.	71 785.4	878.01	854.02	697.44	470.38	309.17	324.58	506.83	678.07	635.62	580.91		(95)
Monthly a	erage exte	ernal tem	perature	from Ta	able 8								
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss	rate for me				Lm , W =	=[(39)m :	x [(93)m	– (96)m	ī —		1		
(97)m= 1277				715.29	472.29	309.36	324.94	514.7	794.71	1053.77	1269.27		(97)
	ting requir	1											
(98)m= 483.	97 309.61	189.98	62.56	13.28	0	0	0	0	86.78	301.06	512.14		_
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1959.38	(98)
Space hea	iting requir	ement in	kWh/m²	² /year								25.35	(99)
9a. Energy	requireme	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space he	_										r		_
Fraction of	f space hea	at from s	econdar	y/supple	mentary	system					Į	0	(201)
Fraction of	space hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction o	f total heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency	of main sp	ace heat	ing syste	em 1								90.3	(206)
Efficiency	of seconda	ry/suppl	ementar	y heating	g system	າ, %					Ī	0	(208)
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	– ar
Space hea	iting requir	ement (c	alculate	d above))	•	•		•				
483.	97 309.61	189.98	62.56	13.28	0	0	0	0	86.78	301.06	512.14		
(211)m = {[(98)m x (20	04)] } x 1	100 ÷ (20	06)									(211)
535.	96 342.87	210.38	69.28	14.71	0	0	0	0	96.1	333.4	567.15		
							Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	2169.86	(211)
Space hea	iting fuel (s	econdar	y), kWh/	month							_		_
$= \{[(98)m x]\}$													
(215)m= 0	0	0	0	0	0	0	0	0	0	0	0		_
							Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	= [0	(215)
Water heat	•												
Output from		182.13	ulated a 161.54	156.4	137.75	131.97	147.12	148.74	169.37	180.8	195.4		
Efficiency of		l .	101.01	100.1	107.70	101.07		1 10.11	100.01	100.0	100.1	81	(216)
(217)m= 87.3		85.5	83.4	81.66	81	81	81	81	83.93	86.57	87.52		(217)
Fuel for wa		l		01.00	0.	<u> </u>		<u> </u>	00.00	00.07	07.02		()
(219)m = (•												
(219)m= 229.	04 201.89	213.03	193.7	191.53	170.06	162.93	181.63	183.63	201.81	208.85	223.25		
							Tota	I = Sum(2	19a) ₁₁₂ =			2361.34	(219)
Annual tot									k'	Wh/year		kWh/year	¬
Space heat	ing fuel use	ed, main	system	1								2169.86	╛
Water heat	ng fuel use	ed										2361.34	
Electricity for	or pumps, f	ans and	electric	keep-ho	t								

mechanical ventilation - balanced, extract o	r positive input from o	utside		168.69		(230a)
central heating pump:				30		(230c)
boiler with a fan-assisted flue				45		(230e)
Total electricity for the above, kWh/year		sum of (230a)	(230g) =		243.69	(231)
Electricity for lighting					336.46	(232)
Electricity generated by PVs					-821.33	(233)
12a. CO2 emissions – Individual heating sy	stems including micro	-CHP				
	Energy kWh/year		Emission fac kg CO2/kWh		Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x		0.216	=	468.69	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)

Space heating (main system 1)	(211) x	0.216	=	468.69	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	510.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =			978.74	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	126.48	(267)
Electricity for lighting	(232) x	0.519	=	174.62	(268)
Energy saving/generation technologies					_
Item 1		0.519	=	-426.27	(269)
Total CO2, kg/year	sum o	of (265) (271) =		853.57	(272)
Dwelling CO2 Emission Rate	(272)	÷ (4) =		11.04	(273)
El rating (section 14)				91	(274)

Assessor Name: Chris Hocknell Stroma Number: STRO016363 Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.12 Property Address: Apartment 4 Address: 1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³) Ground floor Go.9 (1a) x 2.7 (2a) = 169.83 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 62.9 (4) Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 169.83 (5) 2. Ventilation rate: Number of chimneys Number of open flues 0 + 0 + 0 = 0 x 40 = 0 (6a) Number of intermittent fans 0 x 10 = 0 (7a)
Software Version: Version: 1.0.4.12 Property Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Address: Apartment 4 Av. Height(m) Volume(m³) Ground floor 62.9 (1a) x 2.7 (2a) = 169.83 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 62.9 (4) Dwelling volume 2. Ventilation rate: Main heating heating heating other total heating m³ per hour heating Number of chimneys 0 + 0 + 0 = 0 x 40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x 20 = 0 (6b) Number of intermittent fans 0 x 40 = 0 (6b)
Address: 1. Overall dwelling dimensions: Area(m²)
1. Overall dwelling dimensions: Area(m²)
Area(m²)
Ground floor $ 62.9 $
Dwelling volume $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
2. Ventilation rate: main heating secondary heating other heating total m³ per hour Number of chimneys 0 + 0 + 0 = 0 x 40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x 20 = 0 (6b) Number of intermittent fans 0 x 10 = 0 (7a)
2. Ventilation rate: main heating secondary heating other heating total m³ per hour Number of chimneys 0 + 0 + 0 = 0 × 40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 × 20 = 0 (6b) Number of intermittent fans 0 × 10 = 0 (7a)
Number of chimneys 0 + 0 + 0 = 0 x40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x20 = 0 (6b) Number of intermittent fans
Number of chimneys 0 + 0 + 0 = 0 x 40 = 0 (6a) Number of open flues 0 + 0 + 0 = 0 x 20 = 0 (6b) Number of intermittent fans 0 x 10 = 0 (7a)
Number of intermittent fans $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
Number of passive vents $0 \times 10 = 0 $ (7b)
Number of flueless gas fires $0 \times 40 = 0 $ (7c)
Air changes per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$ $\div (5) = 0$ (8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)
Number of storeys in the dwelling (ns)
Additional infiltration $[(9)-1] \times 0.1 = 0 $ (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction o (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
If no draught lobby, enter 0.05, else enter 0
Percentage of windows and doors draught stripped $0.25 - [0.2 \times (14) \div 100] = 0 \tag{14}$ Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0 \tag{15}$
Vindow infiltration $0.25 - [0.2 \times (14) + 100] = 0$ (15) Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ 0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used
Number of sides sheltered $2 mtext{(19)}$ Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85 mtext{(20)}$
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ 0.13 (21)
Infiltration rate modified for monthly wind speed
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly average wind speed from Table 7
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7
Wind Factor (22a)m = (22)m ÷ 4
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18

Adjusted infiltra	ation rate (allowi	ng for sh	nelter an	nd wind s	speed) =	(21a) x	(22a)m				•	
0.16 Calculate effec		0.16 ange	0.14	0.14 he appli	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
If mechanica		_	rate for t	пс аррп	oabic oa	.00						0.5	(23
If exhaust air he	eat pump usir	ng Appe	endix N, (2	3b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recover	ry: effic	iency in %	allowing t	for in-use f	actor (fron	n Table 4h) =				75.65	(23
a) If balance	d mechani	ical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	
24a)m= 0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27		(24
b) If balance	d mechani	ical ve	entilation	without	heat red	covery (I	MV) (24b	o)m = (22	2b)m + (2	23b)	•	1	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole he if (22b)m	ouse extra ı < 0.5 × (2			•	•				.5 × (23b))			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	ventilation n = 1, then								0.5]			-	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change ra	te - er	nter (24a	or (24l	b) or (24	c) or (24	d) in bo	x (25)				-	
25)m= 0.28	0.28	0.28	0.26	0.26	0.24	0.24	0.24	0.25	0.26	0.27	0.27		(25
3. Heat losses	s and heat	loss	paramet	er:									
ELEMENT	Gross area (m	_	Openin m	gs	Net Ar A ,ı		U-val W/m2		A X U (W/F	<)	k-value kJ/m²·		X k J/K
Doors					2	x	1.3	=	2.6	,			(26
Vindows Type	1				3.7	x1	/[1/(1.3)+	0.04] =	4.57				(27
Vindows Type	2				0.91	x1	/[1/(1.3)+	0.04] =	1.12				(27
Vindows Type	3				6.29	x1	/[1/(1.3)+	0.04] =	7.77				(27
Vindows Type	4				8.37	x1	/[1/(1.3)+	0.04] =	10.34				(27
Vindows Type	5				6.29	x1	/[1/(1.3)+	0.04] =	7.77				(27
Valls Type1	51.43		29.2	3	22.17	7 X	0.15	= i	3.33	<u> </u>			(29
Valls Type2	36.05		2		34.0	5 X	0.13	-	4.55	= [(29
Roof	62.9		0		62.9	X	0.1	=	6.29				(30
Total area of e	lements, m	n²			150.3	8							(31
for windows and						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragrapl	n 3.2	
* include the area -abric heat los				ls and par	titions		(26) (30) + (32) =				50.00	(33
leat capacity		•	0)				(20) (00	((28)	(30) + (32	2) + <i>(</i> 32a)	(32e) =	52.92 11247.9	(34
hermal mass	,	,	⊃ = Cm ÷	- TFA) ir	ո kJ/m²K			***	itive Value:	, , ,	(020)	250	(35
or design assess	ments where	the de	tails of the	,			recisely the				able 1f	L	(3.
an be used instea hermal bridge				ısina Δr	nendiy I	K						14.40	(36
details of therma	,	•			•	•						14.48	(36
otal fabric hea				33 A (O	-/			(33) +	(36) =			67.41	(37
entilation hea	t loss calc	ulated	d monthly	/				(38)m	= 0.33 × (25)m x (5))	•	
omandi mod													

(38)m= 15.93	15.76	15.58	14.68	14.5	13.61	13.61	13.43	13.97	14.5	14.86	15.00		(38)
` ′			14.00	14.5	13.01	13.01	13.43				15.22		(30)
Heat transfer of (39)m= 83.34	83.16	1t, VV/K 82.98	82.09	81.91	81.02	81.02	80.84	81.37	= (37) + (3 81.91	82.27	82.62		
(00)111- 00.04	00.10	02.00	02.00	01.01	01.02	01.02	00.04		Average =		<u> </u>	82.04	(39)
Heat loss para	meter (F	HLP), W/	m²K				_		= (39)m ÷				
(40)m= 1.32	1.32	1.32	1.31	1.3	1.29	1.29	1.29	1.29	1.3	1.31	1.31		_
Number of day	e in moi	nth (Tahl	(12 ما					/	Average =	Sum(40) ₁	12 /12=	1.3	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
` '							<u> </u>						
4. Water heat	ina ener	av reaui	rement:								kWh/ye	ear:	
Assumed occur if TFA > 13.9			[1 - exn	(<u>-</u> 0 0003	849 y (TE	Δ -13 0)2)1 + 0 ()013 x (1	ΓFΔ -13		06		(42)
if TFA £ 13.9		· 1.70 X	[I - CXP	(-0.0000	7-3 X (11	A - 10.0	<i>)</i> 2)] · O.() X 010 X	II A - 10.	3)			
Annual averag									o taraat a		3.18		(43)
Reduce the annua not more that 125	_				_	-	o acriieve	a water us	se largel o	I			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in				,				004					
(44)m= 91.5	88.17	84.84	81.52	78.19	74.86	74.86	78.19	81.52	84.84	88.17	91.5		
									Γotal = Su	· /		998.16	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	Tm / 3600	kWh/mon	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 135.69	118.67	122.46	106.77	102.44	88.4	81.92	94	95.12	110.86	121.01	131.41		_
If instantaneous w	ater heatii	na at point	of use (no	hot water	r storage).	enter 0 in	boxes (46		Γotal = Su	m(45) _{1 12} =	• [1308.75	(45)
(46)m= 20.35	17.8	18.37	16.01	15.37	13.26	12.29	14.1	14.27	16.63	18.15	19.71		(46)
Water storage	-	10.57	10.01	15.57	13.20	12.23	14.1	14.21	10.03	10.13	19.71		(10)
Storage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	•			•			` '						
Otherwise if no		hot wate	er (this in	cludes i	nstantar	eous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufact		eclared lo	oss facto	or is kno	wn (kWh	n/dav).					0		(48)
Temperature fa					(0		(49)
Energy lost fro				ear			(48) x (49)	· =			0		(50)
b) If manufact	urer's de	eclared o	ylinder l	oss fact									()
Hot water stora	•			e 2 (kWl	h/litre/da	ıy)					0		(51)
If community h	•		on 4.3										(52)
Temperature fa			2b							-	0		(53)
Energy lost fro				ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (•	,y.	-			, , (= ·)		•		0		(55)
		oulotod f	or each	month			((56)m = (55) × (41)r	m				
Water storage	loss cal	culated i	or cacin										
Water storage (56)m= 0	loss cal	0	0	0	0	0	0	0	0	0	0		(56)
	0	0	0	0			-	-			_	x H	(56)

Primary circuit loss (annual) from Table 3 0 (58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)
(59)m =
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m
(61)m= 46.63 40.58 43.24 40.2 39.84 36.92 38.15 39.84 40.2 43.24 43.48 46.63 (61)
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m
(62)m= 182.32 159.26 165.7 146.97 142.29 125.32 120.07 133.85 135.32 154.09 164.49 178.03 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (63)
Output from water heater
(64)m= 182.32 159.26 165.7 146.97 142.29 125.32 120.07 133.85 135.32 154.09 164.49 178.03
Output from water heater (annual) _{1 12} 1807.7 (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= 56.77 49.61 51.53 45.55 44.02 38.62 36.77 41.22 41.68 47.67 51.11 55.35 (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
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 16.06 14.27 11.6 8.78 6.57 5.54 5.99 7.79 10.45 13.27 15.49 16.51 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m= 180.2 182.07 177.35 167.32 154.66 142.76 134.81 132.94 137.65 147.68 160.35 172.25 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 33.31 (69)
Pumps and fans gains (Table 5a)
(70)m= 3 3 3 3 3 3 3 3 3 (70)
Losses e.g. evaporation (negative values) (Table 5)
(71)m= -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 -82.49 (71)
Water heating gains (Table 5)
(72)m= 76.31 73.82 69.26 63.26 59.17 53.64 49.43 55.4 57.89 64.07 70.98 74.39 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$
(73)m= 329.51 327.09 315.15 296.31 277.33 258.88 247.16 253.06 262.92 281.96 303.75 320.09 (73)
6. Solar gains:
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
Orientation: Access Factor Area Flux g_ FF Gains
Table 6d m² Table 6a Table 6b Table 6c (W)
Southwest _{0.9x} 0.77 x 8.37 x 36.79 0.55 x 0.7 = 82.17 (79)
Southwest _{0.9x} 0.77 x 6.29 x 36.79 0.55 x 0.7 = 61.75 (79)

Southwest _{0.9x}	^ 77	1	0.07	1 .,	00.07	1	0.55	l	0.7	1 _	400.00	7(70)
Southwest _{0.9x}	0.77	X	8.37	X	62.67] 1	0.55	X	0.7] = 1	139.96	(79)
Southwest _{0.9x}	0.77	X	6.29	X	62.67] 1	0.55	X	0.7] = 1	105.18	(79)
<u> </u>	0.77	X	8.37	X	85.75] 1	0.55	X	0.7] = 1	191.5	(79)
Southwest _{0.9x}	0.77	∫ X ¬	6.29	X	85.75] 1	0.55	X	0.7] = 1	143.91	(79)
Southwest _{0.9x}	0.77	X	8.37	X	106.25	<u> </u>	0.55	X	0.7] =	237.28	(79)
Southwest _{0.9x}	0.77	X	6.29	X	106.25	<u> </u>	0.55	X	0.7] =	178.31	(79)
Southwest _{0.9x}	0.77	X	8.37	X	119.01		0.55	X	0.7] =	265.77	(79)
Southwest _{0.9x}	0.77	X	6.29	X	119.01	<u> </u>	0.55	X	0.7	=	199.72	(79)
Southwest _{0.9x}	0.77	X	8.37	X	118.15	<u> </u>	0.55	X	0.7] =	263.85	(79)
Southwest _{0.9x}	0.77	X	6.29	X	118.15	<u> </u>	0.55	X	0.7] =	198.28	(79)
Southwest _{0.9x}	0.77	X	8.37	X	113.91	[0.55	X	0.7	=	254.38	(79)
Southwest _{0.9x}	0.77	X	6.29	X	113.91	_	0.55	X	0.7	=	191.16	(79)
Southwest _{0.9x}	0.77	X	8.37	X	104.39	<u> </u>	0.55	X	0.7	=	233.12	(79)
Southwest _{0.9x}	0.77	X	6.29	X	104.39	<u> </u>	0.55	X	0.7	=	175.19	(79)
Southwest _{0.9x}	0.77	X	8.37	X	92.85		0.55	X	0.7	=	207.35	(79)
Southwest _{0.9x}	0.77	X	6.29	x	92.85]	0.55	X	0.7	=	155.82	(79)
Southwest _{0.9x}	0.77	X	8.37	X	69.27]	0.55	X	0.7	=	154.69	(79)
Southwest _{0.9x}	0.77	X	6.29	X	69.27]	0.55	X	0.7	=	116.25	(79)
Southwest _{0.9x}	0.77	X	8.37	X	44.07]	0.55	X	0.7	=	98.42	(79)
Southwest _{0.9x}	0.77	X	6.29	X	44.07]	0.55	X	0.7	=	73.96	(79)
Southwest _{0.9x}	0.77	X	8.37	X	31.49]	0.55	X	0.7	=	70.32	(79)
Southwest _{0.9x}	0.77	X	6.29	x	31.49]	0.55	x	0.7	=	52.84	(79)
Northwest 0.9x	0.77	X	3.7	x	11.28	X	0.55	x	0.7	=	22.28	(81)
Northwest _{0.9x}	0.77	X	0.91	x	11.28	x	0.55	X	0.7	=	2.74	(81)
Northwest _{0.9x}	0.77	X	6.29	X	11.28	X	0.55	X	0.7	=	18.94	(81)
Northwest _{0.9x}	0.77	X	3.7	x	22.97	X	0.55	X	0.7	=	45.34	(81)
Northwest _{0.9x}	0.77	X	0.91	x	22.97	x	0.55	x	0.7] =	5.58	(81)
Northwest _{0.9x}	0.77	X	6.29	x	22.97	x	0.55	x	0.7	=	38.54	(81)
Northwest _{0.9x}	0.77	x	3.7	x	41.38	x	0.55	x	0.7	=	81.7	(81)
Northwest 0.9x	0.77	X	0.91	x	41.38	x	0.55	x	0.7] =	10.05	(81)
Northwest _{0.9x}	0.77	X	6.29	x	41.38	x	0.55	x	0.7] <u>=</u>	69.44	(81)
Northwest _{0.9x}	0.77	X	3.7	x	67.96	x	0.55	x	0.7] <u>=</u>	134.17	(81)
Northwest 0.9x	0.77	X	0.91	x	67.96	x	0.55	x	0.7	Ī =	16.5	(81)
Northwest 0.9x	0.77	X	6.29	x	67.96	x	0.55	x	0.7	j =	114.04	(81)
Northwest _{0.9x}	0.77	X	3.7	x	91.35	x	0.55	x	0.7	j =	180.35	(81)
Northwest _{0.9x}	0.77	X	0.91	x	91.35	x	0.55	x	0.7	j =	22.18	(81)
Northwest _{0.9x}	0.77	X	6.29	x	91.35	x	0.55	x	0.7	j =	153.3	(81)
Northwest _{0.9x}	0.77	X	3.7	x	97.38	x	0.55	x	0.7	j =	192.27	(81)
Northwest _{0.9x}	0.77	×	0.91	×	97.38	×	0.55	x	0.7	j =	23.64	(81)
Northwest _{0.9x}	0.77	X	6.29	x	97.38	x	0.55	x	0.7	j =	163.43	(81)
Northwest _{0.9x}	0.77	X	3.7	×	91.1	X	0.55	x	0.7	j =	179.87	(81)
L		_						ı				

Northwest 0.9	X 0.77	X	0.9	1	X	91.1	x	0.55	x	0.7	=	22.12	(81)
Northwest 0.9	0.77	x	6.2	9	X	91.1	×	0.55	x	0.7	=	152.89	(81)
Northwest 0.9	0.77	x	3.7	7	X	72.63	×	0.55	x	0.7		143.39	(81)
Northwest 0.9	X 0.77	X	0.9	1	X	72.63	x	0.55	x	0.7	=	17.63	(81)
Northwest 0.9	0.77	x	6.2	9	X	72.63	x	0.55	x	0.7	=	121.88	(81)
Northwest 0.9	0.77	x	3.7	7	X	50.42	x	0.55	х	0.7	=	99.55	(81)
Northwest 0.9	0.77	x	0.9	1	X	50.42	×	0.55	x	0.7		12.24	(81)
Northwest 0.9	0.77	x	6.2	9	X	50.42	x	0.55	x	0.7	=	84.62	(81)
Northwest 0.9	0.77	X	3.7	7	X	28.07	X	0.55	x	0.7	=	55.41	(81)
Northwest 0.9	0.77	x	0.9	1	X	28.07	×	0.55	x	0.7		6.81	(81)
Northwest 0.9	0.77	x	6.2	9	X	28.07	x	0.55	x	0.7		47.1	(81)
Northwest 0.9	0.77	x	3.7	7	X	14.2	x	0.55	x	0.7		28.03	(81)
Northwest 0.9	0.77	X	0.9	1	X	14.2	x	0.55	x	0.7	=	3.45	(81)
Northwest 0.9	0.77	x	6.2	.9	X	14.2	×	0.55	x	0.7		23.83	(81)
Northwest 0.9	0.77	x	3.7	7	X	9.21	x	0.55	x	0.7		18.19	(81)
Northwest 0.9	0.77	X	0.9	1	X	9.21	x	0.55	x	0.7	=	2.24	(81)
Northwest 0.9	0.77	x	6.2	9	X	9.21	x	0.55	x	0.7		15.46	(81)
Solar gains	in watts, calc	ulated	for each	n month	1		(83)n	n = Sum(74)m	(82)m				
(83)m= 187.8		96.59	680.3	821.32		41.47 800.41	691	.22 559.58	380.26	227.68	159.05		(83)
Total gains	 internal and 	l solar	(84)m =	: (73)m	+ (8	33)m , watts							
					_								
(84)m= 517.3	37 661.69 8	11.75	976.61	1098.65	11	00.36 1047.5	7 944	.27 822.51	662.22	531.43	479.14		(84)
						00.36 1047.5	7 944	.27 822.51	662.22	531.43	479.14		(84)
7. Mean in	ternal temper re during hea	ature (heating	seasor	ו)				662.22	531.43	479.14	21	(84)
7. Mean in Temperatu	ternal temper	ature (ating pe	heating eriods ir	seasor the livi	n) ing	area from Ta	able 9		662.22	531.43	479.14	21	
7. Mean in Temperatu	ternal temper re during hea factor for gain	ature (ating pe	heating eriods ir	seasor the livi	ing	area from Ta	able 9		662.22	9 531.43 Nov	479.14 Dec	21	
7. Mean in Temperatu	ternal temper re during hea factor for gain	ature (ating pe	heating eriods in ving are	seasor the livi ea, h1,m	ing n (s	area from Ta	able 9	, Th1 (°C)				21	
7. Mean in Temperatu Utilisation Jai (86)m= 0.99	ternal temper re during hea factor for gain n Feb	ature (ating pe as for li Mar 0.94	heating eriods in ving are Apr 0.83	season the livi ea, h1,n May	ing n (se	area from Ta ee Table 9a Jun Jul 0.46 0.34	able 9	, Th1 (°C) ug Sep 0.64	Oct	Nov	Dec	21	(85)
7. Mean in Temperatu Utilisation Jai (86)m= 0.99	ternal temper re during hea factor for gain Feb 0 0.98	ature (ating pe as for li Mar 0.94	heating eriods in ving are Apr 0.83	season the livi ea, h1,n May	ing n (se	area from Ta ee Table 9a Jun Jul 0.46 0.34	able 9	, Th1 (°C) ug Sep 39 0.64 Table 9c)	Oct	Nov	Dec	21	(85)
7. Mean in Temperatu Utilisation i Jai (86)m= 0.99 Mean inter (87)m= 19.7	ternal temper re during heafactor for gain n Feb 0.98 nal temperatus 20 2	ature (ating persons for li Mar 0.94 ure in li 20.36	heating eriods in ving are Apr 0.83 iving are 20.73	seasor the livies, h1,m May 0.65 ea T1 (for 20.93	ing (second)	area from Taee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21	able 9) A 0.:	s, Th1 (°C) ug Sep 39 0.64 Table 9c) 1 20.95	Oct 0.91	Nov 0.98	Dec 0.99	21	(85)
7. Mean in Temperatu Utilisation Jai (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea	ature (ating person of the state of the sta	heating eriods in ving are Apr 0.83 iving are 20.73	seasor the livi ea, h1,m May 0.65 ea T1 (f 20.93	ing (so	area from Talee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from	able 9 0.3 7 in 1 2 Table	sep	Oct 0.91 20.63	Nov 0.98	Dec 0.99	21	(85)
7. Mean in Temperatu Utilisation (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8	ternal temper re during hear factor for gain n Feb 0.98 nal temperatus 20 2 re during hear 2 19.82 1	ature (ating person of the state of the sta	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84	seasor the livi ea, h1,m May 0.65 ea T1 (f 20.93 rest of	ing (second)	area from Talee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 19.85 19.85	A 0.:	sep	Oct 0.91	Nov 0.98	Dec 0.99	21	(85)
7. Mean in Temperatu Utilisation [86]m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation	ternal temper re during heafactor for gain n Feb 0.98 nal temperatus 20 2 re during heafactor for gain factor for gain	ature (ating peas for li Mar 0.94 ure in li 20.36 ting peas for response for re-	heating eriods in ving are 0.83 iving are 20.73 eriods in 19.84 est of dy	seasor the livies, h1,m May 0.65 ea T1 (for 20.93 or rest of 19.84 welling,	1) ing 1 (see 1) follo 2 h2,	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl	able 9) 7 in 7 2 able 9 19 e 9a)	s, Th1 (°C) ug Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85	Oct 0.91 20.63	Nov 0.98 20.1	Dec 0.99 19.68	21	(85) (86) (87) (88)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99	ternal temper re during heafactor for gain n Feb no.98 nal temperatus 20 2 re during heafactor for gain no.97 no.97	ature (ating pens for li Mar 0.94 ure in li 20.36 uting pens for re 0.92	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78	seasor the livies, h1,m May 0.65 ea T1 (for 20.93 or rest of 19.84 welling, 0.58	1) (solid line) (s	area from Taee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl 0.38 0.25	able 9) 7 in 7 2 able 9 19 e 9a) 0.2	s, Th1 (°C) ug Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85	Oct 0.91 20.63 19.84 0.87	Nov 0.98	Dec 0.99	21	(85)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99 Mean inter	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97	ature (ating person of the second of the se	heating eriods in ving are 20.73 eriods in 19.84 est of do 0.78 he rest of the	seasor the livi ea, h1,m May 0.65 ea T1 (ff 20.93 rest of 19.84 welling, 0.58 of dwell	ing (solloon) folloon h2, h2, collong in (solloon) generally h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong	area from Talee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 19.85 19.85 m (see Table 19.38 0.25 T2 (follow s	7 in 7 2 able 9 9. 19. 19. 10. 2 teps 3	Sep 99 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 29 0.55 to 7 in Table	Oct 0.91 20.63 19.84 0.87 e 9c)	Nov 0.98 20.1 19.83	Dec 0.99 19.68 19.83	21	(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97	ature (ating pens for li Mar 0.94 ure in li 20.36 uting pens for re 0.92	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78	seasor the livies, h1,m May 0.65 ea T1 (for 20.93 or rest of 19.84 welling, 0.58	ing (solloon) folloon h2, h2, collong in (solloon) generally h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong	area from Taee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl 0.38 0.25	able 9) 7 in 7 2 able 9 19 e 9a) 0.2	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 to 7 in Table 85 19.82	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99	21	(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99 Mean inter	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97	ature (ating person of the second of the se	heating eriods in ving are 20.73 eriods in 19.84 est of do 0.78 he rest of the	seasor the livi ea, h1,m May 0.65 ea T1 (ff 20.93 rest of 19.84 welling, 0.58 of dwell	ing (solloon) folloon h2, h2, collong in (solloon) generally h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong h2, collong	area from Talee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 19.85 19.85 m (see Table 19.38 0.25 T2 (follow s	7 in 7 2 able 9 9. 19. 19. 10. 2 teps 3	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 to 7 in Table 85 19.82	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58	Nov 0.98 20.1 19.83	Dec 0.99 19.68 19.83 0.99	0.47	(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99 Mean inter (90)m= 18.6	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97	ature (ating person of the second of the se	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78 he rest of 19.64	seasor the living, have the sea to the sea t	ing (second)	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85	able 9) 7 in 7 2 able 9 19 e 9a) 0.2 teps 3	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 29 0.55 4 to 7 in Table 85 19.82	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99		(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation 1 (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation 1 (89)m= 0.99 Mean inter (90)m= 18.6	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97 nal temperatu 9 18.96 1	ature (ating person of the second of the se	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78 he rest of 19.64	seasor the living, have the sea to the sea t	n) ing (solio) 2 dw h2, (ling) 1	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 relling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85	able 9) 7 in 7 2 able 9 19 e 9a) 0.2 teps 3	g Sep 99 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 10.55 10.7 in Table 19.82	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99		(85) (86) (87) (88) (89)
7. Mean in Temperatu Utilisation i (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation i (89)m= 0.99 Mean inter (90)m= 18.6 Mean inter (92)m= 19.1	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97 nal temperatu 9 18.96 1	ature (ating persons for limiting persons for reconstruction) at the second sec	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of do 0.78 he rest of 19.64 rest of the whole 20.15	seasor the livies, h1,m May 0.65 ea T1 (fr 20.93 rest of 19.84 welling, 0.58 of dwell 19.8	ing (second)	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 elling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85 g) = fLA × T 0.38 20.38	able 9) 7 in 7 2 able 9 19 e 9a) 0.2 teps 3 19.	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 19 0.55 10 7 in Table 85 19.82 - fLA) × T2 38 20.35	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58 LA = Liv	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99 18.65 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperatu Utilisation i (86)m= 0.99 Mean inter (87)m= 19.7 Temperatu (88)m= 19.8 Utilisation i (89)m= 0.99 Mean inter (90)m= 18.6 Mean inter (92)m= 19.1	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97 nal temperatu 9 18.96 1 nal temperatu 7 19.44 stment to the	ature (ating persons for limiting persons for reconstruction) at the second sec	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of do 0.78 he rest of 19.64 rest of the whole 20.15	seasor the livies, h1,m May 0.65 ea T1 (fr 20.93 rest of 19.84 welling, 0.58 of dwell 19.8	ing (soliton) (solito	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 elling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85 g) = fLA × T 0.38 20.38	able 9) 7 in 7 2 able 9 19 e 9a) 0.2 teps 3 19.	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 19.85 19.82 - fLA) × T2 38 20.35 where appro	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58 LA = Liv	Nov 0.98 20.1 19.83 0.98	Dec 0.99 19.68 19.83 0.99 18.65 4) =		(85) (86) (87) (88) (89) (90) (91)
7. Mean in Temperature Utilisation 19 (86)m= 0.99 Mean inter (87)m= 19.7 Temperature (88)m= 0.99 Mean inter (90)m= 18.6 Mean inter (92)m= 19.1 Apply adjure (93)m= 19.0	ternal temper re during hea factor for gain n Feb 0 0.98 nal temperatu 3 20 2 re during hea 2 19.82 1 factor for gain 0 0.97 nal temperatu 9 18.96 1 nal temperatu 7 19.44 stment to the	ature (ating persons for reconstruction) ating persons for reconstruction to the persons for reconstruction	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78 he rest of 19.64 rest of the whole 20.15 internal	season the livi ea, h1,m May 0.65 ea T1 (fi 20.93 rest of 19.84 welling, 0.58 of dwell 19.8 ole dwe 20.32 temper	ing (soliton) (solito	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 elling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85 g) = fLA × T 0.38 20.38 re from Tab	A 0.3 7 in 7 2 Table 9 0.3 19 1+(1) 20 1e 4e,	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 19.85 19.82 - fLA) × T2 38 20.35 where appro	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58 LA = Liv	Nov 0.98 20.1 19.83 0.98 19.07 ing area ÷ (4	Dec 0.99 19.68 19.83 0.99 18.65 4) =		(85) (86) (87) (88) (89) (90) (91) (92)
7. Mean in Temperature Utilisation in Utilisation i	ternal temper re during hear factor for gain not be not seen as a	ature (ating pens for li Mar 0.94 ure in li 20.36 iting pens for re 0.92 ure in t 19.31 ure (for 19.8 mean 19.65 ement nal tern	heating eriods in ving are Apr 0.83 iving are 20.73 eriods in 19.84 est of dv 0.78 he rest of 19.64 rest of the whole 20.15 internal 20 inperature	seasor the livies, h1,m May 0.65 ea T1 (for 20.93) rest of 19.84 welling, 0.58 of dwell 19.8 ole dwell 20.32 temper 20.17	follo fo	area from Ta ee Table 9a Jun Jul 0.46 0.34 w steps 3 to 0.99 21 elling from 7 9.85 19.85 m (see Tabl 0.38 0.25 T2 (follow s 9.85 19.85 g) = fLA × T 0.38 20.38 re from Tab 0.23 20.23	A 0.3 7 in 2 2 2 2 2 2 2 2 2	g Sep 39 0.64 Table 9c) 1 20.95 9, Th2 (°C) 85 19.85 29 0.55 10 7 in Tabl 85 19.82 - fLA) × T2 38 20.35 where approximates a sign of the content of the	Oct 0.91 20.63 19.84 0.87 e 9c) 19.58 LA = Liv	Nov 0.98 20.1 19.83 0.98 19.07 ing area ÷ (4	Dec 0.99 19.68 19.83 0.99 18.65 4) = 19.13	0.47	(85) (86) (87) (88) (89) (90) (91) (92)

Apr

May

Jul

Jun

Aug

Mar

Jan

Feb

Oct

Sep

Nov

Dec

Utilisati	on factor for	gains, hn	n:										
	0.99 0.97	0.92	0.79	0.6	0.41	0.28	0.33	0.58	0.87	0.97	0.99		(94)
Useful (gains, hmGr	n , W = (9	4)m x (8	4)m	ı	l	l		l	l			
(95)m= 5	511.15 640.3	4 743.59	771.73	659.83	451.21	293.83	308.72	475.47	578.1	517.46	474.89		(95)
Monthly	y average ex	ternal ten	nperature	from Ta	able 8								
(96)m=	4.3 4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	ss rate for m	1	1	î e	ı	T	 		<u> </u>			1	
` ′	227.14 1196.			694.05	455.9	294.45	309.96	496.16	763.35	1011.72	1221.01		(97)
	heating requ	1	1										
(98)m=	532.7 374.0	1 258.41	100.42	25.45	0	0	0	0	137.82	355.86	555.11		7,000
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2339.78	(98)
Space I	heating requ	irement ir	n kWh/m²	²/year								37.2	(99)
9a. Ener	gy requirem	ents – Inc	lividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	heating:										,		_
Fraction	n of space h	eat from s	econdar	y/supple	mentary	system						0	(201)
Fraction	n of space h	eat from r	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction	n of total hea	ating from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficien	cy of main s	pace hea	ting syste	em 1								90.3	(206)
Efficien	cy of secon	dary/supp	lementar	y heating	g systen	ո, %						0	(208)
	Jan Fel	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	– ar
Space I	heating requ	irement (calculate	d above)								
	532.7 374.0	1 258.41	100.42	25.45	0	0	0	0	137.82	355.86	555.11		
(211)m =	= {[(98)m x (204)] } x	100 ÷ (20	06)									(211)
5	589.92 414.1	8 286.17	111.2	28.19	0	0	0	0	152.62	394.09	614.74		
							Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	2591.11	(211)
Space I	heating fuel	(seconda	ry), kWh/	month									
· · · · · —	n x (201)] } >		 	i	i			i			i	1	
(215)m=	0 0	0	0	0	0	0	0	0	0	0	0		7
							Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	Ē	0	(215)
Water h	•												
	rom water h		146.97	142.29	125.32	120.07	133.85	135.32	154.09	164.49	178.03		
	cy of water h		110.07	1 12:20	120.02	120.07	100.00	100.02	101.00	101.10	170.00	81	(216)
(217)m=	' 		84.53	82.29	81	81	81	81	85.14	87.14	87.85	01	(217)
` ′ ∟	water heating		Į						00.11		07.00		()
	= (64)m x 1	-											
(219)m= 2	207.81 182.4	1 191.73	173.85	172.92	154.72	148.23	165.24	167.07	180.99	188.77	202.66		
							Tota	I = Sum(2	19a) ₁₁₂ =			2136.39	(219)
Annual									k'	Wh/year		kWh/year	_
Space h	eating fuel ι	sed, mair	system	1								2591.11	_
Water he	eating fuel u	sed										2136.39	
Electricit	ty for pumps	, fans and	electric	keep-ho	t								

mechanical ventilation - balanced, extract or pos	tive input from outside		137.27]	(230a)
central heating pump:			30]	(230c)
boiler with a fan-assisted flue			45		(230e)
Total electricity for the above, kWh/year	sum of (230a) (230g) =		212.27	(231)
Electricity for lighting				283.71	(232)
Electricity generated by PVs				-821.33	(233)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	Energy kWh/year	Emission fa kg CO2/kWh		Emissions kg CO2/ye	
Space heating (main system 1)	<u> </u>				
Space heating (main system 1) Space heating (secondary)	kWh/year	kg CO2/kWh		kg CO2/ye	ar
	kWh/year (211) x	kg CO2/kWh	=	kg CO2/ye	ar (261)
Space heating (secondary)	kWh/year (211) x (215) x	0.216 0.519	=	kg CO2/yea	(261) (263)
Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	0.216 0.519	=	kg CO2/yea 559.68 0 461.46	(261) (263) (264)
Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	0.216 0.519 0.216	= =	kg CO2/yea 559.68 0 461.46	(261) (263) (264) (265)

0.519

sum of (265) (271) =

 $(272) \div (4) =$

Item 1

Total CO2, kg/year

El rating (section 14)

Dwelling CO2 Emission Rate

(269)

(272)

(273)

(274)

-426.27

852.28

13.55

		User [Details:						
Assessor Name:	Chris Hocknell		Strom	a Num	ber:		STRO	016363	
Software Name:	Stroma FSAP 2012		Softwa	are Ve	rsion:		Versio	n: 1.0.4.12	
		Property	Address	: Apartm	nent 5				
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			a(m²) 75.8	(1a) x		2.7	(2a) =	Volume(m³)	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(75.8	(4)		2.1	(20)	204.00	
Dwelling volume	a) · (15) · (15) · (16) · (16) ·(,	73.0	J)+(3c)+(3c	d)+(3e)+	(3n) =	204.66	(5)
								204.00	
2. Ventilation rate:	main second		other		total			m³ per hou	•
Number of chimneys	heating heating	g 	0] = [0	x 4	40 =	0	(6a)
Number of open flues	0 + 0	╡ + ト	0	 =	0	x	20 =	0	(6b)
Number of intermittent fa	ns				0	x	10 =	0	(7a)
Number of passive vents	;			Ī	0	x -	10 =	0	(7b)
Number of flueless gas fi	ires			Ī	0	x	40 =	0	(7c)
				_			A ! I.		_
				_			Air ch	nanges per ho	ur —
	ys, flues and fans = (6a)+(6b)			continuo fi	0		÷ (5) =	0	(8)
Number of storeys in the	peen carried out or is intended, proc he dwelling (ns)	eeu 10 (17),	ouieiwise (conuna e n	om (s) to	(10)		0	(9)
Additional infiltration	3 (=)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame	or 0.35 fo	r masoni	ry constr	ruction			0	(11)
	resent, use the value corresponding	to the grea	ter wall are	ea (after			'		_
deducting areas of openii	ngs); ir equal user 0.35 floor, enter 0.2 (unsealed) or	0.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	· · ·	`	,,					0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic me	res per h	our per s	quare m	etre of e	envelope	area	3	(17)
If based on air permeabil	lity value, then (18) = [(17) ÷ 20]	+(8), otherw	rise (18) =	(16)				0.15	(18)
	es if a pressurisation test has been o	lone or a de	gree air pe	rmeability	is being u	sed	ı		_
Number of sides sheltere	ed		(20) = 1 -	[0 075 v /	10)] -			1	(19)
Shelter factor	line abaltan faatan		` '	•	19)] –			0.92	(20)
Infiltration rate incorporat	-		(21) = (18) X (20) –				0.14	(21)
Infiltration rate modified f	Mar Apr May Jur	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		, j oui	l //ag	<u> </u>	1 000	1 1101	1 200		
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
, ,	1 1 1 00	1	1	<u> </u>	1	1	I	I	
Wind Factor (22a)m = (2		1	1	<u> </u>	T	1 , ,,		1	
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

0.18 0.17	ate (allowi	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16]	
Calculate effective ai	_	rate for t	he appli	cable ca	se					!	l	
If mechanical venti											0.5	(2:
If exhaust air heat pump) = (23a)			0.5	(2:
If balanced with heat re-	-		_								75.65	(23
a) If balanced mec		1			<u> </u>	- 	í `	 		- ` ` `) ÷ 100]	
24a)m= 0.3 0.3	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(2
b) If balanced mec	1	1				- ^ ``	í `	– `	- 	1	1	
24b)m= 0 0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole house e if (22b)m < 0.5			•	•				.5 × (23b)			
24c)m= 0 0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural ventilation if (22b)m = 1, t				•				0.5]			_	
24d)m= 0 0	0	0	0	0	0	0	0	0	0	0		(2
Effective air change	e rate - er	nter (24a) or (24b	o) or (24	c) or (24	ld) in bo	x (25)				_	
25)m= 0.3 0.3	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.28	0.28		(2
3. Heat losses and h	neat loss	paramet	er:									
LEMENT Gro	oss a (m²)	Openin		Net Ar		U-val		AXU		k-value		X k J/K
				A ,r	11=	W/m2	ίK.	(W/l	K)	kJ/m²·	r\ Ku	J/ [\
oors			•	2	x	1.3	:K = [2.6	K)	KJ/m²·	r K	
			•		x		= [,	K)	KJ/m²·∣	r. K.	(2
Vindows Type 1			•	2	x x1	1.3	0.04] =	2.6	k) 	KJ/m²·∣	r K	(2
Doors Vindows Type 1 Vindows Type 2 Vindows Type 3			•	1.27	x x1 x1	1.3 /[1/(1.3)+	0.04] = [0.04] = [2.6	K) 	KJ/m²∙∖	r. K.	(2 (2 (2 (2
Vindows Type 1 Vindows Type 2			•	2 1.27 2.7	x x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+	0.04] = [0.04] = [0.04] = [2.6 1.57 3.34	K)	KJ/m²· l	r. K.	(2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3			•	2 1.27 2.7 2.22 2.78	x x x x x x x x x x x x x x x x x x x	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	0.04] = [0.04] = [0.04] = [0.04] = [2.6 1.57 3.34 2.74 3.44		KJ/m²· l	r. K.	(2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4			•	2 1.27 2.7 2.22	x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	= [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [2.6 1.57 3.34 2.74		KJ/m²· l	r. K.	(2 (2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6			•	2 1.27 2.7 2.22 2.78 7.75	x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	= [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [2.6 1.57 3.34 2.74 3.44 9.58		KJ/m²· l	r. K.	(2 (2 (2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7			•	2 1.27 2.7 2.22 2.78 7.75 1.19	x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	= [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47		KJ/m²· l	r. K.	(2 (2 (2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Cooflights	45			2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05	x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	= [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47		KJ/m²-	~ K	(2 (2 (2 (2 (2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Cooflights Valls Type1	.45	19.9		2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54	x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.6)+	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28		KJ/m²·		(22 (23 (24 (24 (24 (24 (24 (24 (24 (24 (24 (24
/indows Type 1 /indows Type 2 /indows Type 3 /indows Type 4 /indows Type 5 /indows Type 6 /indows Type 7 /ooflights /alls Type1 /alls Type2 4	38	19.9	1	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54	x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+	= [0.04] = [0.	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28		KJ/m²-		(22 (22 (22 (22 (22 (22 (22 (22 (22 (22
/indows Type 1 /indows Type 2 /indows Type 3 /indows Type 4 /indows Type 5 /indows Type 6 /indows Type 7 ooflights /alls Type1 /alls Type2 oof 75	38	19.9	1	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75	x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.3)+ /[1/(1.6)+	= 0.04] = 0.04	2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28		KJ/m²-		
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Rooflights Valls Type1 68 Valls Type2 4. Roof 60tal area of element for windows and roof win	38 5.8 cs, m ² dows, use 6	19.9 2 1.05	1 5 indow U-va	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75 148.6	x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /	= [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [= [= [= [= [= [= [= [= [= [2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28 0.22 7.48				(2 (2 (2
Vindows Type 1 Vindows Type 2 Vindows Type 3 Vindows Type 4 Vindows Type 5 Vindows Type 6 Vindows Type 7 Cooflights Valls Type1 68 Valls Type2 4 Coof 68 Votal area of element	38 5.8 cs, m² dows, use e	19.9 2 1.05 effective winternal wal	1 5 indow U-va	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75 148.6	x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /	= [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [0.04] = [= [= [= [= [= [= [= [= [= [2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28 0.22 7.48				(2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (2 (
/indows Type 1 /indows Type 2 /indows Type 3 /indows Type 4 /indows Type 5 /indows Type 6 /indows Type 7 /ooflights /alls Type1 68 /alls Type2 4. /oof 75 /otal area of element for windows and roof windows and r	38 5.8 cs, m² dows, use eth sides of in	19.9 2 1.05 effective winternal wal	1 5 indow U-va	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75 148.6	x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /		2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28 0.22 7.48	as given in	n paragraph	n 3.2	(22 (22 (22 (22 (22 (22 (22 (22 (22 (22
/indows Type 1 /indows Type 2 /indows Type 3 /indows Type 4 /indows Type 5 /indows Type 6 /indows Type 7 ooflights /alls Type1 68 /alls Type2 4. oof 75 otal area of element for windows and roof windinclude the areas on botal abric heat loss, W/K	38 5.8 s, m² dows, use eth sides of in $X = S(A \times B(A \times k))$	19.9 2 1.05 effective winternal wall U)	1 indow U-valls and par	2 1.27 2.7 2.22 2.78 7.75 1.19 2 1.05 48.54 2.38 74.75 148.6 alue calculatitions	x x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1	1.3 /[1/(1.3)+ /		2.6 1.57 3.34 2.74 3.44 9.58 1.47 2.47 1.68 7.28 0.22 7.48	as given in (2) + (32a)	n paragraph	13.2	(22 (22 (22 (22 (22 (22 (22 (32 (32 (32

	eat loss							(33) +	(36) =			60.02	(3
entilation he	eat loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
3)m= 20.17	19.94	19.7	18.53	18.3	17.13	17.13	16.89	17.59	18.3	18.76	19.23		(3
eat transfer	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
9)m= 80.19	79.96	79.72	78.55	78.32	77.15	77.15	76.91	77.62	78.32	78.79	79.26		
	•							,	Average =	Sum(39) ₁	12 /12=	78.49	(;
at loss par	rameter (H	HLP), W/	m²K				,		= (39)m ÷	(4)			
)m= 1.06	1.05	1.05	1.04	1.03	1.02	1.02	1.01	1.02	1.03	1.04	1.05		-
umber of da	avs in mo	nth (Tab ^ı	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.04	(4
Jan	-	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
				ı	ı					ı			
Water he	ating ene	rav reaui	rement:								kWh/ye	ear:	
· vacor no	ating one	igy roqui										, car	
sumed occ											38		(•
f TFA > 13 f TFA £ 13		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13.	9)			
nual avera	,	ater usac	ne in litre	es ner da	av Vd av	erage =	(25 x N)	+ 36		00	.69		(
duce the ann									se target o		1.09		(
more that 12	25 litres per _l	person per	day (all w	ater use, l	hot and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t water usage	e in litres per	r day for ea				Table 1c x				<u>I</u>			
)m= 99.75	96.13	92.5	88.87	85.24	81.62	81.62	85.24	88.87	92.5	96.13	99.75		
									Total - Su	m(44) _{1 12} =			\neg
									Total – Su			1088.23	16
ergy content	of hot water	used - cal	culated me	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			. ,	c, 1d)	1088.23	(
<i></i>	i	used - calc	culated mo	111.69	190 x Vd,r 96.38	89.31	0Tm / 3600 102.48			. ,	c, 1d)	1088.23	(
~ 	i				· ·			103.71	nth (see Ta	131.93	143.26	1088.23	`
)m= 147.93	3 129.38	133.51	116.4	111.69	96.38	89.31	102.48	103.71	120.86	131.93	143.26		`
)m= 147.93	3 129.38 water heati	133.51	116.4	111.69	96.38	89.31	102.48	103.71	120.86	131.93	143.26		((
nstantaneous)m= 22.19 ater storag	129.38 water heating 19.41 le loss:	133.51 ing at point 20.03	116.4 of use (no	111.69 hot water 16.75	96.38 storage),	89.31 enter 0 in	102.48 boxes (46)	103.71 106.71 107.71 10 to (61)	120.86 Total = Su 18.13	131.93 m(45) _{1 12} =	143.26		((
nstantaneous)m= 22.19 ater storag	129.38 water heating 19.41 le loss:	133.51 ing at point 20.03	116.4 of use (no	111.69 hot water 16.75	96.38 storage),	89.31 enter 0 in	102.48 boxes (46)	103.71 106.71 107.71 10 to (61)	120.86 Total = Su 18.13	131.93 m(45) _{1 12} =	143.26		(,
nstantaneous m= 22.19 ater storag prage volu community	129.38 water heating 19.41 le loss: me (litres)	133.51 ng at point 20.03 includin and no ta	of use (no 17.46 ag any so	111.69 hot water 16.75 clar or W	96.38 storage), 14.46 /WHRS nter 110	89.31 enter 0 in 13.4 storage litres in	102.48 boxes (46, 15.37 within sa (47)	103.71 105.71 106.61) 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} =	143.26		(,
m= 147.93 istantaneous m= 22.19 ater storag prage volume community herwise if	129.38 water heating a no stored	133.51 ng at point 20.03 includin and no ta	of use (no 17.46 ag any so	111.69 hot water 16.75 clar or W	96.38 storage), 14.46 /WHRS nter 110	89.31 enter 0 in 13.4 storage litres in	102.48 boxes (46, 15.37 within sa (47)	103.71 105.71 106.61) 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} =	143.26		(,
nstantaneous m= 22.19 ater storag prage voluce community herwise if i	129.38 water heating a no stored se loss:	133.51 ing at point 20.03) including and no tale hot water	of use (no 17.46 ag any so nk in dw er (this in	111.69 hot water 16.75 Dlar or W velling, e	96.38 storage), 14.46 /WHRS nter 110 nstantar	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47)	103.71 105.71 106.61) 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	143.26		(,
mstantaneous mstantaneous mstartaneous 8 water heating a no stored le loss: cturer's de	133.51 ing at point 20.03 including and no tale hot water	of use (no 17.46 ag any se ank in dw er (this ir	111.69 hot water 16.75 Dlar or W velling, e	96.38 storage), 14.46 /WHRS nter 110 nstantar	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47)	103.71 105.71 106.61) 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	143.26 = 21.49 0		(
mstantaneous mstantaneous m= 22.19 ater storag orage volu- community herwise if in ater storag If manufar mperature	129.38 water heating a no stored le loss: cturer's de factor fro	133.51 ng at point 20.03 includin and no ta hot wate eclared lo	116.4 of use (not) 17.46 ag any so ank in dwer (this in oss factors)	111.69 hot water 16.75 clar or W velling, encludes i	96.38 storage), 14.46 /WHRS nter 110 nstantar	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	143.26		(4
nstantaneous nstantaneous nstantaneous nstantaneous 22.19 ater storag community herwise if in ater storag If manufact mperature nergy lost fi	129.38 water heating a no stored le loss: cturer's de factor from water	133.51 ing at point 20.03 including and no tale hot water water and reclared learn Table and restorage	of use (not) 17.46 Ing any seank in dwer (this in oss factor) 2b , kWh/ye	111.69 hot water 16.75 plar or W velling, encludes i	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47)	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	143.26 = 21.49 0		(4)
m= 147.93 nstantaneous m= 22.19 ater storag prage voluments community herwise if interestorag If manufar mperature ergy lost fill	129.38 water heating a no stored le loss: cturer's de factor from water cturer's de factorer's de f	133.51 ing at point 20.03) including and no tale hot water water and reclared learn Table are storage eclared of the color of the co	of use (not) 17.46 ag any so onk in dwer (this in coss factors) 2b , kWh/yo	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	143.26 = 21.49 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(4)
nstantaneous nstantaneous nstantaneous nstantaneous nstantaneous nstantaneous 22.19 ater storag community herwise if in ater storag if manufantaneous nergy lost fin if manufantaneous to water storag	129.38 water heating a no stored le loss: cturer's de factor from water cturer's de prage loss	133.51 ang at point 20.03 includin and no ta hot wate eclared le m Table r storage eclared co	of use (not) 17.46 ag any so ank in dwer (this in oss factor 2b , kWh/ye cylinder to make the com Table	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	143.26 = 21.49 0		(4)
instantaneous in	129.38 water heating a no stored le loss: cturer's de factor from water cturer's de prage loss heating since heat	133.51 ng at point 20.03 including and no tale and the water and the water and the water at the color and the co	of use (not) 17.46 ag any so ank in dwer (this in oss factor 2b , kWh/ye cylinder to make the com Table	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	143.26 = 21.49 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		
mstantaneous mstantaneous mstantaneous mstantaneous mstantaneous mstantaneous mstantaneous mage volu community herwise if it ater storag If manufac mperature mstantaneous mst	129.38 water heating a no stored le loss: cturer's de factor from water cturer's de prage loss heating sor from Ta	133.51 20.03 including and no tale hot water that wat	of use (not) 17.46 ag any so ank in dwer (this in coss factor 2b by kWh/yo by keylinder from Table on 4.3	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage litres in neous co	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 105.56 15.56 15.56 15.56 15.56	120.86 Total = Su 18.13	131.93 m(45) _{1 12} = 19.79	143.26 = 21.49 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(4 (4 (4 (4) (4) (4)
nstantaneous	129.38 water heating a no stored le loss: cturer's de factor from water cturer's de prage loss heating sor from Tale factor from the factor f	133.51 20.03 including and no tale hot water and reclared learn to the eclared control of	of use (not) 17.46 ag any so onk in dwer (this in coss factors, kWh/yo coylinder to m Table on 4.3	111.69 hot water 16.75 clar or W velling, encludes it or is known is kno	96.38 storage), 14.46 /WHRS nter 110 nstantar wn (kWh	enter 0 in 13.4 storage litres in neous con/day): known:	102.48 boxes (46, 15.37 within sa (47) ombi boil	103.71 103.71 15.56 ame vesters) enter	120.86 Total = Su 18.13 sel er '0' in (131.93 m(45) _{1 12} = 19.79	143.26 = 21.49 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(4

vvater	storage	ioss car	cuiateu i	ioi eacii	monun			((56)m = (00) (41)	•••				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	v circuit	loss (an	nual) fro	om Table	3							0		(58)
	-	•	•			59)m = ((58) ÷ 36	65 × (41)	m					
(mod	dified by	factor fr	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m		-	-	-		
(61)m=	50.83	44.24	47.14	43.83	43.44	40.25	41.59	43.44	43.83	47.14	47.41	50.83		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	198.77	173.63	180.65	160.23	155.13	136.63	130.9	145.92	147.53	168	179.33	194.1		(62)
Solar DF	HW input o	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	I lines if	FGHRS	and/or \	WHRS	applies	, see Ap	pendix (€)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter				•	•		•	•	•		
(64)m=	198.77	173.63	180.65	160.23	155.13	136.63	130.9	145.92	147.53	168	179.33	194.1		
-								Outp	out from w	ater heate	r (annual) ₁	12	1970.8	(64)
Heat a	aina fra												1	
ı ıcal y	aiiis iioi	m water	heating,	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	າ] + 0.8 າ	⟨ (46)m	+ (57)m	+ (59)m	1	
(65)m=	61.9	m water 54.08	heating, 56.18	49.66	onth 0.2:	5 ´ [0.85 42.11	× (45)m 40.09	+ (61)m 44.94	1] + 0.8 x 45.44	51.97	+ (57)m 55.72	+ (59)m 60.34]	(65)
(65)m=	61.9	54.08	56.18	49.66	48	42.11	40.09	44.94	45.44	51.97	55.72	60.34		(65)
(65)m= inclu	61.9 de (57)	54.08 m in cald	56.18 culation o	49.66 of (65)m	48 only if c	42.11	40.09	44.94	45.44	51.97	55.72			(65)
(65)m= inclu 5. Int	61.9 de (57) ernal ga	54.08 m in calc ains (see	56.18 culation of	49.66 of (65)m 5 and 5a	48 only if c	42.11	40.09	44.94	45.44	51.97	55.72	60.34		(65)
(65)m= inclu 5. Int	61.9 de (57) ernal ga olic gain	54.08 m in calc ains (see as (Table	56.18 culation of Table 5	49.66 of (65)m 5 and 5a	48 only if c	42.11 cylinder is	40.09 s in the o	44.94 dwelling	45.44 or hot w	51.97	55.72 rom com	60.34 munity h		(65)
inclu 5. Int	61.9 de (57) ernal ga blic gain Jan	54.08 m in calc ains (see as (Table Feb	56.18 culation of Table 5 : 5), Wat Mar	49.66 of (65)m 5 and 5a ts Apr	48 only if c	42.11 -ylinder is -ylinder is	40.09 s in the o	44.94 dwelling	45.44 or hot w	51.97 rater is fr	55.72	60.34 munity h		(65)
inclu 5. Int Metabo (66)m=	61.9 de (57) ernal ga olic gain Jan 118.92	54.08 m in calc ains (see as (Table Feb 118.92	56.18 culation of Table 5 S), Wat Mar	49.66 of (65)m 5 and 5a ts Apr 118.92	48 only if c : : : : : : : : : : : : : : : : : : :	Jun	40.09 s in the o	44.94 dwelling Aug 118.92	45.44 or hot w Sep 118.92	51.97	55.72 om com	60.34 munity h		
inclu 5. Int Metabo (66)m= Lightin	61.9 de (57) ernal ga olic gain Jan 118.92 g gains	54.08 m in calconing (see the second	56.18 culation of Table 5 5), Wat Mar 118.92 ted in Ap	49.66 of (65)m of and 5a tts Apr 118.92 opendix	48 only if control May 118.92 L, equat	Jun 118.92	40.09 s in the o Jul 118.92 r L9a), a	Aug 118.92	45.44 or hot w Sep 118.92 Table 5	51.97 rater is fr Oct 118.92	55.72 rom com Nov 118.92	Dec		(66)
inclu 5. Int Metabo (66)m= Lightin (67)m=	61.9 de (57) ernal ga blic gain Jan 118.92 g gains 18.76	54.08 m in calc ains (see s (Table Feb 118.92 (calcula	56.18 culation of the Table 5	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26	48 only if control May 118.92 L, equat 7.67	Jun 118.92 ion L9 or	40.09 s in the o Jul 118.92 r L9a), a	Aug 118.92 Iso see	45.44 or hot w Sep 118.92 Table 5	51.97 rater is fr Oct 118.92	55.72 om com	60.34 munity h		
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar	61.9 de (57) ernal ga plic gain Jan 118.92 g gains 18.76 nces ga	54.08 m in calc ains (see as (Table Feb 118.92 (calcula 16.66 ins (calc	56.18 culation of Table 5 culation of Table 5 culation of Table 5 culated in Application A	49.66 of (65)m 6 and 5a ts Apr 118.92 opendix 10.26	48 only if control May 118.92 L, equat 7.67 dix L, eq	Jun 118.92 ion L9 or 6.47 uation L	Jul 118.92 r L9a), a 7	Aug 118.92 Iso see 9.09 3a), also	45.44 or hot w Sep 118.92 Table 5 12.21 see Ta	51.97 rater is fr Oct 118.92 15.5 ble 5	55.72 rom com Nov 118.92	Dec 118.92		(66)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m=	61.9 de (57) ernal ga blic gain Jan 118.92 g gains 18.76 nces ga 210.44	54.08 m in calc ains (see as (Table Feb 118.92 (calcula 16.66 ins (calc	56.18 culation of Table 5 Mar 118.92 ted in Ap 13.55 ulated in 207.12	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Append 195.41	48 only if c : May 118.92 L, equat 7.67 dix L, eq 180.62	Jun 118.92 ion L9 or 6.47 uation L	Jul 118.92 r L9a), a 7 13 or L1 157.43	44.94 dwelling Aug 118.92 lso see 9.09 3a), also 155.25	45.44 or hot w Sep 118.92 Table 5 12.21 see Ta 160.75	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47	55.72 rom com Nov 118.92	Dec		(66)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookin	61.9 de (57) ernal ga blic gain Jan 118.92 g gains 18.76 nces ga 210.44	54.08 m in calc ains (see s (Table Feb 118.92 (calcular 16.66 ins (calc 212.62 (calcula	56.18 culation of the Table 5 culation of the Table 5 culation of the Table 5 culated in April 13.55 culated in April 207.12 culated in April 207.12	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Append 195.41 ppendix	48 only if co : May 118.92 L, equat 7.67 dix L, eq 180.62 L, equat	Jun 118.92 ion L9 or 6.47 uation L 166.72	Jul 118.92 r L9a), a 7 13 or L1 157.43 or L15a	Aug 118.92 Iso see 9.09 3a), also 155.25	Sep 118.92 Table 5 12.21 see Table 160.75	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47	55.72 rom com Nov 118.92 18.09	Dec 118.92 19.28		(66) (67)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookin (69)m=	61.9 de (57) ernal ga blic gain Jan 118.92 g gains 18.76 nces ga 210.44 g gains 34.89	54.08 m in calc ains (see s (Table Feb 118.92 (calcula 16.66 ins (calc 212.62 (calcula 34.89	56.18 culation of Table 5 culation of Table 5 culation of Table 5 culated in Aproximated in Apro	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Append 195.41 ppendix 34.89	48 only if c : May 118.92 L, equat 7.67 dix L, eq 180.62	Jun 118.92 ion L9 or 6.47 uation L	Jul 118.92 r L9a), a 7 13 or L1 157.43	44.94 dwelling Aug 118.92 lso see 9.09 3a), also 155.25	45.44 or hot w Sep 118.92 Table 5 12.21 see Ta 160.75	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47	55.72 rom com Nov 118.92	Dec 118.92		(66)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookin (69)m= Pumps	de (57) ernal ga blic gain Jan 118.92 g gains 18.76 nces ga 210.44 g gains 34.89	s (Table Feb 118.92 (calcula 16.66 calcula 34.89 ms gains	56.18 culation of Table 5 5), Wat Mar 118.92 ted in Ap 13.55 ulated in 207.12 tted in A 34.89 (Table 5	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Append 195.41 opendix 34.89 5a)	48 only if c): May 118.92 L, equat 7.67 dix L, eq 180.62 L, equat 34.89	Jun 118.92 ion L9 or 6.47 uation L 166.72 tion L15 34.89	Jul 118.92 r L9a), a 7 13 or L1 157.43 or L15a) 34.89	Aug 118.92 Iso see 9.09 3a), also 155.25), also se 34.89	45.44 or hot w Sep 118.92 Table 5 12.21 o see Ta 160.75 ee Table 34.89	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47 25 34.89	Nov 118.92 187.26	Dec 118.92 19.28 201.15		(66) (67) (68)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m=	61.9 de (57) ernal ga plic gain Jan 118.92 g gains 18.76 nces ga 210.44 ng gains 34.89 and fai	54.08 m in calc ains (see s (Table Feb 118.92 (calcula 16.66 ins (calc 212.62 (calcula 34.89 ns gains	56.18 culation of the Table 5 5), Wat Mar 118.92 ted in Apr 13.55 ulated in 207.12 ted in Apr 14.89 (Table 5	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Append 195.41 ppendix 34.89 5a) 3	48 only if co : May 118.92 L, equat 7.67 dix L, eq 180.62 L, equat 34.89	Jun 118.92 ion L9 or 6.47 uation L 166.72 tion L15 34.89	Jul 118.92 r L9a), a 7 13 or L1 157.43 or L15a	Aug 118.92 Iso see 9.09 3a), also 155.25	Sep 118.92 Table 5 12.21 see Table 160.75	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47	55.72 rom com Nov 118.92 18.09	Dec 118.92 19.28		(66) (67)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses	de (57) ernal ga plic gain Jan 118.92 g gains 18.76 nces ga 210.44 g gains 34.89 and fai	54.08 m in calc ains (see as (Table Feb 118.92 (calcula 16.66 ins (calc 212.62 (calcula 34.89 as gains 3	56.18 culation of Table 5 5), Wat Mar 118.92 ted in Ap 13.55 ulated in 207.12 ted in A 34.89 (Table 5	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Appendix 34.89 5a) 3 tive valu	48 only if co : May 118.92 L, equat 7.67 dix L, eq 180.62 L, equat 34.89 3 es) (Tab	Jun 118.92 ion L9 or 6.47 uation L 166.72 tion L15 34.89	Jul 118.92 r L9a), a 7 13 or L1 157.43 or L15a) 34.89	44.94 dwelling Aug 118.92 lso see 9.09 3a), also 155.25), also se 34.89	45.44 or hot w Sep 118.92 Table 5 12.21 see Ta 160.75 ee Table 34.89	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47 5 34.89	55.72 Tom com Nov 118.92 187.26 34.89	Dec 118.92 19.28 201.15 34.89		(66) (67) (68) (69)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m=	de (57) ernal ga plic gain Jan 118.92 g gains 18.76 nces ga 210.44 g gains 34.89 and fai 3 e.g. ev -95.13	54.08 m in calc ains (see as (Table Feb 118.92 (calcula 16.66 ins (calc 212.62 (calcula 34.89 ns gains 3 raporatio -95.13	56.18 culation of the Table 5 culation of the Table 5 culation of the Table 5 culated in April 13.55 culated in April 13.55 culated in April 13.4.89 culated in April 13.4.89 culated in April 13.4.89 culated in April 13.55 culated in April 13.55 culated in April 13.55 culated in April 13.55 culated in April 13.55 culated in April 13.55 culated in April 13.55 culated in April 13.55 culation of the Table 5 culatio	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Append 195.41 ppendix 34.89 5a) 3	48 only if co : May 118.92 L, equat 7.67 dix L, eq 180.62 L, equat 34.89	Jun 118.92 ion L9 or 6.47 uation L 166.72 tion L15 34.89	Jul 118.92 r L9a), a 7 13 or L1 157.43 or L15a) 34.89	Aug 118.92 Iso see 9.09 3a), also 155.25), also se 34.89	45.44 or hot w Sep 118.92 Table 5 12.21 o see Ta 160.75 ee Table 34.89	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47 25 34.89	Nov 118.92 187.26	Dec 118.92 19.28 201.15		(66) (67) (68) (69)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m= Water	61.9 de (57) ernal ga blic gain Jan 118.92 g gains 18.76 nces ga 210.44 g gains 34.89 and fai 3 e.g. ev -95.13 heating	54.08 m in calc ains (see s (Table Feb 118.92 (calcula 16.66 ins (calc 212.62 (calcula 34.89 ns gains 3 raporatio -95.13 gains (T	56.18 culation of the Table 5 5), Wat Mar 118.92 ted in Apr 13.55 ulated in Apr 14.89 (Table 5 3 on (negation of the Table 5) Table 5)	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Append 195.41 ppendix 34.89 5a) 3 tive valu -95.13	48 only if co): May 118.92 L, equat 7.67 dix L, eq 180.62 L, equat 34.89 3 es) (Tab -95.13	Jun 118.92 ion L9 or 6.47 uation L15 34.89 3 ole 5) -95.13	Jul 118.92 r L9a), a 7 13 or L1 157.43 or L15a 34.89	Aug 118.92 Iso see 9.09 3a), also 155.25), also se 34.89	45.44 or hot w Sep 118.92 Table 5 12.21 o see Ta 160.75 ee Table 34.89 3 -95.13	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47 5 34.89 3	55.72 rom com Nov 118.92 18.09 187.26 34.89 3	Dec 118.92 19.28 201.15 34.89 3		(66) (67) (68) (69) (70)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	de (57) ernal ga blic gain Jan 118.92 g gains 18.76 nces ga 210.44 g gains 34.89 and fai 3 e.g. ev -95.13 heating	sins (see las (Table Feb 118.92) (calcula 16.66) (calcula 34.89) (calcula 34.8	56.18 culation of the Table 5 5), Wat Mar 118.92 ted in Ap 13.55 ulated in 207.12 tted in Ap 34.89 (Table 5 3 an (negation of the Table 5) 75.51	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Appendix 34.89 5a) 3 tive valu	48 only if co : May 118.92 L, equat 7.67 dix L, eq 180.62 L, equat 34.89 3 es) (Tab	Jun 118.92 ion L9 or 6.47 uation L 166.72 tion L15 34.89 3 ole 5) -95.13	Jul 118.92 r L9a), a 7 13 or L1 157.43 or L15a) 34.89 3	44.94 dwelling Aug 118.92 lso see 9.09 3a), also 155.25), also se 34.89 3 -95.13	45.44 or hot w Sep 118.92 Table 5 12.21 see Ta 160.75 ee Table 34.89 3 -95.13	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47 5 34.89 3 -95.13	55.72 Tom com Nov 118.92 18.09 187.26 34.89 3 -95.13	60.34 munity h Dec 118.92 19.28 201.15 34.89 3 -95.13		(66) (67) (68) (69)
inclu 5. Int Metabo (66)m= Lightin (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	de (57) ernal ga blic gain Jan 118.92 g gains 18.76 nces ga 210.44 g gains 34.89 and fai 3 e.g. ev -95.13 heating	54.08 m in calc ains (see s (Table Feb 118.92 (calcula 16.66 ins (calc 212.62 (calcula 34.89 ns gains 3 raporatio -95.13 gains (T	56.18 culation of the Table 5 5), Wat Mar 118.92 ted in Ap 13.55 ulated in 207.12 tted in Ap 34.89 (Table 5 3 an (negation of the Table 5) 75.51	49.66 of (65)m 5 and 5a ts Apr 118.92 opendix 10.26 n Append 195.41 ppendix 34.89 5a) 3 tive valu -95.13	48 only if co): May 118.92 L, equat 7.67 dix L, eq 180.62 L, equat 34.89 3 es) (Tab -95.13	Jun 118.92 ion L9 or 6.47 uation L 166.72 tion L15 34.89 3 ole 5) -95.13	Jul 118.92 r L9a), a 7 13 or L1 157.43 or L15a) 34.89 3	44.94 dwelling Aug 118.92 lso see 9.09 3a), also 155.25), also se 34.89 3 -95.13	45.44 or hot w Sep 118.92 Table 5 12.21 see Ta 160.75 ee Table 34.89 3 -95.13	51.97 rater is fr Oct 118.92 15.5 ble 5 172.47 5 34.89 3	55.72 Tom com Nov 118.92 18.09 187.26 34.89 3 -95.13	60.34 munity h Dec 118.92 19.28 201.15 34.89 3 -95.13		(66) (67) (68) (69) (70)

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

Orientation: Access Factor Table 6d	or	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	x	7.75	x	11.28	x	0.55	x	0.7	=	23.33	(75)
Northeast 0.9x 0.77	x	1.19	x	11.28	x	0.55	х	0.7	=	3.58	(75)
Northeast 0.9x 0.77	x	7.75	x	22.97	x	0.55	х	0.7	=	47.49	(75)
Northeast 0.9x 0.77	x	1.19	x	22.97	x	0.55	x	0.7	Ī =	7.29	(75)
Northeast 0.9x 0.77	х	7.75	x	41.38	x	0.55	х	0.7] =	85.56	(75)
Northeast 0.9x 0.77	X	1.19	x	41.38	x	0.55	х	0.7] =	13.14	(75)
Northeast 0.9x 0.77	x	7.75	x	67.96	x	0.55	х	0.7	=	140.51	(75)
Northeast _{0.9x} 0.77	x	1.19	x	67.96	X	0.55	x	0.7] =	21.58	(75)
Northeast 0.9x 0.77	x	7.75	x	91.35	x	0.55	х	0.7] =	188.88	(75)
Northeast 0.9x 0.77	x	1.19	x	91.35	X	0.55	х	0.7] =	29	(75)
Northeast _{0.9x} 0.77	x	7.75	x	97.38	x	0.55	x	0.7	=	201.37	(75)
Northeast _{0.9x} 0.77	x	1.19	x	97.38	x	0.55	x	0.7] =	30.92	(75)
Northeast _{0.9x} 0.77	x	7.75	x	91.1	X	0.55	х	0.7] =	188.37	(75)
Northeast 0.9x 0.77	x	1.19	x	91.1	X	0.55	х	0.7	=	28.92	(75)
Northeast 0.9x 0.77	x	7.75	x	72.63	x	0.55	х	0.7	=	150.17	(75)
Northeast 0.9x 0.77	x	1.19	x	72.63	x	0.55	х	0.7	=	23.06	(75)
Northeast 0.9x 0.77	X	7.75	x	50.42	X	0.55	х	0.7	=	104.26	(75)
Northeast 0.9x 0.77	x	1.19	x	50.42	x	0.55	х	0.7	=	16.01	(75)
Northeast 0.9x 0.77	x	7.75	x	28.07	x	0.55	x	0.7	=	58.04	(75)
Northeast 0.9x 0.77	X	1.19	x	28.07	x	0.55	х	0.7] =	8.91	(75)
Northeast 0.9x 0.77	x	7.75	x	14.2	x	0.55	x	0.7] =	29.36	(75)
Northeast 0.9x 0.77	x	1.19	x	14.2	x	0.55	х	0.7	=	4.51	(75)
Northeast _{0.9x} 0.77	x	7.75	x	9.21	X	0.55	х	0.7] =	19.05	(75)
Northeast 0.9x 0.77	x	1.19	x	9.21	X	0.55	х	0.7] =	2.93	(75)
Southeast 0.9x 0.77	x	2	x	36.79	x	0.55	x	0.7	=	19.63	(77)
Southeast 0.9x 0.77	x	2	x	62.67	x	0.55	x	0.7	=	33.44	(77)
Southeast 0.9x 0.77	x	2	x	85.75	x	0.55	х	0.7] =	45.76	(77)
Southeast 0.9x 0.77	x	2	x	106.25	x	0.55	x	0.7	=	56.7	(77)
Southeast 0.9x 0.77	X	2	x	119.01	x	0.55	X	0.7	=	63.51	(77)
Southeast 0.9x 0.77	x	2	x	118.15	x	0.55	x	0.7	=	63.05	(77)
Southeast 0.9x 0.77	x	2	x	113.91	x	0.55	x	0.7	=	60.78	(77)
Southeast 0.9x 0.77	x	2	x	104.39	x	0.55	x	0.7] =	55.7	(77)
Southeast 0.9x 0.77	X	2	x	92.85	X	0.55	х	0.7] =	49.55	(77)
Southeast 0.9x 0.77	x	2	x	69.27	X	0.55	х	0.7	=	36.96	(77)
Southeast 0.9x 0.77	x	2	x	44.07	x	0.55	х	0.7	=	23.52	(77)
Southeast 0.9x 0.77	x	2	x	31.49	x	0.55	х	0.7] =	16.8	(77)
Southwest _{0.9x} 0.77	x	1.27	x	36.79]	0.55	х	0.7] =	12.47	(79)
Southwest _{0.9x} 0.77	x	2.7	x	36.79]	0.55	x	0.7] =	26.51	(79)
Southwest _{0.9x} 0.77	X	2.22	×	36.79]	0.55	X	0.7	=	21.79	(79)

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Southwest _{0.9x}	0.77	X	2.78	X	36.79	0.55	X	0.7] =	27.29	(79)
Southwest _{0.9x}	0.77	X	1.27	X	62.67	0.55	X	0.7	=	21.24	(79)
Southwest _{0.9x}	0.77	X	2.7	X	62.67	0.55	X	0.7	=	45.15	(79)
Southwest _{0.9x}	0.77	X	2.22	X	62.67	0.55	X	0.7	=	37.12	(79)
Southwest _{0.9x}	0.77	X	2.78	X	62.67	0.55	X	0.7	=	46.49	(79)
Southwest _{0.9x}	0.77	X	1.27	X	85.75	0.55	X	0.7	=	29.06	(79)
Southwest _{0.9x}	0.77	X	2.7	X	85.75	0.55	X	0.7	=	61.77	(79)
Southwest _{0.9x}	0.77	X	2.22	X	85.75	0.55	X	0.7	=	50.79	(79)
Southwest _{0.9x}	0.77	X	2.78	X	85.75	0.55	X	0.7	=	63.6	(79)
Southwest _{0.9x}	0.77	X	1.27	x	106.25	0.55	X	0.7	=	36	(79)
Southwest _{0.9x}	0.77	X	2.7	X	106.25	0.55	X	0.7	=	76.54	(79)
Southwest _{0.9x}	0.77	X	2.22	X	106.25	0.55	X	0.7	=	62.93	(79)
Southwest _{0.9x}	0.77	X	2.78	x	106.25	0.55	x	0.7	=	78.81	(79)
Southwest _{0.9x}	0.77	X	1.27	X	119.01	0.55	x	0.7	=	40.33	(79)
Southwest _{0.9x}	0.77	X	2.7	X	119.01	0.55	X	0.7	=	85.73	(79)
Southwest _{0.9x}	0.77	x	2.22	x	119.01	0.55	x	0.7	=	70.49	(79)
Southwest _{0.9x}	0.77	x	2.78	x	119.01	0.55	X	0.7	=	88.27	(79)
Southwest _{0.9x}	0.77	X	1.27	x	118.15	0.55	X	0.7] =	40.03	(79)
Southwest _{0.9x}	0.77	X	2.7	x	118.15	0.55	X	0.7] =	85.11	(79)
Southwest _{0.9x}	0.77	X	2.22	x	118.15	0.55	X	0.7	=	69.98	(79)
Southwest _{0.9x}	0.77	X	2.78	x	118.15	0.55	X	0.7] =	87.63	(79)
Southwest _{0.9x}	0.77	x	1.27	x	113.91	0.55	x	0.7] =	38.6	(79)
Southwest _{0.9x}	0.77	X	2.7	x	113.91	0.55	x	0.7] =	82.06	(79)
Southwest _{0.9x}	0.77	X	2.22	x	113.91	0.55	X	0.7] =	67.47	(79)
Southwest _{0.9x}	0.77	x	2.78	x	113.91	0.55	x	0.7	=	84.49	(79)
Southwest _{0.9x}	0.77	x	1.27	x	104.39	0.55	x	0.7	=	35.37	(79)
Southwest _{0.9x}	0.77	X	2.7	x	104.39	0.55	X	0.7] =	75.2	(79)
Southwest _{0.9x}	0.77	x	2.22	x	104.39	0.55	x	0.7	=	61.83	(79)
Southwest _{0.9x}	0.77	x	2.78	x	104.39	0.55	x	0.7	=	77.43	(79)
Southwest _{0.9x}	0.77	X	1.27	x	92.85	0.55	X	0.7] =	31.46	(79)
Southwest _{0.9x}	0.77	x	2.7	x	92.85	0.55	x	0.7] <u>=</u>	66.89	(79)
Southwest _{0.9x}	0.77	x	2.22	x	92.85	0.55	x	0.7	Ī =	55	(79)
Southwest _{0.9x}	0.77	x	2.78	x	92.85	0.55	x	0.7	j =	68.87	(79)
Southwest _{0.9x}	0.77	x	1.27	x	69.27	0.55	x	0.7] <u>-</u>	23.47	(79)
Southwest _{0.9x}	0.77	x	2.7	x	69.27	0.55	x	0.7	j =	49.9	(79)
Southwest _{0.9x}	0.77	x	2.22	x	69.27	0.55	x	0.7	j =	41.03	(79)
Southwest _{0.9x}	0.77	x	2.78	x	69.27	0.55	x	0.7	j =	51.38	(79)
Southwest _{0.9x}	0.77	x	1.27	x	44.07	0.55	x	0.7	j =	14.93	(79)
Southwest _{0.9x}	0.77	x	2.7	x	44.07	0.55	x	0.7	j =	31.75	(79)
Southwest _{0.9x}	0.77	x	2.22	x	44.07	0.55	x	0.7	j =	26.1	(79)
Southwest _{0.9x}	0.77	x	2.78	x	44.07	0.55	x	0.7	i =	32.69	(79)
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Southwest _{0.9x}	0.77	X	1.2	27	X	31.49		0.55	X	0.7	=	10.67	(79)
Southwest _{0.9x}	0.77	X	2.	7	X	31.49		0.55	x	0.7	=	22.68	(79)
Southwest _{0.9x}	0.77	X	2.2	22	x	31.49		0.55	x	0.7	=	18.65	(79)
Southwest _{0.9x}	0.77	X	2.7	78	X	31.49		0.55	x	0.7	=	23.36	(79)
Rooflights 0.9x	1	X	1.0)5	x	26	×	0.55	x	0.8	=	10.81	(82)
Rooflights 0.9x	1	x	1.0)5	x	54	×	0.55	x	0.8		22.45	(82)
Rooflights 0.9x	1	x	1.0)5	x	96	×	0.55	x	0.8	=	39.92	(82)
Rooflights 0.9x	1	x	1.0)5	x	150	X	0.55	x	0.8		62.37	(82)
Rooflights 0.9x	1	x	1.0)5	x	192	×	0.55	x	0.8	=	79.83	(82)
Rooflights 0.9x	1	X	1.0)5	x	200	×	0.55	x	0.8	=	83.16	(82)
Rooflights 0.9x	1	X	1.0)5	x	189	×	0.55	x	0.8	=	78.59	(82)
Rooflights 0.9x	1	X	1.0)5	X	157	×	0.55	x	0.8	=	65.28	(82)
Rooflights 0.9x	1	X	1.0)5	x	115	×	0.55	x	0.8	=	47.82	(82)
Rooflights 0.9x	1	X	1.0)5	X	66	×	0.55	x	0.8	=	27.44	(82)
Rooflights 0.9x	1	X	1.0)5	x	33	×	0.55	x	0.8	=	13.72	(82)
Rooflights 0.9x	1	X	1.0)5	x	21	×	0.55	x	0.8	=	8.73	(82)
							_						
Solar gains in	watts, calc	culated	for eacl	h montl	h		(83)n	n = Sum(74)m	(82)m				
(83)m= 145.41	1 1	389.6	535.44	646.04	\neg	61.25 629.28	544	.05 439.85	297.13	3 176.57	122.87]	(83)
Total gains –	internal and	d solar	(84)m =	= (73)m	+ (33)m , watts	'	!				_	
(84)m= 519.48	632.11	747.45	871.75	960.51	5	54.6 909.27	7 830	.46 737.59	616.62	2 520.98	486.09]	(84)
7 Mean inte	rnal tempe	rature (heating	seaso	n)		•		•				
7. Mean inte	•	`	`			area from Ta	able 9	. Th1 (°C)				21	(85)
Temperature	during hea	ating pe	eriods ir	n the liv	ing			, Th1 (°C)				21	(85)
Temperature Utilisation fa	during hea	ating pe	eriods ir	n the liv ea, h1,r	ving m (s	ee Table 9a)		Oct	Nov	Dec	21	(85)
Temperature Utilisation fa	during hea	ating pens for li	eriods ir	n the liv	ring m (s	ee Table 9a Jun Jul)	ug Sep	Oct	Nov 0.99	Dec 1	21	(85)
Temperature Utilisation fa Jan (86)m= 1	e during hea	ating penns for li Mar 0.96	eriods ir ving are Apr 0.88	n the livea, h1,r May	ring m (s	ee Table 9a Jun Jul 0.51 0.37) A	ug Sep 12 0.69	 	+		21	
Temperature Utilisation fa Jan (86)m= 1 Mean interna	e during heat ctor for gain Feb 0.99	ating penns for li Mar 0.96	eriods ir ving are Apr 0.88 iving are	n the livea, h1,r May 0.71	ring m (s	Jun Jul 0.51 0.37 w steps 3 to) A 0.4	ug Sep 12 0.69 Table 9c)	0.94	0.99	1	21	(86)
Temperature Utilisation fa Jan (86)m= 1	e during heat ctor for gain Feb 0.99	ating penns for li Mar 0.96	eriods ir ving are Apr 0.88	n the livea, h1,r May	ring m (s	ee Table 9a Jun Jul 0.51 0.37) A	ug Sep 12 0.69 Table 9c)	 	+		21	
Temperature Utilisation fa Jan (86)m= 1 Mean interna	e during heactor for gain Feb 0.99 al temperat 20.17	ating pens for li Mar 0.96 cure in li 20.45	eriods in ving are Apr 0.88 iving are 20.77	n the livea, h1,r May 0.71 ea T1 (1 20.94	ring m (s follo	ee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21) A 0.4	ug Sep 12 0.69 Table 9c) 1 20.96	0.94	0.99	1	21	(86)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96	e during heat ctor for gain Feb 0.99 al temperat 20.17	ating pens for li Mar 0.96 cure in li 20.45	eriods in ving are Apr 0.88 iving are 20.77	n the livea, h1,r May 0.71 ea T1 (1 20.94	ring m (s follo	ee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21) A 0.4 7 in 1 2 [able 1]	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C)	0.94	0.99	1	21	(86)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04	e during heat ctor for gain Feb 0.99 al temperat 20.17 e during heat 20.04	ns for li Mar 0.96 ure in li 20.45 ating pe	Apr 0.88 iving are 20.77 eriods ir	n the livea, h1,r May 0.71 ea T1 (* 20.94 n rest o 20.06	ring m (s	Dee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21 relling from 7 0.07 20.07	A 0.4 7 in 1 2 20.	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C)	0.94	0.99	19.93	21	(86)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature	e during heat ctor for gain Feb 0.99 al temperat 20.17 e during heat 20.04	ns for li Mar 0.96 ure in li 20.45 ating pe	Apr 0.88 iving are 20.77 eriods ir	n the livea, h1,r May 0.71 ea T1 (* 20.94 n rest o 20.06	ring m (s	Dee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21 relling from 7 0.07 20.07	A 0.4 7 in 1 2 20.	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06	0.94	0.99	19.93	21	(86)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99	te during heat ctor for gain Feb 0.99 at temperat 20.17 at during heat 20.04 ctor for gain 0.99	ns for li Mar 0.96 ure in li 20.45 ating pe 20.04 ns for re 0.95	eriods in ving are Apr 0.88 iving are 20.77 eriods in 20.05 est of do 0.85	n the livea, h1,r May 0.71 ea T1 (20.94 n rest 0 20.06 welling, 0.65	ring m (s follo	ee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21 relling from 7 0.07 20.07 m (see Tabl 0.44 0.29	0.4 7 in 1 2 7able 9 20.6 9a) 0.3	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06	0.94 20.7 20.06	20.27	19.93	21	(86) (87) (88)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99 Mean interna	e during heat ctor for gain Feb 0.99 al temperat 20.17 e during heat 20.04 ctor for gain 0.99 al temperat	ns for li Mar 0.96 ure in li 20.45 ating per 20.04 ns for re 0.95 ure in t	eriods in Apr 0.88 iving are 20.77 eriods in 20.05 est of do 0.85 he rest	n the livea, h1,r May 0.71 ea T1 (** 20.94 n rest of 20.06 welling, 0.65 of dwel	ring (sm (s follow), h2, h2, h2, h2, h2, h2, h2, h2, h2, h2	Jun	A 0.4 7 in 1 2 20. e 9a) 0.3 teps 3	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 14 0.61 15 7 in Tab	0.94 20.7 20.06 0.91 le 9c)	0.99 20.27 20.05	19.93	21]	(86) (87) (88)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99 Mean interna	te during heat temperat 20.17 e during heat 20.04 ctor for gain 0.99 al temperat 20.99 al temperat	ns for li Mar 0.96 ure in li 20.45 ating pe 20.04 ns for re 0.95	eriods in ving are Apr 0.88 iving are 20.77 eriods in 20.05 est of do 0.85	n the livea, h1,r May 0.71 ea T1 (20.94 n rest 0 20.06 welling, 0.65	ring (sm (s follow), h2, h2, h2, h2, h2, h2, h2, h2, h2, h2	Jun	A 0.4 7 in 1 2 20. e 9a) 0.3 teps 3	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 14 0.61 15 7 in Tab 17 20.05	0.94 20.7 20.06 0.91 le 9c) 19.83	0.99 20.27 20.05	1 19.93 20.05	0.39	(86) (87) (88) (89)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99 Mean interna (90)m= 19.1	te during heat ctor for gain Feb 0.99 at temperat 20.17 ctor for gain 0.99 at temperat 19.3	ns for li Mar 0.96 ure in li 20.45 ating pe 20.04 ns for re 0.95 ure in t 19.58	eriods in ving are 0.88 iving are 20.77 eriods in 20.05 est of do 0.85 he rest 19.88	n the livea, h1,r May 0.71 ea T1 (20.94 n rest o 20.06 welling, 0.65 of dwel 20.02	ring (s (s follows), h2, h2, h2, h2, h2, h2, h2, h2, h2, h2	ee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21 celling from 7 0.07 20.07 m (see Tabl 0.44 0.29 T2 (follow s 0.07 20.07	A 0.4 7 in 7 2 7able 9a) 0.3 teps 3	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 1 to 7 in Tab 107 20.05	0.94 20.7 20.06 0.91 le 9c) 19.83	0.99 20.27 20.05 0.99	1 19.93 20.05		(86) (87) (88) (89)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99 Mean interna (90)m= 19.1	e during heat temperat 20.17 e during heat 20.04 ctor for gain 0.99 al temperat 19.3 el temperat 19.3	ns for li Mar 0.96 ure in li 20.45 ating per 20.04 ns for re 0.95 ure in tr 19.58	eriods in ving are Apr 0.88 iving are 20.77 eriods in 20.05 est of dr 0.85 he rest 19.88	ea, h1,r May 0.71 ea T1 (20.94 n rest o 20.06 welling 0.65 of dwel 20.02	ring m (s following) following f dw 2 llling 2 ellin	ee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21 relling from 7 0.07 20.07 m (see Table 20.44 0.29 T2 (follow see 30.07 20.07) g) = fLA × T	A 0.4 7 in 1 2 7able 9 20. 1 teps 3 1 + (1	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 14 0.61 15 7 in Tab 15 20.05 - fLA) × T2	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Liv	0.99 20.27 20.05 0.99 19.41 ring area ÷ (4	1 19.93 20.05 1 19.07		(86) (87) (88) (89) (90) (91)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99 Mean interna (90)m= 19.1 Mean interna (92)m= 19.43	e during heat ctor for gain Feb 0.99 at temperat 20.17 ctor for gain 0.99 at temperat 19.3 at temperat 19.63	ns for li Mar 0.96 ure in li 20.45 ating pe 20.04 ns for re 0.95 ure in t 19.58 ure (for	eriods in ving are Apr 0.88 iving are 20.77 eriods in 20.05 est of do 0.85 he rest 19.88 r the wh 20.23	n the livea, h1,r May 0.71 ea T1 (20.94 n rest o 20.06 welling, 0.65 of dwel 20.02	ring (s (s follows)) follows (s follows) follo	ee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21 elling from 7 0.07 20.07 m (see Table 20.44 0.29 T2 (follow see 20.07) g) = fLA × T 0.43 20.43	A 0.4 7 in 7 20 Fable 9 0.3 teps 3 1 + (1 20.	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 14 0.61 15 7 in Tab 16 7 20.05 17 43 20.4	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Liv	0.99 20.27 20.05 0.99 19.41 ring area ÷ (4	1 19.93 20.05		(86) (87) (88) (89)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99 Mean interna (90)m= 19.1 Mean interna (92)m= 19.43 Apply adjust	e during heat temperat 20.17 e during heat 20.17 e during heat 20.04 ctor for gain 0.99 al temperat 19.3 al temperat 19.63 ment to the	ns for li Mar 0.96 ure in li 20.45 ating pe 20.04 ns for r 0.95 ure in t 19.58 ure (for 19.92	eriods in ving are Apr 0.88 iving are 20.77 eriods in 20.05 est of do 0.85 he rest 19.88 r the wh 20.23 internal	the livea, h1,r May 0.71 ea T1 (' 20.94 n rest o 20.06 welling, 0.65 of dwel 20.02 ole dwel 20.38 tempe	ring (s follo	See Table 9a Jun	A 0.4 7 in 1 2 7able 9 20. teps 3 20. 1 + (1 20. le 4e,	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 34 0.61 1 to 7 in Tab 07 20.05 - fLA) × T2 43 20.4 where appre	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Liv	0.99 20.27 20.05 0.99 19.41 ring area ÷ (4	1 19.93 20.05 1 19.07 4) =		(86) (87) (88) (89) (90) (91)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99 Mean interna (90)m= 19.1 Mean interna (92)m= 19.43 Apply adjust (93)m= 19.28	te during heat ctor for gain Feb 0.99 at temperat 20.17 ctor for gain 0.99 at temperat 19.3 at temperat 19.63 ment to the 19.48	ns for li Mar 0.96 ure in li 20.45 ating pe 20.04 ns for re 0.95 ure in t 19.58 ure (for 19.92 e mean 19.77	eriods in ving are Apr 0.88 iving are 20.77 eriods in 20.05 est of do 0.85 he rest 19.88 r the wh 20.23	n the livea, h1,r May 0.71 ea T1 (20.94 n rest o 20.06 welling, 0.65 of dwel 20.02	ring (s follo	ee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21 elling from 7 0.07 20.07 m (see Table 20.44 0.29 T2 (follow see 20.07) g) = fLA × T 0.43 20.43	A 0.4 7 in 1 2 7able 9 20. teps 3 20. 1 + (1 20. le 4e,	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 34 0.61 1 to 7 in Tab 07 20.05 - fLA) × T2 43 20.4 where appre	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Liv	0.99 20.27 20.05 0.99 19.41 ring area ÷ (4	1 19.93 20.05 1 19.07		(86) (87) (88) (89) (90) (91)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99 Mean interna (90)m= 19.1 Mean interna (92)m= 19.43 Apply adjust (93)m= 19.28 8. Space hear	e during heat ctor for gain Feb 0.99 al temperat 20.17 ctor for gain 0.99 al temperat 19.3 al temperat 19.63 ment to the 19.48 ating requir	ns for li Mar 0.96 ure in li 20.45 ating pe 20.04 ns for re 0.95 ure in t 19.58 ure (for 19.92 e mean 19.77	eriods in ving are Apr 0.88 iving are 20.77 eriods in 20.05 est of do 0.85 he rest 19.88 r the wh 20.23 internal 20.08	ea, h1,r May 0.71 ea T1 (20.94 n rest o 20.06 welling, 0.65 of dwel 20.02 ole dwel 20.38 tempe	ring m (s 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	ee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21 relling from 7 0.07 20.07 m (see Table 1.44 0.29) T2 (follow see 1.44 0.29) T2 (follow see 1.44 0.29) T3 (follow see 1.44 0.29) T4 (follow see 1.44 0.29) T5 (follow see 1.44 0.29) T6 (follow see 1.44 0.29) T7 (follow see 1.44 0.29) T8 (follow see 1.44 0.29) T9 (follow see 1.44 0.29)	A 0.4 7 in 1 2 7able 9 20. 1 + (1 20. 1 + (1 20. 1 + (20.	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 34 0.61 1 to 7 in Tab 07 20.05 - fLA) × T2 43 20.4 where appress	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Liv 20.17 opriate 20.02	0.99 20.27 20.05 0.99 19.41 ring area ÷ (4) 19.74	1 19.93 20.05 1 19.07 4) =	0.39	(86) (87) (88) (89) (90) (91)
Temperature Utilisation fa Jan (86)m= 1 Mean interna (87)m= 19.96 Temperature (88)m= 20.04 Utilisation fa (89)m= 0.99 Mean interna (90)m= 19.1 Mean interna (92)m= 19.43 Apply adjust (93)m= 19.28	e during heat ctor for gain Feb 0.99 al temperat 20.17 ctor for gain 0.99 al temperat 19.3 al temperat 19.63 ment to the 19.48 ating requir mean inter	ns for li Mar 0.96 ure in li 20.45 ating pe 20.04 ns for re 0.95 ure in t 19.58 ure (for 19.92 e mean 19.77 ement rnal tern	eriods in ving are Apr 0.88 iving are 20.77 eriods in 20.05 est of do 0.85 he rest 19.88 r the who 20.23 internal 20.08	the lives, h1,r May 0.71 ea T1 (20.94 n rest o 20.06 welling, 0.65 of dwel 20.02 ole dwel 20.38 tempe 20.23	ring m (s 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	ee Table 9a Jun Jul 0.51 0.37 w steps 3 to 0.99 21 relling from 7 0.07 20.07 m (see Table 1.44 0.29) T2 (follow see 1.44 0.29) T2 (follow see 1.44 0.29) T3 (follow see 1.44 0.29) T4 (follow see 1.44 0.29) T5 (follow see 1.44 0.29) T6 (follow see 1.44 0.29) T7 (follow see 1.44 0.29) T8 (follow see 1.44 0.29) T9 (follow see 1.44 0.29)	A 0.4 7 in 1 2 7able 9 20. 1 + (1 20. 1 + (1 20. 1 + (20.	ug Sep 12 0.69 Table 9c) 1 20.96 9, Th2 (°C) 07 20.06 34 0.61 1 to 7 in Tab 07 20.05 - fLA) × T2 43 20.4 where appress	0.94 20.7 20.06 0.91 le 9c) 19.83 fLA = Liv 20.17 opriate 20.02	0.99 20.27 20.05 0.99 19.41 ring area ÷ (4) 19.74	1 19.93 20.05 1 19.07 4) =	0.39	(86) (87) (88) (89) (90) (91)

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb

Utilisa	ation fac	tor for a	ains, hm):										
(94)m=	0.99	0.98	0.95	0.85	0.66	0.46	0.31	0.36	0.63	0.91	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (8	4)m		<u> </u>	!			<u>l</u>	<u> </u>		
(95)m=	516.22	621.22	709.76	739.51	637.26	434.73	283.63	297.88	461.35	561.47	513.22	483.88		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			an intern			Lm , W =	-``	x [(93)m	-]		1	1	
	1201.63		1057.73		667.97	437.88	283.93	298.53	477.57	737.65	984.39	1193.23		(97)
			r		r			24 x [(97	<u> </u>				I	
(98)m=	509.95	366.21	258.88	99.59	22.84	0	0	0	0	131.08	339.24	527.76		٦٫٫٫۰
								Tota	ıl per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2255.55	(98)
Space	e heating	g require	ement in	kWh/m²	² /year								29.76	(99)
9a. En	ergy req	luiremer	nts – Indi	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatir	•										i		_
Fracti	on of sp	ace hea	it from s	econdar	y/supple	mentary	system						0	(201)
Fracti	on of sp	ace hea	it from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	main spa	ace heat	ing syste	em 1								90.3	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heating	g require	ement (c	alculate	d above)			· ·		I.	l		
	509.95	366.21	258.88	99.59	22.84	0	0	0	0	131.08	339.24	527.76		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20)6)	-	-	-	-		-	-		(211)
	564.72	405.55	286.69	110.29	25.3	0	0	0	0	145.16	375.68	584.45		
•								Tota	l (kWh/yea	ar) =Sum(2	211)		2497.84	(211)
Space	e heating	g fuel (s	econdar	y), kWh/	month							!		_
= {[(98])m x (20	1)]}x1	00 ÷ (20	8)									•	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	I (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	2=	0	(215)
	heating													
Output	from wa 198.77	ater hea 173.63	ter (calc 180.65	ulated a	bove) 155.13	136.63	130.9	145.92	147.53	168	179.33	194.1	1	
⊏fficion		ater hea	l	100.23	100.10	130.03	130.9	145.92	147.55	100	179.33	194.1	81	(216)
(217)m=		87.08	86.23	84.33	82.09	81	81	81	81	84.83	86.85	87.6	01	(217)
			kWh/mo	<u> </u>	02.09	01	01	"	01	04.03	00.03	67.0	I	(217)
		0,	(217) ÷ (
(219)m=		199.38	209.49	190	188.98	168.68	161.6	180.15	182.14	198.04	206.48	221.58		
'				-			-	Tota	I = Sum(2	19a) ₁₁₂ =	ē	•	2333.74	(219)
Annua	ıl totals									k'	Wh/year	•	kWh/year	_
Space	heating	fuel use	ed, main	system	1								2497.84	
Water I	heating	fuel use	d										2333.74	1
Electric	city for p	oumps, f	ans and	electric	keep-ho	t						!		

mechanical ventilation - balanced, extract or posit central heating pump:	tive input from ou	tside		165.42]	(230a) (230c)
boiler with a fan-assisted flue				45		(230e)
Total electricity for the above, kWh/year		sum of (230a)	(230g) =		240.42	(231)
Electricity for lighting					331.32	(232)
Electricity generated by PVs					-821.33	(233)
12a. CO2 emissions – Individual heating systems	including micro-	CHP				
	Energy kWh/year		Emission factors kg CO2/kWh	tor	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x		0.216	=	539.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)

(261) + (262) + (263) + (264) =

(219) x

(231) x

(232) x

Energy saving/generation technologies

Electricity for pumps, fans and electric keep-hot

Item 1

Water heating

Total CO2, kg/year

Space and water heating

Electricity for lighting

Dwelling CO2 Emission Rate

El rating (section 14)

0.216

0.519

0.519

0.519

-426.27 (269)

504.09

1043.62

124.78

171.96

(264)

(265)

(267)

(268)

914.08 (272)

12.06 (273) 90 (274)