eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Document information

Document prepared for

lan Liptrot Metashape Limited

Date of issue

09/06/2022

Issue no.

4

Our reference

6910-The Bird in Hand Kilburn-Energy Assessment-2204-26vvhy

Document prepared by

Hamad Yoonus

Quality assured by

Vanessa Vienna

Disclaimer

This report is made on behalf of Eight Associates Ltd. By receiving the report and acting on it, the client - or any third party relying on it - accepts that no individual is personally liable in contract, tort or breach of statutory duty (including negligence).

Contents:

Document information	
Executive summary	2
Carbon Emission Factors	
Establishing Carbon Emissions	
Baseline	
Demand Reduction	10
Cooling and Overheating	13
Heating Infrastructure	16
Renewable Energy	18
Conclusion	
Appendix A	
Appendix B	

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Executive summary

About the Scheme

The proposal comprises refurbishment of a three-storey pub (1 unit) including a basement and 9 newly built apartments. The development is located in the London Borough of Camden with a total NIA of approximately 770 sqm.

Planning policy

The scheme has been developed in accordance with the London Plan 2021 "The Spatial Development Strategy for Greater London, March 2021" and with the Sustainable, Design and Construction SPG. According to the planning policies, the scheme should achieve:

- Zero carbon target
- A minimum on-site CO2 reduction of at least 35% beyond Building Regulations
- Residential development should achieve 10% CO2 improvement through energy efficiency measures, 'Be Lean' stage
- As least 20% CO2 improvement through renewable technologies, 'Be Green' stage
- Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved onsite, any shortfall should be provided, in agreement with the borough, either:
 - o through a cash in lieu contribution to the borough's carbon offset fund, or
 - o off-site provided that an alternative proposal is identified, and delivery is certain

Summary

All flats and the refurbished house have been modelled for the purposes of the energy assessment. High energy efficiency performance building services have been used for these units in order to achieve the required carbon emission targets.

The scheme complies with the 2013 Building Regulations Part L and the minimum energy efficiency targets in the following documents have been followed:

- New build (Part L1A) The actual building CO2 emissions rate (DER) is no greater than the notional building CO2 target emissions rate.
- Refurbishment (Part L1B) Consequential improvements to refurbished areas have been
 made to ensure that the building complies with Part L, to the extent that such improvements
 are technically, functionally, and economically feasible.

In addition, the CO2 emissions of the scheme have been calculated using the SAP 10.0 carbon emission factors, and the scheme can achieve:

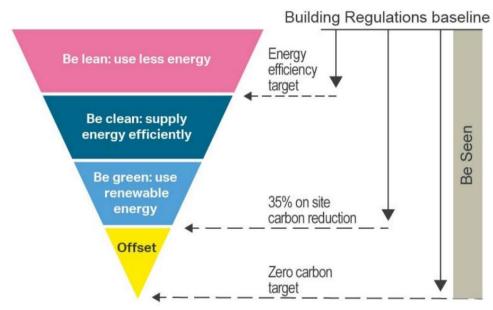
- An on-site CO2 reduction of 68.5% beyond Building Regulations achieved through energy
 efficiency measures and maximised of renewable technologies (Communal Air Source Heat
 Pumps and PV panels)
- The development achieves 18.8% CO2 improvement through energy efficiency measures, 'Be Lean' stage
- A further improvement of 49.7% CO2 has been achieved through renewable technologies 'Be Green' stage (Air Source Heat Pumps and PV panels)
- Overall, the scheme achieves an improvement of 68.5% through measures on-site
- Zero-carbon target can be achieved through a cash in lieu contribution to the borough's carbon offset fund. The carbon offset payment cost has been calculated as £15,210.

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Energy hierarchy

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



Source: Greater London Authority

Key measures

Key measures identified for each stage are shown below:

- Be Lean:
 - o Low U-values for opaque elements and fenestration
 - o Low a-value
 - o Low air permeability
 - o High efficiency lighting
 - o Mechanical ventilation with heat recovery
 - Green roof
- Be Clean:
 - No measures identified
- Be Green:
 - o Communal Air Source Heat Pumps to provide space heating and hot water
 - o Photovoltaic panels

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

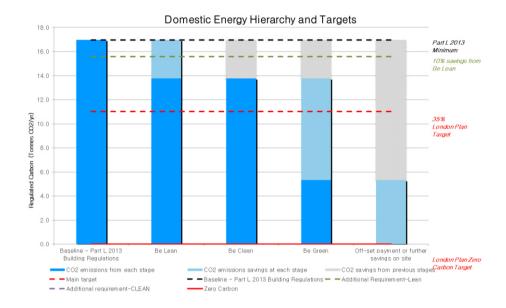
GLA's Energy Hierarchy: Regulated carbon emissions

The proposed scheme has followed the energy hierarchy. A graphical illustration of how the scheme performs in relation to Building Regulations and the Energy Hierarchy is shown below. Carbon dioxide emission factors for SAP 10.0 have been used for the calculation.

As demonstrated in the figure the proposed scheme will reduce carbon emissions by 18.8% from the fabric energy efficiency measures described in the 'Be Lean' section and will reduce total carbon emissions by 68.5% over Existing Building and Building Regulations (using SAP 10.0 carbon dioxide emission factors) with the further inclusion of low and zero carbon technology (Air source heat pumps and photovoltaic panels).

Therefore, the scheme meets and exceeds the planning policy carbon reduction target and complies with London Plan 2021 Policy SI2.

The carbon offset payment to meet the zero-carbon target has been calculated as £15,210.



eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Regulated CO2 emissions

Site-wide					
GLA's Energy Hierarchy: Regulated CO2	2 - Calculated ι	using SAP 2012	2 CO2 factors		
	Baseline:	Be lean:	Be clean:	Be green:	
CO2 emissions (tCO2/yr)	18.58	15.85	-	11.89	
CO2 emissions saving (tCO2/yr)	-	2.73	-	3.96	
Saving from each stage (%)	-	14.7	-	21.3	
Total CO2 emissions saving (tCO2/yr)	6.69				
36% total CO2 savings over Existing Building and 2013 Building Regulations Part L achieved					
GLA's Energy Hierarchy: Regulated CO2	2 - Calculated ι	using SAP 10.0	CO2 factors		
	Baseline:	Be lean:	Be clean:	Be green:	
CO2 emissions (tCO2/yr)	16.96	13.77	-	5.34	
CO2 emissions saving (tCO2/yr)	-	3.19	-	8.44	
Saving from each stage (%)	-	18.8	-	49.7	
Total CO2 emissions saving (tCO2/yr)	11.63	•		•	
68.5% total CO2 savings over Existing B	uilding and 20	13 Building Re	gulations Part L	. achieved	

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Carbon Emission Factors

Emission factors:

The Greater London Authority (GLA) Guidance on Energy Assessments published in October 2018 highlights a critical development regarding carbon emission factors. Grid electricity has significantly decarbonised since the last update of Part L in April 2014 and in July 2018 the Government published updated carbon emission factors (SAP 10.0) demonstrating this. Although SAP 10.0 is not in use yet, the GLA Guidance encourages the use of SAP 10.0 carbon emission factors from January 2019 in areas where there are no opportunities to connect to existing or planned district heat networks. Any applicants proposing to use the SAP 2012 emissions factors is required to provide adequate justification.

SAP 2012 emission factors can be used where:

- The scheme is located within a Heat Network Priority area; and
- There is potential to connect to an existing network using gas-engine CHP or a new network using low-emission CHP; and
- The heat network operator has, or is in the process of developing, a strategy to decarbonise the network and has shared it with the GLA

While the proposed scheme is expected to comply with SAP 2012 for Building Regulation compliance, the assessment presents total emissions using SAP10.0 as it is required for demonstrating performance against planning policy targets. The revised factors are below:

Fuel Type	Carbon Factor (kg _ CO2/kWh)		
	SAP 2012	SAP10.0	SAP 10.2
Natural Gas	0.216	0.210	0.210
Grid Electricity	0.519	0.233	0.136

The carbon emissions of the scheme have been calculated using Building Regulations methodology for estimating energy performance against Part L 2013 requirements, and the outputs have been manually converted for the SAP 10.0 emission factors using a spreadsheet.

Carbon Emission Factors 6

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Establishing Carbon Emissions

Methodology

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 scheme's design and evolution.

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 Assessment Guidance: Greater London Authority guidance on preparing energy assessments as part of planning applications (April 2020)". The scheme has been developed in accordance with the London Plan 2021.

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

- Baseline: A calculation of the Part L 2013 Building Regulations compliant CO2 emission baseline using approved software. The baseline assumes a gas boiler would provide heating and any active cooling would be electrically powered (For refurbishments, Appendix 4 of GLA's Guidance has been used).
- Be 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 London Plan 2021Policy SI4, 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.
- Be Clean: In accordance with London Plan 2021 Policy SI3, 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.
- Be Green: In accordance with London Plan 2021 Policy SI2, this report has conducted a
 feasibility assessment of renewable energy technologies. This comprised a site-specific
 analysis of the technologies and, if applicable, how they would be integrated into the
 heating and cooling strategy for the scheme.
- Be Seen: monitor, verify and report on energy performance through the Mayor's post construction monitoring platform.

Establishing Carbon Emissions 7

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Establishing CO2 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.

CO2 Emissions - Regulated and Unregulated (tonnes CO2/yr) - SAP 10.0 - Site-wide				
	Regulated	Unregulated	Total Emissions	
	Emissions	Emissions		
Baseline: Part L 2013	16.96	5.96	22.93	
Be Lean: Use less energy	13.77	5.96	19.74	
Be Clean: Supply energy efficiently	-	-	-	
Be Green: Use renewable energy	5.34	5.96	11.30	

Carbon offsetting

London Plan 2021 Policy SI2, requires carbon dioxide reductions to be achieved as far as possible onsite and a cash in lieu contribution will be considered acceptable only in instances where it has been clearly demonstrated that no further savings can be achieved on-site. The remaining savings to reach zero carbon can be achieved either off-site or via a cash in lieu contribution.

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 (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. The cumulative savings for offset payment and the cash-in-lieu contribution have been anticipated and tabulated below, using SAP 10.0 carbon emission factors and an offset price of £95 per tonne.

Regulated carbon dioxide savings from each stage of the energy hierarchy - SAP 10.0				
	(tonnes CO2/yr)	%		
Be Lean: Savings from energy demand reduction	3.19	18.8%		
Be Clean: Savings from heat networks	0.00	0.0%		
Be Green: Savings from renewable energy	8.44	49.7%		
Cumulative on-site savings	11.63	68.5%		
Carbon shortfall	5.34	-		
	(tonnes CO2)			
Cumulative savings for offset	160.11			
Cash-in-lieu contribution	£15,210			

Establishing Carbon Emissions 8

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

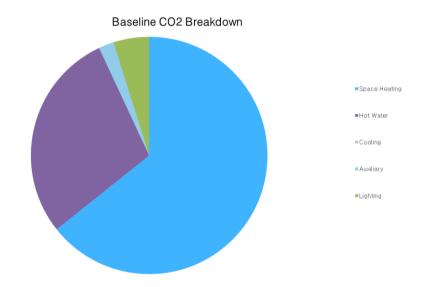
Baseline

Building regulations Part L 2013 minimum compliance

The total baseline carbon emissions for the whole scheme is 16.96 tonnes CO2/yr (using SAP 10.0 carbon dioxide emission factors).

The pie chart provides a breakdown of the specific carbon emissions by system over the course of one year. The chart shows that space heating is the primary source of carbon dioxide emissions, and hot water is the second largest, across the scheme as a whole.

Carbon Emiss	sions in tonnes CO2/yr			
Heating	Hot Water	Cooling	Auxiliary	Lighting
11.44	4.58	0.00	0.17	0.78



Baseline 9

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Demand Reduction

Be Lean: summary

Demand reduction measures have reduced the scheme's carbon emissions by 18.8% (using SAP 10.0 figures) over the minimum Part L 2013 Building Regulations baseline for new built and over Appendix 4 of GLA's Guidance for refurbishment.

U-values

Domestic - new built		
Element	Minimum Building Regulations	Proposed U-value W/m2K
	U-value W/m2K	
Flat roof	0.20	0.18
Wall	0.30	0.15
Corridor wall	0.30	0.15
Ground floor	0.25	0.15
Exposed floor	0.55	0.15
Windows	2.00	1.60 (g value - 0.55)
Rooflights	2.00	1.60 (g value - 0.55)
Doors	2.00	1.0

Party walls will be fully filled cavity with effective sealing at all exposed edges and in line with insulation layers in abutting elements.

Domestic - refurbishment		
Element	Existing Building U-value W/m2K Appendix 4 (GLA guidance 2020)	Proposed U-value W/m2K
Flat roof	0.18	0.18
Pitched roof	0.18	0.18
Wall	0.55	0.55
Wall (new)	0.30	0.15
Corridor wall	0.55	0.55
Ground floor	0.55	0.25
Exposed floor	0.55	0.25
Windows	1.60 (g value - 0.63)	1.60 (g value - 0.55)
Rooflights	1.60 (g value - 0.63)	1.60 (g value - 0.55)

Demand Reduction 10

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Air permeability

A reduced air permeability has been targeted as per the table below:

Air permeability	Minimum Building	Existing Building	Proposed
(m3/hm2 @50 Pa)	Regulations	Appendix 4 (GLA	
	-	guidance 2020)	
House	15	15	8
Flats	10	-	3

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 the blockwork or brickwork. 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 new dwellings within the scheme will be designed in line with the accredited construction details (ACD) and therefore it has been indicatively modelled with the accredited thermal bridge Psi-values for the following junctions:

- Lintels (E2)
- Sill (E3)
- Jambs (E4)
- Ground floor (E5)
- Party floor between dwellings (E7)
- Corners (E16)
- Corners inverted (E17)

A bespoke thermal bridging calculation will be required for the following junctions in the new dwellings in order to achieve the specified Psi-values:

Balcony (E23); 0.30 W/mK

The default psi-value has been used for the remaining junctions.

Thermal Mass:

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

Demand Reduction 11

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Heating

For the 'Be Lean' scenario, the scheme has been modelled with a gas boiler with an efficiency of 89.5% (as required by the GLA). For the 'Be Green' final scenario, a communal air source heat pump with a minimum COP of 2.80 will be proposed as the main heating system. Heat will be provided via radiators and will be controlled with a charging system linked to use of community with programmer and TRVs.

Hot Water

For the 'Be Lean', the hot water will be provided by the main gas heating system (gas boilers with an efficiency of 89.5%). For the 'Be Green' final scenario, hot water will be provided by the air source heat pump, with a minimum COP of 2.80. A top-up electric immersion heater will provide less than 20% of the hot water demand.

Ventilation

Balanced ventilation with heat recovery has been specified for the apartments.

- The apartments with one toilet have been modelled with an SFP of 0.76 W/l/s and a heat recovery efficiency of 91%.
- The apartments with two toilets have been modelled with an SFP of 0.88 W/l/s and a heat recovery efficiency of 91%.
- The house with two toilets have been modelled with an SFP of 0.88 W/l/s and a heat recovery efficiency of 91%.

Cooling

No cooling has been specified for the development.

Lighting

High efficiency lighting has been specified for the development with a minimum efficacy of 75 lumens/W

Energy demand following energy efficiency measures (MWh/year)

	Space Heating	Hot water	Lighting	Auxiliary	Cooling	Unregulated gas	Unregulated electricity
House	16.3	2.6	0.6	0.7	0.0	0.0	4.7
Flats	20.8	19.3	2.6	2.1	0.0	0.0	20.9

Fabric energy efficiency

(MWh/	year) (MWh/y	rear)	
House 20.69	17.16	17%	
Flats 30.88	35.14	12%	

Demand Reduction 12

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Cooling and Overheating

Overheating and cooling

The aim of this section 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 in Policy SI4

Developments should reduce potential overheating and reliance on air conditioning systems and demonstrate this with the Cooling Hierarchy:

- 1. Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure
- 2. Minimise internal heat generation through energy efficient design
- 3. Manage the heat within the building through exposed internal thermal mass and high ceilings
- 4. Provide passive ventilation
- 5. Provide mechanical ventilation
- 6. Provide active cooling systems

Avoiding overheating: measures taken

The following measures have been taken in accordance with the cooling hierarchy to reduce overheating and the need for cooling:

- 1. Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure
 - 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 have been specified.
 - Green roofs a green roof has been specified for the scheme at the fourth-floor roof for the flats. This will act as an insulation barrier and the ecological processes will reduce the amount of solar energy absorbed by the roof membrane, so will reduce temperatures below the surface and cool the building areas directly below.
 - Dark-coloured curtain/roller blinds will be specified to limit solar gain. The shading has also been optimised to avoid substantially reducing daylighting or increasing the requirement for electric lighting.
 - o 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.
 - o A reduced air permeability rate 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.

Cooling and Overheating 13

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

- 2. 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 as per the 'Be Lean' section.
 Occupancy and daylight sensors will also be specified to reduce unnecessary lighting usage.
 - Heat distribution infrastructure within building will be designed to minimise pipe lengths, particularly lateral pipework in corridors of the apartment block. Twin pipes configuration will be adopted to minimise heat loss.
- 3. Manage the heat within the building through exposed internal thermal mass and high ceilings
 - High thermal mass exposed building fabric materials such as masonry or concrete have been utilised in the form of concrete floors. These materials act as 'thermal batteries'; they absorb heat gains during the day when the building is occupied and 'store' it for an extended period, thereby helping to stabilise daytime temperatures. At night this heat can be dissipated, which 'resets' the heating cycle. Ventilation will also be used at night to purge the stored heat within the structure. A 'ground coupled' system that uses the thermal storage capacity of the ground has not been specified as the passive ventilation option has been selected instead.
 - 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 proposed building has floor to ceiling heights of more than 2.5m. As the roof will be well insulated to below building regulations, there will be minimal penetration of heat through the roof.

- 4. Provide passive ventilation
 - Openable windows are specified on all facades of the building.
 - o Shallow floorplates have been specified with dual aspect units to allow for cross ventilation. 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.
- 5. Provide mechanical ventilation
 - Mechanical ventilation with summer by-pass will be used for all residential units use of 'free cooling' where the outside air temperature is below that in the building during summer months.
 - o The mechanical systems will comply with the Domestic Building Services Compliance Guide as it is demonstrated in the 'Be Lean' section.

Cooling and Overheating 14

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Overheating risk

The overheating risk considering all the above-described passive measures have been assessed for the scheme:

Areas	Overheating risk from SBEM and SAP
House	Not significant
Flat G01	Not significant
Flat 101	Not significant
Flat 102	Not significant
Flat 201	Not significant
Flat 202	Not significant
Flat 301	Not significant
Flat 302	Not significant
Flat 401	Not significant
Flat 402	Not significant

According to the GLA guidance on preparing energy assessments (April 2020) Section 8, a dynamic modelling in line with CIBSE TM59 should be carried out to assess the risk of overheating. However, since the SAP outputs indicate that overheating risk is 'not significant' a dynamic overheating assessment has not been carried out at this stage.

Active cooling

Air conditioning has not been specified for the scheme.

Cooling and Overheating 15

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Heating Infrastructure

Heating infrastructure including CHP

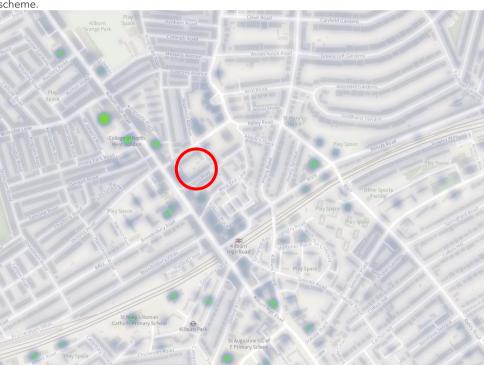
Once demand for energy has been minimised, schemes must demonstrate how their energy systems have been selected in accordance with the order of preference in Policy SI3 of London Plan 2021. This has involved a systematic appraisal of the potential to connect to existing or planned heating networks and on site communal and CHP systems.

To comply with London Plan 2021 Policy SI 3, developments in Heat Network Priority Areas (HNPAs) should have a communal low-temperature heating system and should select a heat source in accordance with the following heating hierarchy:

- connect to local existing or planned heat networks
- use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
- use low-emission combined heat and power (only where there is a case for CHP to enable
 the delivery of an area-wide heat network, meet the development's electricity demand and
 provide demand response to the local electricity network)
- use ultra-low NOx gas boilers

Connect to local existing or planned heat network

The illustration below shows the London heat map. The red circle shows the location of the proposed scheme.



A review of the London Heat Map demonstrates that there are no existing networks present within connectable range of the scheme. Therefore, a connection is not possible.

Heating Infrastructure 16

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Use zero-emission and/or local secondary heat sources

According to the GLA and London Plan 2021 Policy SI3, the exploitation of local energy opportunities to maximise the use of locally available energy sources whilst minimising primary energy demand and carbon emissions is encouraged. Secondary heat includes environmental sources such as air, water and ground; and waste sources such as heat from the sewerage system, sewage treatment plants, the tube network, data centres and chiller systems.

There are no local available waste heat sources for the scheme.

Use low-emission combined heat and power (CHP)

In accordance with section 9 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 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.

Use ultra-low NOx gas boilers

Where it is clearly demonstrated that the above heating options (District heating, local secondary heat source and CHP) have been fully investigated and ruled out, then a site-wide heating strategy led by ultra-low NOx gas boilers can be considered.

The scheme will adopt a site wide ASHP heating network. This will comprise a single energy centre for the scheme where all mechanical heat generating plant will be housed. The communal heating system will serve all of the units within the scheme The results of the communal ASHP heating network are presented in the 'Be Green' stage (renewable technologies).

The design team has investigated the options of reducing the distribution losses by:

- Reducing the lateral pipe lengths
- Use of variable flow control systems to lower flow rates and lower return temperatures at part-load
- System will operate with low return temperature with low return temperatures in line with the CIBSE Heat Networks: Code of Practice for the UK.

Air quality impacts

An air quality assessment is required for all major developments as per the London Plan 2021 policy SI1. To ensure that the air quality assessment is as robust as possible, the total gas and electricity consumption is shown in Appendix A, as it is required by GLA.

Heating Infrastructure 17

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Renewable Energy

Renewable Energy Feasibility:

In line with Policy SI2 of the London Plan 2021 the feasibility of renewable energy technologies has been considered. A detailed site-specific analysis and associated carbon saving calculations has also been provided for renewable energy technologies considered feasible.

Each technology has been assessed under 3 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:

The weighting of each of the criteria within the categories is shown below:

- Local, site-specific impact: (Maximum score of 5)
 - o Local planning criteria = ✓
 - o Land used by all components = ✓
 - o Noise impact from operation = ✓
 - o Interaction on the current building design = ✓
 - o Buildability of installation = ✓
- Economic viability: (Maximum score of 5)
 - o Capital cost of all components = ✓
 - o Grants and funding available = ✓
 - o Payback periods (years) 3-5, 5-10, 10-15 = ✓
 - o Servicing requirements (low or high) = ✓
 - o Maintenance costs (low or high) = ✓

- CO2 and sustainability: (Maximum score of 10)
 - o Carbon saving per year = ✓✓✓✓
 - o Impact of future grid decarbonisation (gas vs. electric) = ✓✓
 - o Local air quality/pollution = ✓✓
 - o Resource use of installation = ✓✓

Key comments on each of the criteria and the corresponding score will be provided in a table 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.

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

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 large to meet the required CO2 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. 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.

Local, site-specific impact	Economic viability	CO2 and sustainability
(out of 5)	(out of 5)	(out of 10)
\checkmark	$\checkmark\checkmark\checkmark$	$\checkmark\checkmark\checkmark\checkmark$
Local air quality impacts, increased transport usage, increased plant space, 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.

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Photovoltaic Panels (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 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 roof area of approximately 120 sqm including circulation area with approximately 40 sqm of PV panels (2 m2/panel for 20 panels) and is orientated south-west – north-east.

Local, site-specific impact	Economic viability	CO ₂ and sustainability
(out of 5)	(out of 5)	(out of 10)
$\checkmark\checkmark\checkmark$	√√	$\checkmark\checkmark\checkmark\checkmark$
No local air quality impacts, use of unutilised roof space, no noise issues, good orientation, and slightly increased buildability issues for wiring and metering.	Increased capital costs of installation, typical payback of 10-15 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.

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

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.

It is estimated that the CO2 emissions reduction that would be produced by solar hot water as a standalone system would not be adequate to achieve the required CO2 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.

Local, site-specific impact	Economic viability	CO ₂ and sustainability
(out of 5)	(out of 5)	(out of 10)
$\checkmark\checkmark\checkmark$	√√√	√√√√
No local air quality impacts, no roof space, no noise issues, good orientation, slightly increased buildability issues for piping and cylinders.	Increased capital costs of installation, typical payback of 8-10 years, Heat Incentive available, limited servicing and maintenance i.e. 1 visit per year, 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.

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

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.

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 groups within the local community could also affect the viability of wind energy for the project.

Local, site-specific impact	Economic viability	CO ₂ and sustainability
(out of 5)	(out of 5)	(out of 10)
✓	$\checkmark\checkmark\checkmark$	$\checkmark\checkmark\checkmark\checkmark$
No local air quality impacts, use of unutilised roof space, medium noise issues, relatively limited wind speeds in local area, increased buildability	Medium capital costs of installation, typical payback of 5 years, Feed in Tariff available, limited servicing and maintenance, costs of 2-3%	High carbon saving from electricity, output limited from urban installation, consumes little grid electricity, no local air impact, low embodied
issues for wiring and metering.	typical.	energy of panels

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

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 boreholes, 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 boreholes 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 were viable.

From the boreholes 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 / borehole 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.

The installation cost for a Ground Source Heat pump is typically high compared to a gas-boiler installation.

Local, site-specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
No local air quality impacts, no visual impact, 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 >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.	Medium carbon saving from gas displacement, consumes some electricity so benefits from decarbonisation, no local air impact, high embodied energy of equipment.

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Air Source Heat Pump (ASHP) - Accepted

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 they 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 carbon dioxide emission savings will typically be less than that of a ground source heat pump.

Air source heat pumps would provide a suitable HVAC solution for commercial spaces which have relatively low heating demands as well as a regular need for cooling given the higher internal gains of these use classes. Having a system which is able to both, heat and cool provides versatility and reduces the amount installed plant.

The residential space has a relatively large domestic hot water demand which could be met with heat pumps if combined with another heating source to achieve the required DHW temperatures. The scheme could meet 80% of its hot water heating consumption via air source heat pumps, with the remaining 20% demand being met by another heating source.

Local, site-specific impact	Economic viability	CO ₂ and sustainability
(out of 5)	(out of 5)	(out of 10)
(out of 5) ✓✓✓✓ No local air quality impacts, use of unutilised roof space, over visual impact, low noise issues, increased buildability issues for pipework and heating emitters internally.	(out of 5) ✓✓ 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	(out of 10) VVVVV Medium carbon saving from gas displacement, less efficient in winter, consumes electricity so benefits from decarbonisation, no local air impact, high embodied energy of equipment.
	require replacement over lifespan.	energy of equipment.

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Summary comparison matrix

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

Renewable Technology	Comments	Local, site- specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainabili ty (out of 10)	Total Score
Biomass Boiler	High air quality impact	√	/ / /	////	9
Photovoltaic	High CO ₂ savings and low visual impact	////	√ √	√√√√ √√	14
Solar Thermal	Low CO ₂ savings compared to PV panels	√√√	///	√√√√ ✓	12
Wind Energy	High visual and noise impact	√	V V V	////	10
GSHP	High capital cost	√ √	✓	√√√√ √√√	11
ASHP	Low capital cost but low CO ₂ savings compared to GSHP	√√√	√ √	√√√√√ ✓	13

Photovoltaic panels, solar thermal panels and ASHPs have scored the best.

Due to the limited roof space, photovoltaic panels and ASHPs have been specified as they can provide higher CO2 savings compared to the solar thermal panels.

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Air Source Het Pump (ASHP) - Performance

The lifecycle of the proposed system is 25 years. To calculate the lifecycle cost of the ASHP, the maintenance of the system and cost of electricity to run the pumps will be included.

The communal ASHP has been estimated to have a CoP of 2.8 and it will cover 100% of the space heating demand and 80% of the hot water demand. The remaining 20% of the hot water demand will be covered by immersion heater. A thermal store will be specified to optimise the system's operations

The following table summarise the reduction in carbon emissions and the life cycle cost of the ASHP system compared to a gas boiler.

	Gas Boiler	Air Source Heat Pump
	Heating and hot water	Heating and hot water
Installation cost (£)	10,000	39,000
Maintenance and replacement cost (f)	12,000	4,000
Total (£)	22,000	43,000
Energy demand (kWh)	58,900	22,392
Cost of gas/electricity (p/kWh)	5.0	12.5
Annual operational cost (£)	2,945	2,800

It should be noted that the figures above are based on SAP modelling for CO2 compliance. Compliance models are not well suited to investment appraisals because they do not accurately estimate energy consumption. It is estimated that the lifecycle saving for ASHP will be greater than boiler under 'real-life' operating conditions and consumption.

Moreover, the servicing strategy has been proposed based on sustainability aspirations and compliance with GLA requirements, which is intended to supersede simple economic payback appraisals for purposes of energy strategies.

Cost Performance Criteria	Value
Extra Cost Over Life Cycle (£)	21,000
Predicted Annual Savings (£)	146
Payback Period (years)	143.5
Energy and Carbon Performance Criteria	Value
Predicted Annual Energy Saved (kWh/yr)	36.514
Annual Carbon Emissions Reductions (kg CO2/year) using SAP10.0 carbon factors	7,094
CO2 Emissions Reduction (%) with SAP10.0	41.8%

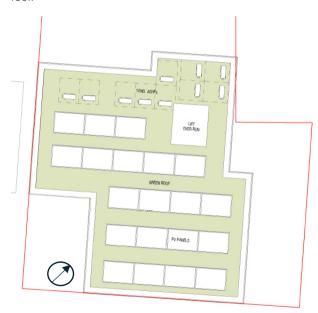
eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Photovoltaic panels (PV) - Performance

A photovoltaic panel system of 7.0 kWp (20 panels of 350W each) has been specified for the whole development, a detailed summary of the lifecycle cost, revenue and payback for the photovoltaic panels is presented in this section.

The following drawing shows that there are approx.120 sqm of available roof area including circulation area that could be used to install photovoltaic modules with lack of shading. PV panels will be placed with 30° tilt, oriented south-east, covering approx. 40 m2 (2m2/panel for 20 panels) of the roof.



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 shown in the table below.

Capital cost (£)	9,100
Maintenance cost (f)	1,800
Operational cost (f)	900
Total (£)	11,800
Cost of electricity (p/kWh)	12.5
Electricity generation (kWh/yr)	5,763
% of energy used on site	
Savings (£)	515
Summary	
Cost Performance Criteria	Value
Extra Cost Over Life Cycle (£)	11,800
Predicted Annual Savings (£)	515
Payback Period (years)	22.9
Energy and Carbon Performance Criteria	Value
Predicted Annual Energy Saved (kWh/yr)	5,763
Annual Carbon Emissions Reductions (kg CO ₂ /year) using SAP10.0 carbon factors	1,343
CO ₂ Emissions Reduction (%) with SAP10.0	7.9%

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Conclusion

Summary

All flats and the refurbished house have been modelled for the purposes of the energy assessment. High energy efficiency performance building services have been used for these units in order to achieve the required carbon emission targets.

The scheme complies with the 2013 Building Regulations Part L and the minimum energy efficiency targets in the following documents have been followed:

- New build (Part L1A) The actual building CO2 emissions rate (DER) is no greater than the notional building CO2 target emissions rate.
- Refurbishment (Part L1B) Consequential improvements to refurbished areas have been
 made to ensure that the building complies with Part L, to the extent that such improvements
 are technically, functionally, and economically feasible.

In addition, the CO2 emissions of the scheme have been calculated using the SAP 10.0 carbon emission factors, and the scheme can achieve:

- An on-site CO2 reduction of 68.5% beyond Building Regulations achieved through energy
 efficiency measures and maximised of renewable technologies (Communal Air Source Heat
 Pumps and PV panels)
- The development achieves 18.8% CO2 improvement through energy efficiency measures, 'Be Lean' stage
- A further improvement of 49.7% CO2 has been achieved through renewable technologies 'Be Green' stage (Air Source Heat Pumps and PV panels)
- Overall, the scheme achieves an improvement of 68.5% through measures on-site
- Zero-carbon target can be achieved through a cash in lieu contribution to the borough's carbon offset fund. The carbon offset payment cost has been calculated as £15,210.

Conclusion 28

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Appendix A

Air quality impacts

To ensure that the air quality assessment is as robust as possible, the total gas and electricity consumption is shown in the table below.

Energy source	Total fuel consumption (residential)
Grid electricity	(MWh/year) 48.5
Gas boilers (communal/individual)	0
Gas CHP	0
Connection to existing District Heating network	0
Other gas use (e.g. cookers)	0

Appendix A 29

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Appendix B

SAP files

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 Refurbishment (GLA's Appendix 4) DER from the DER SAP worksheet
- Baseline New-built TER from the TER SAP worksheet
- Be Lean DER from the Be Lean scenario DER SAP worksheet
- Be Green- DER from the Be Green scenario DER SAP worksheet

Appendix B 30

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Baseline Refurbishment (GLA's Appendix 4) - DER from the DER SAP worksheet

Appendix B 31

		User Details:				
				277.0	0.4.00.00	
Assessor Name:	Chris Hocknell	Stroma I			016363	
Software Name:	Stroma FSAP 2012		e Version:		n: 1.0.5.51	
A ddrago i	West End Lane, LONDON, N	operty Address: H	ouse- HUT-Not	ionai		
Address: 1. Overall dwelling dime		VVO 4INA				
1. Overall awelling diffic	,	Area(m²)	Av. Heig	aht(m)	Volume(m ³	3)
Basement			i) x 2.7	· · ·	120.54	(3a)
Ground floor		53.06 (1b	o) x 2.8	(2b) =	151.22	(3b)
First floor		53.06 (10	s) x 3.0	(2c) =	163.42	(3c)
Second floor		43.77 (10	l) x 2.2	(2d) =	98.92	(3d)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1n)	207.29 (4)				
Dwelling volume		(3	a)+(3b)+(3c)+(3d)+	+(3e)+(3n) =	534.11	(5)
2. Ventilation rate:						
2. Voltalation fato.	main secondary	other	total		m³ per hou	ır
Number of chimneys	heating heating 0 + 0	+ 0	= 0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0	= 0	x 20 =	0	(6b)
Number of intermittent fa	ns		4	x 10 =	40	(7a)
Number of passive vents	;		0	x 10 =	0	(7b)
Number of flueless gas fi	ires		0	x 40 =	0	(7c)
				Air ch	anges per ho	
Infiltration due to abjects	fl and fana - (62)±(6b)±(75)+/7b)+/7c) =				_
· · · · · · · · · · · · · · · · · · ·	ys, flues and fans = (6a)+(6b)+(7a neen carried out or is intended, proceed		40 tinue from (9) to (1)	÷ (5) =	0.07	(8)
Number of storeys in the		to (17), otherwise com	ac	<i>5)</i>	0	(9)
Additional infiltration	3 ()			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame or	0.35 for masonry o	construction		0	(11)
if both types of wall are pa deducting areas of openia	resent, use the value corresponding to a	he greater wall area (a	after			
	floor, enter 0.2 (unsealed) or 0.1	(sealed), else en	ter 0		0	(12)
If no draught lobby, en	,				0	(13)
•	s and doors draught stripped				0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate		(8) + (10) + (1	11) + (12) + (13) +	(15) =	0	(16)
Air permeability value,	q50, expressed in cubic metres	per hour per squa	are metre of en	velope area	15	(17)
•	ity value, then (18) = [(17) ÷ 20]+(8)			·	0.82	(18)
•	es if a pressurisation test has been done			ed		 ` ′
Number of sides sheltere	ed				2	(19)
Shelter factor		(20) = 1 - [0.0	75 x (19)] =		0.85	(20)
Infiltration rate incorporat	ting shelter factor	$(21) = (18) \times ($	(20) =		0.7	(21)
Infiltration rate modified f	or monthly wind speed					

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb

Monthly average	ge wind	speed fr	om Tabl	e 7									
(22)m= 5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
)A/5:: 1 = : . t = : /0	0 - \	(00)	4				•	•	•		•	-	
Wind Factor (2 (22a)m= 1.27	2a)m = 1.25	(22)m ÷	1.1	1.08	0.95	0.95	0.92	1 1	1.08	1.12	1.18	1	
(224)111- 1.21	1.20	1.23	1.1	1.00	0.93	0.93	0.92		1.00	1.12	1.10		
Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m											1		
0.89 Calculate effec	0.88	0.86	0.77	0.75 he appli	0.67 cable ca	0.67	0.65	0.7	0.75	0.79	0.82		
If mechanica		•	ato for t	пс аррт	oubic ou	00						0	(23a)
If exhaust air he	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b	o) = (23a)			0	(23b)
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(23c)
a) If balance	d mech	anical ve	ntilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance	d mech	anical ve	ntilation	without	heat rec	overy (N	ЛV) (24b	o)m = (2	2b)m + (23b)		,	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole he				•	•				F (00l	,			
if (22b)m	0.5 >	(23b), t	nen (240	(230) = (230)	o); other	wise (24)	c) = (221)	o) m + 0	.5 × (23b	0	0	1	(24c)
(2.15)						<u> </u>			1 0		0		(240)
d) If natural \ if (22b)m				•	•				0.5]				
(24d)m= 0.9	0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.75	0.78	0.81	0.84		(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)													
Effective air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)	1		•	•	
(25)m= 0.9	change 0.88	rate - er 0.87	oter (24a 0.8) or (24k 0.78	o) or (24 0.72	c) or (24 0.72	d) in box	x (25)	0.78	0.81	0.84]	(25)
(25)m= 0.9	0.88	0.87	0.8	0.78	ŕ	´``	 	` 	0.78	0.81	0.84		(25)
	0.88	0.87	0.8	0.78 er:	ŕ	0.72	 	0.75	AXU		0.84 k-value	· 	(25) A X k
3. Heat losses ELEMENT	0.88	0.87 eat loss p	0.8 paramete	0.78 er:	0.72	0.72 ea	0.71	0.75 ue				-	A X k kJ/K
3. Heat losses ELEMENT Doors Type 1	0.88 s and he	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar	0.72 ea	0.71 U-val	0.75 ue	AXU		k-value	-	AXk
3. Heat losses ELEMENT Doors Type 1 Doors Type 2	0.88 s and he	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r	0.72 ea m²	0.71 U-vali W/m2	0.75 ue	A X U (W/I		k-value	-	A X k kJ/K
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3	0.88 s and he Gros area	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r	0.72 ea m²	0.71 U-vali W/m2 1.6 1.6	0.75	A X U (W/I 5.872		k-value	-	A X k kJ/K (26) (26) (26)
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type	0.88 S and he Gros	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67	0.72 ea m²	0.71 U-vali W/m2 1.6 1.6 1 /[1/(1.6)+	0.75 ue 2K = = = = = = = = = = = = = = = = = = =	A X U (W/I 5.872 4.56		k-value	-	A X k kJ/K (26) (26) (26) (27)
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type Windows Type	0.88 S and he Gros area	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67 2.85	0.72 ea m²	U-valu W/m2 1.6 1.6 1 1/[1/(1.6)+	0.75 ue 2K = = = = = = = = = = = = = = = = = = =	A X U (W/I 5.872 4.56 2.35		k-value	-	A X k kJ/K (26) (26) (26) (27) (27)
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type Windows Type Windows Type	0.88 Gros area 1	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67 2.85 2.22	0.72 ea m² x x x x x x x x x x x x x x x x x x	U-valu W/m2 1.6 1.6 1 /[1/(1.6)+ /[1/(1.6)+	0.75 ue 2K =	A X U (W/I 5.872 4.56 2.35 3.34		k-value	-	A X k kJ/K (26) (26) (26) (27)
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type	0.88 Gros area 1 2 3 4	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67 2.85 2.35 1.13	0.72 ea m²	U-valu W/m2 1.6 1.6 1 1/[1/(1.6)+	0.75 ue 2K =	A X U (W/I 5.872 4.56 2.35 3.34 1.7		k-value	-	A X k kJ/K (26) (26) (26) (27) (27)
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	0.88 Gros area 1 2 3 4 5	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67 2.85 2.22 1.13 0.61	0.72 ea m²	U-valu W/m2 1.6 1.6 1 /[1/(1.6)+ /[1/(1.6)+	0.75 ue 2K = 0.04] = 0.04] = 0.04] = 0.04] =	A X U (W/I 5.872 4.56 2.35 3.34 1.7 0.92		k-value	-	A X k kJ/K (26) (26) (26) (27) (27) (27)
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type	0.88 Gros area 1 2 3 4 5	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67 2.85 2.22 1.13 0.61 2.25	0.72 ea m²	U-value W/m2 1.6 1.6 1 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.75 ue 2K = = = = = = = = = = = = = = = = = = =	A X U (W/I 5.872 4.56 2.35 3.34 1.7 0.92 3.38		k-value	-	A X k kJ/K (26) (26) (26) (27) (27) (27) (27)
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type	0.88 Gros area 1 2 3 4 5 6 7	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67 2.85 2.35 2.22 1.13 0.61 2.25	0.72 ea m²	U-vali W/m2 1.6 1.6 1 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.75 ue 2K = = = = = = = = = = = = = = = = = = =	A X U (W/I 5.872 4.56 2.35 3.34 1.7 0.92 3.38 2.66		k-value	-	A X k kJ/K (26) (26) (26) (27) (27) (27) (27) (27)
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type	0.88 Gros area 1 2 3 4 5 6 7	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67 2.85 2.35 2.22 1.13 0.61 2.25 1.77 1.31	0.72 ea m²	U-value W/m2 1.6 1.6 1 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.75 ue 2K = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	A X U (W/I 5.872 4.56 2.35 3.34 1.7 0.92 3.38 2.66 1.97		k-value	-	A X k kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27)
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type	0.88 Gros area 1 2 3 4 5 6 7 8	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67 2.85 2.35 2.22 1.13 0.61 2.25 1.77 1.31 0.68	0.72 ea m²	U-value W/m2 1.6 1.6 1 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.75 ue 2K = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	A X U (W/I 5.872 4.56 2.35 3.34 1.7 0.92 3.38 2.66 1.97 1.02		k-value	-	A X k kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27) (27
3. Heat losses ELEMENT Doors Type 1 Doors Type 2 Doors Type 3 Windows Type	0.88 Gros area 1 2 3 4 5 6 7 8 9	0.87 eat loss p	0.8 Daramete	0.78 er:	0.72 Net Ar A ,r 3.67 2.85 2.35 2.22 1.13 0.61 2.25 1.77 1.31 0.68 2.69	0.72 ea m²	U-vali W/m2 1.6 1.6 1 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.75 ue 2K = = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	A X U (W/I 5.872 4.56 2.35 3.34 1.7 0.92 3.38 2.66 1.97 1.02 4.05		k-value	-	A X k kJ/K (26) (26) (26) (27) (27) (27) (27) (27) (27) (27) (27

Floor T	ype 1					57.4	х	0.55	= [31.57				(28)
Floor T	Floor Type 2							0.55	= [29.183				(28)
Walls	Гуре1	81.4	.3	0		81.43	3 X	0.55	_ = [44.79				(29)
Walls ⁻	Гуре2	15.3	1	6.41		8.9	x	0.28	= [2.49				(29)
Walls ⁻	Гуре3	24.3	3	0		24.3	x	0.28	<u> </u>	6.8	— [(29)
Walls ⁻	Гуре4	101.4	44	33.5	7	67.87	7 X	0.55	<u> </u>	37.33				(29)
Roof 7	Гуре1	62.7	4	3.34	_	59.4	x	0.18	= i	10.69	T i			(30)
Roof 7	Гуре2	10.9	6	0	_	10.96	3 x	0.18	= i	1.97	Ħ i			(30)
Total a	rea of e	lements	, m²			406.6	4							(31)
Party v	vall					58.5	x	0		0				(32)
* for win	dows and	roof windo	ows, use e	ffective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valu	re)+0.04] a	ns given in	paragraph	3.2	
			sides of in		ls and part	titions		(00) (00)	(22) –				Γ	_
		ŕ	= S (A x	U)				(26)(30)		(00) : (0)	2) . (00-)	(00-)	229.41	(33)
		Cm = S(•) = Cm :	TEA\ in	. l. 1/m21/				(30) + (32		(32e) =	39052.95	(34)
		•	ter (TMF		,			acisaly the		tive Value		ohle 1f	250	(35)
	For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.													
Thermal bridges : S (L x Y) calculated using Appendix K											61	(36)		
if details of thermal bridging are not known (36) = 0.05 x (31)													_	
Total fabric heat loss $(33) + (36) =$ 290.41 (37) Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$													(37)	
ventila						1	11	A		= 0.33 × (1		1	
(38)m=	Jan 158.56	Feb 155.82	Mar 153.14	Apr 140.55	May 138.2	Jun 127.23	Jul 127.23	Aug 125.2	Sep 131.45	Oct 138.2	Nov 142.96	Dec 147.94		(38)
,				140.00	100.2	127.25	127.25	120.2		<u> </u>	<u> </u>	147.34		(00)
Heat tr (39)m=	448.96	oefficier 446.23	1t, VV/K 443.55	430.96	428.6	417.63	417.63	415.6	(39)m 421.86	= (37) + (3 428.6	38)m 433.37	438.35	1	
(39)111–	440.90	440.23	443.33	430.90	420.0	417.03	417.03	415.0		Average =			430.95	(39)
Heat Id	ss para	meter (F	HLP), W/	m²K						= (39)m ÷		12 / 12-	400.00	
(40)m=	2.17	2.15	2.14	2.08	2.07	2.01	2.01	2	2.04	2.07	2.09	2.11		
NIls a	f .l		-41- / T -1-	I- 4-\						Average =	Sum(40) ₁	12 /12=	2.08	(40)
Numbe			nth (Tab		Max	1	1	A	Can	0-4	Nav	Daa		
(41)m=	Jan 31	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31		(41)
(41)111-	01	20	01	30	01		J 01		30			01		(11)
4 \//6	tor boot	ing oner	av roqui	romonti								IAMb/v	oor:	
4. Water heating energy requirement: kWh/year:														
		ipancy, I		[4 0.400	/ n nnnn)40 v /T	-	\0\1 + 0 <i>(</i>	0042 v /	TEA 40		.01		(42)
	A > 13.9		+ 1.76 X	[1 - ехр	(-0.0003	349 X (11	-A -13.9)2)] + 0.(JU13 X (TFA -13.	.9)			
Annua	l averag	e hot wa						(25 x N)				5.72		(43)
		-	hot water person per			-	-	to achieve	a water us	se target o	f			
not more						1		A	Can	0-4	Nav	Daa		
Hot wate	Jan er usage in	Feb n litres per	Mar day for ea	Apr ach month	May Vd,m = fa	Jun ctor from	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	116.29	112.06	107.84	103.61	99.38	95.15	95.15	99.38	103.61	107.84	112.06	116.29		
() ijiii '	0.20	2.00	.51.04	. 55.01	1	L 30.10	L 30.10	L 30.00	<u> </u>	Total = Su			1268.65	(44)
											· / / ·····-			` ′

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) 172.46 150.83 155.65 130.2 112.36 104.11 119.47 120.9 140.9 153.8 167.02 (45)m =Total = $Sum(45)_{1...12}$ = 1663.4 (45)If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 25.87 22.63 23.35 20.35 (46)19.53 16.85 15.62 18.14 21.13 23.07 25.05 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): (48)Temperature factor from Table 2b 0 (49)Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0 b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)If community heating see section 4.3 Volume factor from Table 2a 0 (52)Temperature factor from Table 2b 0 (53)Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ (54)0 Enter (50) or (54) in (55) (55)0 Water storage loss calculated for each month $((56)m = (55) \times (41)m$ (56)m =0 (56)If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H (57)(57)m =(58)Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) \div 365 \times (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)(59)m =0 Combi loss calculated for each month (61)m = (60) \div 365 × (41)m 50.96 50.96 50.64 46.92 48.49 50.64 49.32 50.96 49.32 50.96 (61)(61)m=Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m 170.11 223.42 196.86 206.61 185.01 152.6 170.22 (62)180.85 159.28 191.86 203.12 217.98 (62)m=Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)(63)m=0 0 0 0 0 0 0 Output from water heater (64)m=223.42 196.86 206.61 185.01 180.85 159.28 152.6 170.11 170.22 191.86 203.12 217.98 (64)Output from water heater (annual)_{1...12} 2257.9 Heat gains from water heating, kWh/month 0.25 \(^{1}\) [0.85 \times (45)m + (61)m] + 0.8 \(^{1}\) [(46)m + (57)m + (59)m] 64.49 52.39 (65)(65)m=70.08 57.45 55.95 49.09 46.74 52.53 59.59 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 Aug Jan Feb Mar Apr May Jun Jul Sep Oct Nov Dec

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 42.12 37.41 30.42 23.03 17.22 14.53 15.7 20.41 27.4 34.79 40.6 43.29 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 377.92 381.84 371.96 350.92 324.37 299.41 282.73 278.81 288.69 309.73 336.29 361.25 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.06	(66)m=	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57		(66)
(67)m= 42.12 37.41 30.42 23.03 17.22 14.53 15.7 20.41 27.4 34.79 40.6 43.29 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 377.92 381.84 371.96 350.92 324.37 299.41 282.73 278.81 288.69 309.73 336.29 361.25 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.06	Liahtin														
(68)m= 377.92 381.84 371.96 350.92 324.37 299.41 282.73 278.81 288.69 309.73 336.29 361.25 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 (69) Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Ū		ì	·	·			, , , , , , , , , , , , , , , , , , ,			34.79	40.6	43.29		(67)
(68)m= 377.92 381.84 371.96 350.92 324.37 299.41 282.73 278.81 288.69 309.73 336.29 361.25 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 (69) Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Appliar													l	
(69)m= 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 38.06 (69) Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3												336.29	361.25		(68)
Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Cookin	Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	(69)m=	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06		(69)
Losses e.g. evaporation (negative values) (Table 5) (71)m=	Pumps	and far	ns gains	(Table 5	<u></u> ба)									•	
	(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Water heating gains (Table 5) (72)m= 94.2 91.75 86.68 79.79 75.21 68.18 62.82 70.41 72.96 80.09 88.15 91.76 Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$	Losses e.g. evaporation (negative values) (Table 5)														
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	(71)m=	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46		(71)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$	Water heating gains (Table 5)														
Total Internal game	(72)m=	94.2	91.75	86.68	79.79	75.21	68.18	62.82	70.41	72.96	80.09	88.15	91.76		(72)
(70)	Total i	nternal	gains =				(66)	m + (67)m	+ (68)m +	- (69)m + (70)m + (7	1)m + (72)	m		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	(73)m=	585.4	582.18	560.24	524.91	487.96	453.29	432.43	440.8	460.22	495.78	536.21	567.47		(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 m²			Flux Table 6a		g_ Table 6b		FF Table 6c	Gains (W)		
Northeast _{0.9x}	0.77	x	0.68	x	11.28	x	0.63	x	0.8	=	8.04	(75)
Northeast _{0.9x}	0.77	X	0.68	x	22.97	x	0.63	x	0.8	=	16.36	(75)
Northeast _{0.9x}	0.77	x	0.68	x	41.38	x	0.63	x	0.8	=	29.48	(75)
Northeast _{0.9x}	0.77	x	0.68	x	67.96	x	0.63	x	0.8	=	48.42	(75)
Northeast _{0.9x}	0.77	x	0.68	x	91.35	x	0.63	x	0.8	=	65.09	(75)
Northeast _{0.9x}	0.77	X	0.68	X	97.38	x	0.63	X	0.8	=	69.39	(75)
Northeast _{0.9x}	0.77	x	0.68	x	91.1	x	0.63	x	0.8	=	64.91	(75)
Northeast _{0.9x}	0.77	x	0.68	x	72.63	x	0.63	x	0.8	=	51.75	(75)
Northeast _{0.9x}	0.77	X	0.68	X	50.42	x	0.63	x	0.8	=	35.93	(75)
Northeast _{0.9x}	0.77	X	0.68	X	28.07	x	0.63	x	0.8	=	20	(75)
Northeast _{0.9x}	0.77	x	0.68	x	14.2	x	0.63	x	0.8	=	10.12	(75)
Northeast _{0.9x}	0.77	x	0.68	x	9.21	x	0.63	x	0.8	=	6.57	(75)
Southeast _{0.9x}	0.77	x	2.69	x	36.79	x	0.63	x	0.8	=	69.14	(77)
Southeast _{0.9x}	0.77	x	1.03	x	36.79	x	0.63	x	0.8	=	13.24	(77)
Southeast 0.9x	0.77	x	2.69	X	62.67	X	0.63	X	0.8	=	117.77	(77)
Southeast _{0.9x}	0.77	x	1.03	x	62.67	x	0.63	x	0.8	=	22.55	(77)
Southeast _{0.9x}	0.77	x	2.69	x	85.75	x	0.63	x	0.8	=	161.14	(77)
Southeast _{0.9x}	0.77	x	1.03	X	85.75	x	0.63	x	0.8	=	30.85	(77)
Southeast _{0.9x}	0.77	x	2.69	X	106.25	x	0.63	x	0.8	=	199.66	(77)
Southeast _{0.9x}	0.77	X	1.03	x	106.25	x	0.63	x	0.8	=	38.22	(77)
Southeast _{0.9x}	0.77	x	2.69	x	119.01	x	0.63	x	0.8	=	223.63	(77)

o ,, , , ,		,		1		ı		1		1		_
Southeast 0.9x	0.77	X	1.03	X	119.01	X	0.63	X	0.8] =	42.81	(77)
Southeast _{0.9x}	0.77	X	2.69	X	118.15	X	0.63	X	0.8	=	222.01	(77)
Southeast _{0.9x}	0.77	X	1.03	X	118.15	X	0.63	X	0.8	=	42.5	(77)
Southeast _{0.9x}	0.77	X	2.69	X	113.91	Х	0.63	X	0.8	=	214.04	(77)
Southeast _{0.9x}	0.77	X	1.03	X	113.91	X	0.63	X	0.8	=	40.98	(77)
Southeast _{0.9x}	0.77	X	2.69	X	104.39	X	0.63	X	0.8	=	196.16	(77)
Southeast 0.9x	0.77	X	1.03	X	104.39	X	0.63	X	0.8	=	37.55	(77)
Southeast _{0.9x}	0.77	X	2.69	X	92.85	X	0.63	X	0.8	=	174.48	(77)
Southeast _{0.9x}	0.77	X	1.03	X	92.85	X	0.63	X	0.8	=	33.4	(77)
Southeast 0.9x	0.77	X	2.69	x	69.27	X	0.63	X	0.8	=	130.16	(77)
Southeast _{0.9x}	0.77	X	1.03	x	69.27	x	0.63	x	0.8] =	24.92	(77)
Southeast _{0.9x}	0.77	X	2.69	x	44.07	X	0.63	X	0.8	=	82.81	(77)
Southeast _{0.9x}	0.77	X	1.03	x	44.07	X	0.63	X	0.8] =	15.85	(77)
Southeast _{0.9x}	0.77	X	2.69	x	31.49	х	0.63	x	0.8] =	59.17	(77)
Southeast _{0.9x}	0.77	X	1.03	x	31.49	х	0.63	x	0.8] =	11.33	(77)
Southwest _{0.9x}	0.77	X	2.22	x	36.79	ĺ	0.63	x	0.8	j =	57.06	(79)
Southwest _{0.9x}	0.77	x	1.13	х	36.79		0.63	х	0.8] =	29.04	(79)
Southwest _{0.9x}	0.77	X	0.61	x	36.79		0.63	x	0.8	j =	7.84	(79)
Southwest _{0.9x}	0.77	x	2.22	х	62.67		0.63	х	0.8	j =	97.19	(79)
Southwest _{0.9x}	0.77	x	1.13	х	62.67		0.63	х	0.8] =	49.47	(79)
Southwest _{0.9x}	0.77	X	0.61	х	62.67		0.63	х	0.8	j =	13.35	(79)
Southwest _{0.9x}	0.77	x	2.22	х	85.75		0.63	х	0.8	j =	132.98	(79)
Southwest _{0.9x}	0.77	X	1.13	x	85.75		0.63	x	0.8	j =	67.69	(79)
Southwest _{0.9x}	0.77	X	0.61	x	85.75	İ	0.63	x	0.8	j =	18.27	(79)
Southwest _{0.9x}	0.77	X	2.22	x	106.25		0.63	x	0.8	j =	164.77	(79)
Southwest _{0.9x}	0.77	X	1.13	x	106.25		0.63	х	0.8	j =	83.87	(79)
Southwest _{0.9x}	0.77	X	0.61	x	106.25	İ	0.63	х	0.8	j =	22.64	(79)
Southwest _{0.9x}	0.77	j×	2.22	x	119.01		0.63	x	0.8	j =	184.56	(79)
Southwest _{0.9x}	0.77	X	1.13	x	119.01	İ	0.63	x	0.8	j =	93.94	(79)
Southwest _{0.9x}	0.77	X	0.61	x	119.01	İ	0.63	x	0.8	j =	25.36	(79)
Southwest _{0.9x}	0.77	X	2.22	x	118.15		0.63	x	0.8	j =	183.22	(79)
Southwest _{0.9x}	0.77	X	1.13	x	118.15		0.63	X	0.8	j =	93.26	(79)
Southwest _{0.9x}	0.77	X	0.61	x	118.15	İ	0.63	x	0.8	j =	25.17	(79)
Southwest _{0.9x}	0.77	X	2.22	х	113.91		0.63	х	0.8	i =	176.65	(79)
Southwest _{0.9x}	0.77	X	1.13	х	113.91		0.63	X	0.8	i =	89.91	(79)
Southwest _{0.9x}	0.77] x	0.61	ı X	113.91		0.63	X	0.8	=	24.27	(79)
Southwest _{0.9x}	0.77	X	2.22	X	104.39		0.63	X	0.8]] =	161.89	(79)
Southwest _{0.9x}	0.77	X	1.13	X	104.39		0.63	X	0.8]] =	82.4	(79)
Southwest _{0.9x}	0.77) X	0.61	l X	104.39		0.63	X	0.8]] =	22.24	(79)
Southwest _{0.9x}	0.77	X	2.22) x	92.85		0.63	X	0.8]] =	143.99	(79)
Southwest _{0.9x}	0.77]]	1.13	l X	92.85		0.63	X	0.8]] =	73.29	(79)
L		J		I		I		ı		1		」 ` ′

ОИ		7		1		1		ı		1		٦
Southwest _{0.9x}	0.77	X	0.61	X	92.85		0.63	X	0.8	=	19.78	(79)
Southwest _{0.9x}	0.77	X	2.22	Х	69.27		0.63	X	0.8	=	107.42	(79)
Southwest _{0.9x}	0.77	X	1.13	X	69.27		0.63	X	0.8] =	54.68	(79)
Southwest _{0.9x}	0.77	X	0.61	X	69.27		0.63	X	0.8	=	14.76	(79)
Southwest _{0.9x}	0.77	X	2.22	X	44.07		0.63	X	0.8	=	68.34	(79)
Southwest _{0.9x}	0.77	X	1.13	X	44.07		0.63	X	0.8	=	34.79	(79)
Southwest _{0.9x}	0.77	X	0.61	X	44.07		0.63	X	0.8	=	9.39	(79)
Southwest _{0.9x}	0.77	X	2.22	X	31.49		0.63	X	0.8	=	48.83	(79)
Southwest _{0.9x}	0.77	X	1.13	X	31.49]	0.63	X	0.8	=	24.86	(79)
Southwest _{0.9x}	0.77	X	0.61	X	31.49]	0.63	x	0.8	=	6.71	(79)
Northwest 0.9x	0.77	X	2.25	X	11.28	X	0.63	X	0.8	=	26.6	(81)
Northwest 0.9x	0.77	X	1.77	X	11.28	X	0.63	X	0.8	=	6.98	(81)
Northwest 0.9x	0.77	X	1.31	x	11.28	X	0.63	x	0.8	=	15.49	(81)
Northwest 0.9x	0.77	X	2.9	x	11.28	X	0.63	x	0.8] =	11.43	(81)
Northwest 0.9x	0.77	X	2.25	x	22.97	X	0.63	X	0.8	=	54.15	(81)
Northwest 0.9x	0.77	X	1.77	x	22.97	x	0.63	x	0.8] =	14.2	(81)
Northwest _{0.9x}	0.77	X	1.31	x	22.97	x	0.63	x	0.8	Ī =	31.53	(81)
Northwest _{0.9x}	0.77	X	2.9	x	22.97	x	0.63	x	0.8	j =	23.26	(81)
Northwest 0.9x	0.77	x	2.25	х	41.38	x	0.63	x	0.8	j =	97.55	(81)
Northwest 0.9x	0.77	x	1.77	х	41.38	X	0.63	x	0.8] =	25.58	(81)
Northwest _{0.9x}	0.77	x	1.31	х	41.38	X	0.63	x	0.8	j =	56.8	(81)
Northwest 0.9x	0.77	x	2.9	x	41.38	x	0.63	x	0.8	j =	41.91	(81)
Northwest 0.9x	0.77	X	2.25	x	67.96	x	0.63	x	0.8	j =	160.21	(81)
Northwest 0.9x	0.77	X	1.77	x	67.96	x	0.63	x	0.8	j =	42.01	(81)
Northwest 0.9x	0.77	j×	1.31	x	67.96	x	0.63	x	0.8	j =	93.28	(81)
Northwest _{0.9x}	0.77	X	2.9	x	67.96	x	0.63	x	0.8	j =	68.83	(81)
Northwest _{0.9x}	0.77	X	2.25	x	91.35	x	0.63	x	0.8	j =	215.36	(81)
Northwest _{0.9x}	0.77	X	1.77	x	91.35	X	0.63	X	0.8	j =	56.47	(81)
Northwest _{0.9x}	0.77	X	1.31	x	91.35	X	0.63	X	0.8	i =	125.39	(81)
Northwest 0.9x	0.77	X	2.9	x	91.35	X	0.63	x	0.8	j =	92.52	(81)
Northwest 0.9x	0.77	X	2.25	×	97.38	X	0.63	x	0.8	j =	229.59	(81)
Northwest 0.9x	0.77	X	1.77	x	97.38	X	0.63	X	0.8	j =	60.2	(81)
Northwest 0.9x	0.77	X	1.31	x	97.38	X	0.63	x	0.8	j =	133.67	(81)
Northwest 0.9x	0.77	X	2.9	x	97.38	X	0.63	X	0.8] =	98.64	(81)
Northwest 0.9x	0.77	X	2.25	×	91.1	X	0.63	X	0.8] =	214.78	(81)
Northwest _{0.9x}	0.77) x	1.77	×	91.1	X	0.63	x	0.8] =	56.32	(81)
Northwest _{0.9x}	0.77) X	1.31	X	91.1	X	0.63	x	0.8]] =	125.05	(81)
Northwest _{0.9x}	0.77] x	2.9	X	91.1	X	0.63	x	0.8]] =	92.28	(81)
Northwest _{0.9x}	0.77]]	2.25	l X	72.63	X	0.63	X	0.8]] =	171.22	(81)
Northwest _{0.9x}	0.77	X	1.77) x	72.63	X	0.63	X	0.8]] =	44.9	(81)
Northwest _{0.9x}	0.77]]	1.31	l X	72.63) X	0.63	X	0.8]] =	99.69	(81)
		J		I		J	0.00	ı	1	1		」 ` ′

				_			,		_				_
Northwest _{0.9x}	0.77	X	2.9	X	7	2.63	X	0.63	X	0.8	=	73.56	(81)
Northwest _{0.9x}	0.77	X	2.25	X	5	0.42	X	0.63	X	8.0	=	118.87	(81)
Northwest _{0.9x}	0.77	X	1.77	X	5	0.42	X	0.63	X	8.0	=	31.17	(81)
Northwest _{0.9x}	0.77	X	1.31	X	5	0.42	X	0.63	X	8.0	=	69.21	(81)
Northwest _{0.9x}	0.77	X	2.9	X	5	0.42	X	0.63	X	8.0	=	51.07	(81)
Northwest _{0.9x}	0.77	X	2.25	X	2	8.07	X	0.63	X	0.8	=	66.17	(81)
Northwest 0.9x	0.77	X	1.77	X	2	8.07	X	0.63	X	0.8	=	17.35	(81)
Northwest _{0.9x}	0.77	X	1.31	X	2	8.07	X	0.63	X	0.8	=	38.53	(81)
Northwest _{0.9x}	0.77	X	2.9	X	2	8.07	X	0.63	X	0.8	=	28.43	(81)
Northwest 0.9x	0.77	X	2.25	X		14.2	X	0.63	X	0.8	=	33.47	(81)
Northwest _{0.9x}	0.77	X	1.77	X		14.2	X	0.63	X	0.8	=	8.78	(81)
Northwest _{0.9x}	0.77	X	1.31	X		14.2	X	0.63	X	0.8	=	19.49	(81)
Northwest _{0.9x}	0.77	X	2.9	x		14.2	X	0.63	x	0.8	=	14.38	(81)
Northwest _{0.9x}	0.77	X	2.25	x	,	9.21	X	0.63	x	0.8	=	21.72	(81)
Northwest _{0.9x}	0.77	х	1.77	x	9	9.21	X	0.63	x	0.8	=	5.7	(81)
Northwest _{0.9x}	0.77	Х	1.31	X		9.21	X	0.63	x	0.8	=	12.65	(81)
Northwest _{0.9x}	0.77	X	2.9	x	,	9.21	X	0.63	x	0.8	=	9.33	(81)
Rooflights _{0.9x}	1	X	1.11	x	3	7.03	X	0.55	x	0.8	=	48.92	(82)
Rooflights _{0.9x}	1	X	1.11	x	7	0.28	X	0.55	x	0.8	=	92.85	(82)
Rooflights _{0.9x}	1	X	1.11	x	1	11.87	X	0.55	x	0.8	=	147.79	(82)
Rooflights _{0.9x}	1	X	1.11	x	1:	59.33	X	0.55	x	0.8	=	210.48	(82)
Rooflights _{0.9x}	1	Х	1.11	X	1	93.3	X	0.55	x	0.8	=	255.37	(82)
Rooflights 0.9x	1	x	1.11	X	1:	97.35	X	0.55	x	0.8	=	260.71	(82)
Rooflights _{0.9x}	1	х	1.11	x	1	38.08	X	0.55	x	0.8	=	248.47	(82)
Rooflights 0.9x	1	x	1.11	X	1	62.62	X	0.55	x	0.8	=	214.83	(82)
Rooflights 0.9x	1	x	1.11	X	1:	28.66	X	0.55	x	0.8	=	169.98	(82)
Rooflights 0.9x	1	x	1.11	X	8	2.24	X	0.55	x	8.0	=	108.65	(82)
Rooflights 0.9x	1	x	1.11	x	4	5.75	X	0.55	x	0.8	=	60.44	(82)
Rooflights _{0.9x}	1	х	1.11	x	3	0.74	X	0.55	x	0.8	=	40.61	(82)
							_						
Solar gains in v	vatts, cal	culated					`	= Sum(74)m	(82)m			,	
(83)m= 293.77		810.05				1347.66	115	6.2 921.17	611.06	357.86	247.47		(83)
Total gains – in			· · · · · ·								1	1	,
(84)m= 879.17	1114.86	1370.28	1657.31 186	8.45 1	871.68	1780.08	159	1381.39	1106.8	4 894.07	814.94		(84)
7. Mean intern	nal tempe	erature ((heating sea	ison)									
Temperature o	during he	eating p	eriods in the	living	area	rom Tal	ble 9	Th1 (°C)				21	(85)
Utilisation fact	or for ga	ins for I	iving area, h	11,m (s	see Ta	ble 9a)			1	i	1	1	
Jan	Feb	Mar		1ay	Jun	Jul	A	ug Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.98 0.	95	0.88	0.78	0.8	0.95	0.99	1	1		(86)
Mean internal	tempera	ture in I	iving area T	1 (follo	ow ste	ps 3 to	7 in T	able 9c)					
(87)m= 18.47	18.67	19.05	19.61 20	.14	20.6	20.82	20.	77 20.38	19.7	19.02	18.48		(87)
Temperature o	during he	eating p	eriods in res	t of d	welling	from Ta	able 9	9, Th2 (°C)					
(88)m= 19.92	19.92	19.93	19.96 19	.97	19.99	19.99	20	19.98	19.97	19.95	19.94		(88)
				-								-	

Utilisa	ition fac	tor for a	ains for ı	rest of d	wellina. I	h2.m (se	ee Table	9a)						
(89)m=	1	1	0.99	0.98	0.94	0.83	0.67	0.74	0.93	0.99	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	ps 3 to 7	7 in Tabl	le 9c)				
(90)m=	17.57	17.78	18.17	18.74	19.27	19.72	19.91	19.88	19.51	18.83	18.14	17.6		(90)
!									1	fLA = Livin	g area ÷ (4	1) =	0.17	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwel	lina) = fl	LA × T1	+ (1 – fl	A) × T2					
(92)m=	17.73	17.93	18.32	18.89	19.42	19.87	20.06	20.03	19.66	18.98	18.29	17.75		(92)
Apply	adjustn	nent to t	he mean	internal	tempera	ature fro	m Table	4e, whe	re appro	priate				
(93)m=	18.33	18.53	18.92	19.49	20.02	20.47	20.66	20.63	20.26	19.58	18.89	18.35		(93)
8. Spa	ace hea	ting requ	uirement											
			ernal ter or gains	•		ed at ste	ep 11 of	Table 9b	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
l Utilisa			ains, hm		iviay	Ouri	l oui	7 tug	ОСР	000	1101	DCO		
(94)m=	1	1	0.99	0.98	0.94	0.86	0.75	0.8	0.94	0.99	1	1		(94)
Usefu	l gains,	hmGm	, W = (94	↓ 1)m x (84	 4)m		l		l .	l				
(95)m=	877.6	1110.51	1357.62	1616.59	1751.24	1607.02	1332.88	1282.9	1293.91	1092.85	891.35	813.84		(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)
							=[(39)m :	x [(93)m-	<u> </u>					
(97)m=	6297.15	6084.02	5507.97	4564.13	3565.87	2452.29	1697.48	1757.79	2599.88	3849.15	5111.21	6201.71		(97)
)m] x (4 ⁻		· ·		
(98)m=	4032.15	3342.2	3087.86	2122.23	1350.08	0	0	0	0	2050.69	3038.3	4008.57		_
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	23032.07	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								111.11	(99)
9a. En	ergy rec	luiremer	nts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	HP)					
•	e heatir	•										,		_
			t from se			mentary	-						0	(201)
Fracti	on of sp	ace hea	it from m	ain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fracti	on of to	tal heati	ng from	main sys	stem 1			(204) = (20	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/supple	ementar	y heating	g system	ո, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	e heatin	g require	ement (c	alculate	d above)									
	4032.15	3342.2	3087.86	2122.23	1350.08	0	0	0	0	2050.69	3038.3	4008.57		
(211)m	= {[(98)m x (20	4)] } x 1	00 ÷ (20	6)									(211)
	4465.28	3701.21	3419.56	2350.2	1495.11	0	0	0	0	2270.97	3364.67			_
								Tota	l (kWh/yea	ar) =Sum(2	211),15,1012	=	25506.17	(211)
•		• `	econdar	• • •	month									
· · · · i			00 ÷ (20								-			
(215)m=	0	0	0	0	0	0	0	0 Tata	0	0	0	0		7,0,-
								rota	i (kvvii/yea	ar) =Sum(2	. 10) _{15,1012}		0	(215)

Water heating								
Output from water heater (calculated above) 223.42	59.28 152.6	170.11	170.22	191.86	203.12	217.98]	
Efficiency of water heater			Į				81	(216)
(217)m= 89.76 89.73 89.65 89.48 89.09	81 81	81	81	89.42	89.65	89.77		(217)
Fuel for water heating, kWh/month								
$(219)m = (64)m \times 100 \div (217)m$ (219)m = 248.91 219.4 230.45 206.77 202.99 1	96.64 188.4	210.02	210.14	214.55	226.55	242.82		
		Tota	ıl = Sum(2	19a) ₁₁₂ =			2597.64	(219)
Annual totals				k\	Wh/year	•	kWh/year	-
Space heating fuel used, main system 1							25506.17	<u> </u>
Water heating fuel used							2597.64	
Electricity for pumps, fans and electric keep-hot								
central heating pump:						39]	(230c)
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =			39	(231)
Electricity for lighting							743.76	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)	(237b)	=				28886.58	(338)
12a. CO2 emissions – Individual heating system	s including m	icro-CHF)					
	Energy kWh/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x			0.2	16	=	5509.33	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.2	16	=	561.09	(264)
Space and water heating	(261) + (262)	+ (263) + ((264) =				6070.42	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	20.24	(267)
	(232) x 0.519 =							_
Electricity for lighting	(232) x			0.5	19	=	386.01	(268)
Electricity for lighting Total CO2, kg/year	(232) x		sum o	0.5 of (265)(2		=	386.01 6476.68	(268) (272)

El rating (section 14)

(274)

Energy Assessment The Bird in Hand, Kilburn

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Baseline New built - TER from the TER SAP worksheet

Appendix B 32

		l lsor-F	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	<u> </u>	Strom Softwa	_				016363 on: 1.0.5.51	
	F	Property	Address	Flat-G0)1-LEAN	J			
Address :									
1. Overall dwelling dime	ensions:	•	4 0						. .
Ground floor			a(m²) 81.64	(1a) x		ight(m) 2.7	(2a) =	Volume(m ³	(3a)
	a).(4b).(4a).(4d).(4a).					2.1	_(2a) =	220.43	(Ja)
•	a)+(1b)+(1c)+(1d)+(1e)+(1	n) [81.64	(4)					_
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	220.43	(5)
2. Ventilation rate:	main seconda	۲۱/	other		total			m³ per hou	ı p
	heating heating	<u> </u>	Other	, –	lotai			iii periliou	_
Number of chimneys	0 + 0		0	_ = <u>L</u>	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	X :	20 =	0	(6b)
Number of intermittent fa	ins				3	X	10 =	30	(7a)
Number of passive vents	3				0	X	10 =	0	(7b)
Number of flueless gas f	ires			Ī	0	X ·	40 =	0	(7c)
								_	
							Air ch	nanges per ho	our —
	ys, flues and fans = (6a)+(6b)+(_	30		÷ (5) =	0.14	(8)
Number of storeys in t	peen carried out or is intended, procee he dwelling (ns)	ea to (17),	otnerwise (ontinue tr	om (9) to ((16)		0	(9)
Additional infiltration	ine arreining (ine)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	y constr	uction			0	(11)
	resent, use the value corresponding t	o the grea	ter wall are	a (after					
deducting areas of openial lf suspended wooden	floor, enter 0.2 (unsealed) or 0).1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en		`	,,					0	(13)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)					0	(16)
•	q50, expressed in cubic metro	•	•	•	etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$ es if a pressurisation test has been do				is heina u	sed		0.39	(18)
Number of sides sheltere		ne or a ac	gree an pe	moubinty	io being a	50 0		2	(19)
Shelter factor			(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18) x (20) =				0.33	(21)
Infiltration rate modified t	for monthly wind speed					•		,	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7					•		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 = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18]	
						•		•	

Adjusted infiltr 0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.39		
Calculate effe		_	rate for t	he appli	cable cas	se	ļ.					J 	
If mechanica												0	(2
If exhaust air h									o) = (23a)			0	(2
If balanced with									0 1.) ((00	0	(2
a) If balance			i		1		, ``	ŕ	, 		` ` `) ÷ 100] T	(c
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
b) If balance	ed mecna	nicai ve	ntilation	without	neat rec	overy (I	VIV) (24b	0)m = (2) 0	2b)m + (1 0	23b) ₀	0	7	(2
	L				ا أ				<u> </u>	0	1 0	_	(4
c) If whole h	n < 0.5 ×			•	•				5 × (23h	n)			
24c)m= 0	0.0	0	0	0	0	0	0	0	0	0	0]	(2
d) If natural	ventilatio	n or wh	ole hous	L nositi	ve input v	entilatio	n from l	oft	<u>!</u>	<u>!</u>	<u>!</u>	_	
,	n = 1, the			•	•				0.5]				
24d)m= 0.59	0.58	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(2
Effective air	change r	rate - er	nter (24a) or (24l	b) or (24c	;) or (24	d) in box	(25)		-	-	_	
25)m= 0.59	0.58	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57		(
3. Heat losse	s and he	at loss i	paramet	er:									
LEMENT	Gros		Openin		Net Are	эа	U-valı	ue	ΑXU		k-valu	e	ΑΧk
	area ((m²)	· m		A ,m	1 ²	W/m2	K	(W/	K)	kJ/m²·	K	kJ/K
oors)					1.99	X	1	=	1.99				(
Vindows Type) 1				1.37	x1.	/[1/(1.4)+	0.04] =	1.82				(
Vindows Type	∌ 2				4.34	x1.	/[1/(1.4)+	0.04] =	5.75				(
Vindows Type	∌ 3				5.76	x1	/[1/(1.4)+	0.04] =	7.64				(2
Vindows Type	e 4				1.65	x1	/[1/(1.4)+	0.04] =	2.19				(
loor					81.64	X	0.13	=	10.613	2			(
Valls Type1	79.62	2	16.1	4	63.48	X	0.18	=	11.43				(2
Valls Type2	53.08	В	1.99		51.09	x	0.18	-	9.2			7 7	(2
Roof Type1	4.85		0		4.85	X	0.13	=	0.63			= =	(3
Roof Type2	1.55		0		1.55	x	0.13	-	0.2	= i		i i	(:
otal area of e	elements,	m²			220.74	二							(;
Party ceiling					75.24					[$\neg \vdash$	(:
for windows and	roof windo	ws, use e	ffective wi	ndow U-va			ı formula 1.	/[(1/U-valu	ue)+0.04] a	ו as given in	n paragrapi		,
include the area	as on both s	sides of in	ternal wal	ls and par	titions								
مما الممام منسمام	ss, W/K =	•	U)				(26)(30)	+ (32) =				55.46	(
	Cm = S(A)	•						((28).	(30) + (32	2) + (32a)	(32e) =	30206	.1 (
		or /TME	P = Cm +	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(
leat capacity hermal mass	•	•											
leat capacity hermal mass or design assess	sments whe	ere the de	tails of the	construct	ion are not	known pr	ecisely the	indicative	e values of	TMP in T	able 1f		
leat capacity Thermal mass or design assess an be used inste	sments whe	ere the de ailed calcu	tails of the ulation.			•	ecisely the	indicative	e values of	TMP in T	able 1f	16.41	(

Total fabric he	eat loss							(33) +	(36) =		İ	71.86	(37)
Ventilation he		alculated	d monthl	V					= 0.33 × (25)m x (5)		71.00	(01)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 42.74	42.49	42.25	41.11	40.9	39.91	39.91	39.72	40.29	40.9	41.33	41.78		(38)
Heat transfer	coefficie	nt, W/K	I					(39)m	= (37) + (3	38)m		l	
(39)m= 114.6	114.35	114.11	112.97	112.76	111.77	111.77	111.58	112.15	112.76	113.19	113.64		
Heat loss para	ameter (I	· · · · · · · · · · · · · · · · · · ·	/m²K	•		•			Average = = (39)m ÷		12 /12=	112.97	(39)
(40)m= 1.4	1.4	1.4	1.38	1.38	1.37	1.37	1.37	1.37	1.38	1.39	1.39		
Number of da	vs in mo	nth (Tab	le 1a)	•	•	•		,	Average =	Sum(40) ₁	12 /12=	1.38	(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)
												l	
4. Water hea	itina ene	rav reau	irement:								kWh/ye	ear:	
	<u> </u>												
Assumed occ if TFA > 13.			:[1 - exp	(-0 0003	349 x (TF	FA -13 9)2)1 + 0 ()013 x (ΓFA -13		49		(42)
if TFA £ 13.		1.1.07.	. [(0.000	/ 10 / (11	71 10.0	<i>j</i> _/j · 0.0) N 010 N (0 ,			
Annual average											.41		(43)
Reduce the annu							o acnieve	a water us	se target o	ſ			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage								ОСР	Oct	1407	DCC		
(44)m= 102.76	99.02	95.28	91.55	87.81	84.07	84.07	87.81	91.55	95.28	99.02	102.76		
. ,				l .		l .		-	Γotal = Su	m(44) ₁₁₂ =		1120.97	(44)
Energy content o	f hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x D	OTm / 3600	kWh/mon	th (see Ta	bles 1b, 1	c, 1d)		
(45)m= 152.38	133.28	137.53	119.9	115.05	99.28	92	105.57	106.83	124.5	135.9	147.58		
If instantaneous v	vater heati	na at naint	of use (no	hot water	r storage)	enter O in	haves (46		Total = Su	m(45) ₁₁₂ =	=	1469.77	(45)
		· ·				1		` '				İ	(40)
(46)m= 22.86 Water storage	19.99 e loss:	20.63	17.99	17.26	14.89	13.8	15.83	16.02	18.67	20.38	22.14		(46)
Storage volun) includir	ng any s	olar or W	/WHRS	storage	within sa	me ves	sel		0		(47)
If community I	heating a	and no ta	ınk in dv	velling, e	nter 110) litres in	(47)						
Otherwise if n	o stored	hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage												•	
a) If manufac				or is kno	wn (kWł	n/day):					0		(48)
Temperature											0		(49)
Energy lost fro		_	-		or is not		(48) x (49)	=			0		(50)
b) If manufac Hot water stor			-								0		(51)
If community	_			(.,	.,,					0		(0.)
Volume factor	from Ta	ble 2a									0		(52)
Temperature	factor fro	m Table	2b								0		(53)
Energy lost from		_	, kWh/y	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or	(54) in (5	55)									0		(55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m)$	
(56)m= 0 0 0 0 0 0 0 0 0 0 0 0	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H	
(57)m= 0 0 0 0 0 0 0 0 0 0 0	(57)
Primary circuit loss (annual) from Table 3	(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)	
(59)m= 0 0 0 0 0 0 0 0 0 0 0	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 50.96 45.58 48.56 45.15 44.75 41.46 42.84 44.75 45.15 48.56 48.83 50.96	(61)
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (50)m$	61)m
(62)m= 203.34 178.85 186.08 165.05 159.79 140.74 134.84 150.31 151.97 173.05 184.73 198.53	(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	(63)
Output from water heater	
(64)m= 203.34 178.85 186.08 165.05 159.79 140.74 134.84 150.31 151.97 173.05 184.73 198.53	
Output from water heater (annual) ₁₁₂ 2027	3 (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= 63.41 55.71 57.87 51.15 49.44 43.37 41.3 46.29 46.81 53.53 57.39 61.81	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating	
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(66)m= 124.66 124.66 124.66 124.66 124.66 124.66 124.66 124.66 124.66 124.66 124.66	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 20.03 17.79 14.47 10.95 8.19 6.91 7.47 9.71 13.03 16.55 19.31 20.59	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 222.83 225.15 219.32 206.91 191.26 176.54 166.71 164.39 170.22 182.63 198.28 213	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 35.47 35.47 35.47 35.47 35.47 35.47 35.47 35.47 35.47 35.47 35.47 35.47	(69)
Pumps and fans gains (Table 5a)	
(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3	(70)
Losses e.g. evaporation (negative values) (Table 5)	
(71)m= -99.73 -99.73 -99.73 -99.73 -99.73 -99.73 -99.73 -99.73 -99.73 -99.73 -99.73	(71)
Water heating gains (Table 5)	
(72)m= 85.23 82.9 77.78 71.05 66.45 60.24 55.51 62.21 65.01 71.95 79.71 83.08	(72)
Total internal gains = $(66)m + (67)m + (68)m + (70)m + (71)m + (72)m$	
(73)m= 391.49 389.24 374.97 352.31 329.29 307.09 293.08 299.72 311.66 334.52 360.71 380.06	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	X	1.65	x	11.28	x	0.63	x	0.7	=	11.38	(75)
Northeast 0.9x	0.77	X	1.65	X	22.97	x	0.63	X	0.7] =	23.16	(75)
Northeast 0.9x	0.77	X	1.65	x	41.38	x	0.63	X	0.7] =	41.73	(75)
Northeast 0.9x	0.77	X	1.65	x	67.96	x	0.63	x	0.7] =	68.54	(75)
Northeast 0.9x	0.77	X	1.65	x	91.35	x	0.63	x	0.7] =	92.12	(75)
Northeast 0.9x	0.77	X	1.65	x	97.38	x	0.63	X	0.7] =	98.21	(75)
Northeast 0.9x	0.77	X	1.65	x	91.1	x	0.63	x	0.7	=	91.88	(75)
Northeast _{0.9x}	0.77	X	1.65	X	72.63	x	0.63	X	0.7	=	73.25	(75)
Northeast 0.9x	0.77	X	1.65	x	50.42	x	0.63	x	0.7] =	50.85	(75)
Northeast 0.9x	0.77	X	1.65	x	28.07	x	0.63	X	0.7	=	28.31	(75)
Northeast _{0.9x}	0.77	X	1.65	x	14.2	x	0.63	x	0.7	=	14.32	(75)
Northeast _{0.9x}	0.77	X	1.65	X	9.21	x	0.63	X	0.7] =	9.29	(75)
Southeast 0.9x	0.77	X	5.76	X	36.79	x	0.63	X	0.7] =	64.77	(77)
Southeast 0.9x	0.77	X	5.76	X	62.67	x	0.63	X	0.7] =	110.33	(77)
Southeast 0.9x	0.77	X	5.76	x	85.75	x	0.63	x	0.7] =	150.95	(77)
Southeast 0.9x	0.77	X	5.76	x	106.25	x	0.63	x	0.7	=	187.04	(77)
Southeast 0.9x	0.77	X	5.76	X	119.01	x	0.63	X	0.7] =	209.5	(77)
Southeast 0.9x	0.77	X	5.76	x	118.15	x	0.63	x	0.7] =	207.98	(77)
Southeast 0.9x	0.77	X	5.76	X	113.91	x	0.63	X	0.7] =	200.52	(77)
Southeast 0.9x	0.77	X	5.76	x	104.39	x	0.63	X	0.7] =	183.76	(77)
Southeast 0.9x	0.77	X	5.76	x	92.85	x	0.63	x	0.7	=	163.45	(77)
Southeast 0.9x	0.77	X	5.76	X	69.27	x	0.63	X	0.7] =	121.93	(77)
Southeast 0.9x	0.77	X	5.76	x	44.07	x	0.63	x	0.7	=	77.58	(77)
Southeast 0.9x	0.77	X	5.76	x	31.49	x	0.63	x	0.7	=	55.43	(77)
Southwest _{0.9x}	0.77	X	1.37	x	36.79		0.63	x	0.7	=	30.81	(79)
Southwest _{0.9x}	0.77	X	4.34	x	36.79		0.63	x	0.7	=	48.8	(79)
Southwest _{0.9x}	0.77	X	1.37	x	62.67		0.63	x	0.7	=	52.48	(79)
Southwest _{0.9x}	0.77	X	4.34	X	62.67		0.63	X	0.7	=	83.13	(79)
Southwest _{0.9x}	0.77	X	1.37	X	85.75		0.63	X	0.7	=	71.81	(79)
Southwest _{0.9x}	0.77	X	4.34	X	85.75		0.63	X	0.7	=	113.74	(79)
Southwest _{0.9x}	0.77	X	1.37	X	106.25		0.63	X	0.7	=	88.97	(79)
Southwest _{0.9x}	0.77	X	4.34	X	106.25		0.63	x	0.7	=	140.93	(79)
Southwest _{0.9x}	0.77	X	1.37	x	119.01		0.63	x	0.7	=	99.66	(79)
Southwest _{0.9x}	0.77	X	4.34	x	119.01		0.63	x	0.7	=	157.85	(79)
Southwest _{0.9x}	0.77	X	1.37	X	118.15		0.63	X	0.7] =	98.94	(79)
Southwest _{0.9x}	0.77	X	4.34	x	118.15		0.63	x	0.7] =	156.71	(79)
Southwest _{0.9x}	0.77	X	1.37	x	113.91		0.63	x	0.7] =	95.39	(79)
Southwest _{0.9x}	0.77	X	4.34	x	113.91		0.63	x	0.7] =	151.08	(79)
Southwest _{0.9x}	0.77	X	1.37	X	104.39		0.63	X	0.7	=	87.41	(79)

Southwest	0.9x 0.77	×	4.3	34	X	10	04.39			0.63	X	0.7	=	· <u>L</u>	138.46	(79)
Southwest	0.9x 0.77	x	1.3	37	X	9	2.85			0.63	X	0.7	=	•	77.75	(79)
Southwest	0.9x 0.77	X	4.3	34	x	9	2.85			0.63	X	0.7	-	=	123.16	(79)
Southwest	0.9x 0.77	X	1.3	37	x	6	9.27			0.63	x	0.7	-	=	58	(79)
Southwest	0.9x 0.77	X	4.3	34	x	6	9.27			0.63	X	0.7	-		91.87	(79)
Southwest	0.9x 0.77	X	1.3	37	x	4	4.07			0.63	x	0.7	=	=	36.9	(79)
Southwest	0.9x 0.77	X	4.3	34	x	4	4.07] [0.63	x [0.7	=		58.45	(79)
Southwest	0.9x 0.77	X	1.3	37	x	3	1.49] [0.63	x [0.7		-	26.37	(79)
Southwest	0.9x 0.77	X	4.3	34	x	3	1.49			0.63	x [0.7	-	=	41.76	(79)
Solar gair	ns in watts, c	alculated	for eac	h month				(83)m	= Su	um(74)m .	(82)m	_				
` '	55.76 269.1	378.23	485.47	559.13		61.84	538.87	482.	.88	415.21	300.12	187.25	132.8	5		(83)
Total gair	ns – internal a	and solar	(84)m =	= (73)m	+ (8	33)m	, watts					_		_		
(84)m= 54	17.25 658.33	753.2	837.79	888.42	86	68.94	831.95	782	2.6	726.87	634.64	547.96	512.9	2		(84)
7. Mean	internal temp	perature	(heating	season)											
Tempera	ature during h	neating p	eriods ir	n the livi	ng	area 1	from Tab	ole 9,	Th1	1 (°C)					21	(85)
Utilisatio	n factor for g	ains for l	iving are	ea, h1,m	ı (sı	ee Ta	ble 9a)									
	Jan Feb	Mar	Apr	May		Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec	;		
(86)m=	1 0.99	0.98	0.95	0.87	(0.73	0.57	0.6	62	0.84	0.97	0.99	1			(86)
Mean int	ternal temper	ature in	living ar	ea T1 (fd	ollo	w ste	ps 3 to 7	in T	able	e 9c)				_		
	19.5 19.69	19.99	20.37	20.7	_	0.91	20.98	20.9	$\overline{}$	20.82	20.38	19.87	19.46			(87)
Tompor	turo durina h	L	oriodo i	root of	طىد	olling	from To	blo C) Th	.2 (°C)		1	l			
· —	ature during h 9.76 19.76	19.77	19.78	19.78	_	9.79	19.79	19.7	_	19.78	19.78	19.77	19.77			(88)
` ′	<u> </u>			l				<u> </u>	. •			1				()
	n factor for g				_	·		<u> </u>	<u> </u>	0.70	0.05	1 000		_		(00)
(89)m=	1 0.99	0.97	0.93	0.82	<u> </u>	0.62	0.42	0.4		0.76	0.95	0.99	1			(89)
_	ternal temper				Ť			i 	_			,		_		
(90)m= 1	7.78 18.07	18.51	19.05	19.49	1	9.73	19.78	19.7	78	19.64	19.08	18.33	17.74			(90)
										f	LA = Livi	ng area ÷ (4	4) =		0.34	(91)
Mean int	ternal temper	ature (fo	r the wh	ole dwe	llin	g) = fl	_A × T1	+ (1 -	– fL	A) × T2						
(92)m= 1	8.36 18.62	19.01	19.49	19.89	2	0.12	20.18	20.1	18	20.04	19.52	18.85	18.32			(92)
Apply ac	ljustment to t	he mean	interna	l temper	_			4e, \	whe	re appro	priate	•		_		
(93)m= 1	8.36 18.62	19.01	19.49	19.89	2	0.12	20.18	20.1	18	20.04	19.52	18.85	18.32			(93)
	e heating req															
	the mean intactor for				ned	at ste	ep 11 of	Table	e 9b	, so tha	t Ti,m=	(76)m an	d re-ca	alculat	е	
	Jan Feb	Mar	Apr	May	Г	Jun	Jul	Λ.	ug	Sep	Oct	Nov	Dec	\Box		
	n factor for g			Iviay	_	Juli	Jui		ug [Geb	Oct	INOV	Dec	<u></u>		
	0.99	0.97	0.93	0.83		0.66	0.47	0.5	2	0.78	0.95	0.99	1			(94)
` ′	ains, hmGm							<u> </u>				<u> </u>	<u> </u>			
	13.75 649.15	729.81	775.13	736.3	56	69.88	391.71	407.	.97	564.4	600.11	541.02	510.4			(95)
Monthly	average exte	rnal tem	perature	from T	abl	e 8						1	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 los	s rate for me	an intern	al tempe	erature,	Lm	, W =	=[(39)m :	x [(93	3)m-	- (96)m]			_		
(97)m= 16	11.24 1568.73	1427.2	1196.83	924.04	6	17.43	400.3	421	.3	665.88	1005.56	1329.77	1604.3	4		(97)
														_		

Space heating requirement for each month, kWh/r	nonth	n = 0.02	4 x [(97))m – (95)m] x (4 ⁻	1)m			
(98)m= 794.21 617.95 518.85 303.63 139.68 (0	0	0	0	301.65	567.9	813.89		
			Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	4057.76	(98)
Space heating requirement in kWh/m²/year							[49.7	(99)
9a. Energy requirements – Individual heating syste	ms in	cluding	micro-C	HP)					
Space heating:									_
Fraction of space heat from secondary/supplemen	ntary	system					Į	0	(201)
Fraction of space heat from main system(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of total heating from main system 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1								93.4	(206)
Efficiency of secondary/supplementary heating sys	stem,	, %						0	(208)
Jan Feb Mar Apr May J	un	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space heating requirement (calculated above)		·	1						
794.21 617.95 518.85 303.63 139.68	0	0	0	0	301.65	567.9	813.89		
(211) m = {[(98)m x (204)] } x 100 ÷ (206)									(211)
850.33 661.62 555.52 325.08 149.55 0	0	0	0	0	322.97	608.03	871.41		-
			lota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	-	4344.5	(211)
Space heating fuel (secondary), kWh/month									
$= \{[(98)\text{m x } (201)]\} \text{ x } 100 \div (208)$ $(215)\text{m} = 0 0 0 0 0$	0	0	0	0	0	0	0		
(210)	<u> </u>				ar) =Sum(2			0	(215)
Water heating					, ,	715,1012	L		
Output from water heater (calculated above)									
203.34 178.85 186.08 165.05 159.79 140).74	134.84	150.31	151.97	173.05	184.73	198.53		_
Efficiency of water heater								80.3	(216)
(217)m= 88.14 87.92 87.49 86.57 84.71 80).3	80.3	80.3	80.3	86.44	87.69	88.22		(217)
Fuel for water heating, kWh/month									
(219) m = (64) m x $100 \div (217)$ m (219)m = 230.7 203.43 212.68 190.66 188.63 175	5.27	167.92	187.19	189.26	200.21	210.65	225.03		
			Tota	I = Sum(2	19a) ₁₁₂ =			2381.63	(219)
Annual totals					k۱	Nh/year		kWh/year	
Space heating fuel used, main system 1						•		4344.5	
Water heating fuel used							Ī	2381.63	<u></u>
Electricity for pumps, fans and electric keep-hot							_		_
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							Ī	353.75	(232)
Total delivered energy for all uses (211)(221) + (2	231) +	+ (232)	(237b)	=			Ī	7154.88	(338)
12a. CO2 emissions – Individual heating systems									_

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	938.41 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	514.43 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1452.84 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	183.6 (268)
Total CO2, kg/year	sum	of (265)(271) =	1675.36 (272)
TER =			20.52 (273)

		User D	etails:						
Assessor Name:	Chris Hocknell		Strom	a Num	her		STRO	016363	
Software Name:	Stroma FSAP 2012		Softwa					n: 1.0.5.51	
		Property <i>i</i>	Address	: Flat-10	1-LEAN				
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			a(m²)	(4-)		ight(m)	7(0-) -	Volume(m³	_
				(1a) x	2	2.63	(2a) =	208.59	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1n)	9.31	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	208.59	(5)
2. Ventilation rate:	<u> </u>		4					2 1	
	main seconda heating heating	•	other	_	total			m³ per hou	r
Number of chimneys	0 + 0	+	0] = [0	X	40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	X :	20 =	0	(6b)
Number of intermittent fa	ins			Γ	3	X	10 =	30	(7a)
Number of passive vents	3			Ī	0	X	10 =	0	(7b)
Number of flueless gas f	ires			Ē	0	x -	40 =	0	(7c)
				_					_
							Air ch	anges per ho	ur
	ys, flues and fans = $(6a)+(6b)+$				30		÷ (5) =	0.14	(8)
If a pressurisation test has be Number of storeys in t	peen carried out or is intended, proce	ed to (17), o	otherwise (continue fr	om (9) to	(16)			(9)
Additional infiltration	ne aweiling (113)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame	or 0.35 for	r masonı	y constr	uction	2()	•	0	(11)
	resent, use the value corresponding	to the great	er wall are	a (after					
deducting areas of openii	ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or	0 1 (seale	ed) else	enter 0				0	(12)
If no draught lobby, en	,	o (ooa	, o.oo	ontor o				0	(13)
• •	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic met	•	•	•	etre of e	envelope	area	5	(17)
·	lity value, then $(18) = [(17) \div 20]$				ta batana			0.39	(18)
Number of sides sheltere	es if a pressurisation test has been d ed	one or a deg	gree air pe	rmeability	is being u	sea		2	(19)
Shelter factor	, u		(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18) x (20) =				0.33	(21)
Infiltration rate modified f	for 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 = (2	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		
. ,	1 1 1 1 1 1 1 1 1 1	1		•			1	I	

Adjusted infiltra	ation rate	e (allowi	ng for sh	nelter ar	nd wind s	peed) =	(21a) x	(22a)m					
0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39]	
Calculate effect If mechanica		_	ale ioi li	пе аррп	cable ca	SE						0	(23
If exhaust air he	at pump ι	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0	(23
If balanced with	heat reco	very: effic	iency in %	allowing	for in-use f	actor (fron	n Table 4h) =				0	(23
a) If balance	d mecha	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balance	d mecha	anical ve	entilation	without	heat red	overy (N	ИV) (24b)m = (22	2b)m + (2	23b)	1	1	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24)
c) If whole ho				•	•				F (00l-	,			
if (22b)m (24c)m= 0	0.5 ×	(23b), t	nen (240	0 = (231	o); otnerv	vise (24 0	$\frac{c}{0} = (22)$	o) m + 0.	.5 × (23b	0	0	1	(24
d) If natural v		_			<u> </u>							J	(=
if (22b)m									0.5]				
(24d)m= 0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58		(24
Effective air	change	rate - er	nter (24a) or (24l	b) or (24	c) or (24	d) in bo	x (25)	-		-	-	
(25)m= 0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58		(25)
3. Heat losses	and he	at loss p	paramete	er:									
ELEMENT	Gros	•	Openin		Net Ar	ea	U-val	ue	AXU		k-value	9	ΑXk
	area	(m²)	m	2	A ,r	n²	W/m2	!K	(W/I	<)	kJ/m²·	K	kJ/K
Doors					1.99	X	1	=	1.99	_			(26)
Windows Type					1.16	x1	/[1/(1.4)+	0.04] =	1.54	╛			(27
Windows Type					0.76	_	/[1/(1.4)+		1.01				(27
Windows Type					4.92	_	/[1/(1.4)+		6.52				(27
Windows Type					3.7		/[1/(1.4)+		4.91				(27
Windows Type	5				3.53	х1	/[1/(1.4)+	0.04] =	4.68				(27
Rooflights					2.5972	36 x1	/[1/(1.7) +	0.04] =	4.41530	1			(27
Floor					55.4	X	0.13	=	7.202				(28
Walls Type1	70.8	4	15.23	3	55.61	X	0.18	=	10.01				(29
Walls Type2	27.9	1	1.99		25.92	X	0.18	=	4.67				(29
Roof Type1	5.84	1	2.6		3.24	X	0.13	=	0.42				(30
Roof Type2	0.17	7	0		0.17	X	0.13	=	0.02				(30
Total area of el	ements	, m²			160.1	6							(31
Party wall					17.81	X	0	=	0				(32
Party floor					23.91					[(32
Party ceiling					70.27	,				[(32
* for windows and						ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	n 3.2	-
** include the areas Fabric heat los				s ana par	titions		(26)(30)) + (32) =				40.04	(22
Heat capacity (•	<i>J</i>				,==)(00)		(30) + (32	2) + <i>(</i> 32a)	(32e) =	25046 7	
. Tour oupdoily (Jiii – O(, , , , ,						((20).	(55) . (52	-, · (UZU).	(525) =	25946.7	1 (34)
Thermal mass	narame	ter (TMF	P = Cm ÷	· TFA) i	n k,l/m²K			Indica	tive Value	Medium		250	(35

n be u														(3
	Ū	,	,		using Ap = 0.05 x (3	•	`						20.48	(•
	abric he	0 0	are not kn	OWII (30) -	- 0.05 X (3	1)			(33) +	(36) =			69.12	(3
entila	tion hea	at loss ca	alculated	l monthl	٧				(38)m	= 0.33 × (25)m x (5))	002	`
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
8)m=	40.69	40.44	40.2	39.08	38.87	37.9	37.9	37.72	38.27	38.87	39.3	39.74		(3
ا eat tr	ansfer c	coefficier	nt. W/K				ı		(39)m	= (37) + (37)	38)m	ı	I	
9)m=	109.8	109.56	109.32	108.2	107.99	107.01	107.01	106.83	107.39	107.99	108.41	108.86		
ا eat lo	ss para	meter (H	HLP), W/	m²K			<u>. </u>			Average = = (39)m ÷	Sum(39) _{1.} (4)	12 /12=	108.2	(3
0)m=	1.38	1.38	1.38	1.36	1.36	1.35	1.35	1.35	1.35	1.36	1.37	1.37		
									,	Average =	Sum(40) ₁ .	12 /12=	1.36	(4
umbe I	i		nth (Tab	· ·									1	
4.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		,
1)m=	31	28	31	30	31	30	31	31	30	31	30	31		(4
l. Wa	ter heat	ing ener	gy requi	rement:								kWh/ye	ear:	
														(-
if TF.	A > 13.9 A £ 13.9	9, N = 1	+ 1.76 x			•)2)] + 0.(•	ΓFA -13.	9)	45	1	,
if TF. if TF. nnual	A > 13.9 A £ 13.9 averag the annua	9, N = 1 9, N = 1 e hot wa al average	+ 1.76 x ater usaç hot water	ge in litre	s per da	ay Vd,av Iwelling is	erage = designed)2)] + 0.((25 x N) to achieve	+ 36		9)	2.38		(
if TF. if TF. nnual	A > 13.9 A £ 13.9 averag the annua	9, N = 1 9, N = 1 e hot wa al average	+ 1.76 x ater usaç hot water	ge in litre	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		9)			(
if TF, if TF, nnual duce t t more	A > 13.9 A £ 13.9 averag the annua that 125 Jan	9, N = 1 9, N = 1 e hot wa al average litres per p	+ 1.76 x ater usag hot water person per Mar	ge in litre usage by day (all w	es per da 5% if the d rater use, f	ay Vd,av welling is not and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us	se target o	9) 92	2.38		(
if TF. if TF. innual duce t more	A > 13.9 A £ 13.9 averag the annua that 125 Jan	9, N = 1 9, N = 1 e hot wa al average litres per p	+ 1.76 x ater usag hot water person per Mar	ge in litre usage by day (all w	es per da 5% if the d vater use, I	ay Vd,av welling is not and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us	se target o	9) 92	2.38		(
if TF, if TF, nnual educe if t more	A > 13.9 A £ 13.9 averag the annua that 125 Jan er usage ir	P, N = 1 P,	+ 1.76 x ater usag hot water person per Mar day for ea	ge in litre usage by day (all w Apr ach month 90.53	es per da 5% if the d vater use, I May Vd,m = fal 86.84	ay Vd,av welling is not and co Jun ctor from 1	erage = designed id) Jul Table 1c x 83.14	(25 x N) to achieve Aug (43)	+ 36 a water us Sep	Oct 94.23 Fotal = Su	9) 92 Nov 97.92 m(44) ₁₁₂ =	Dec 101.62	1108.55	
if TF, if TF, nnual duce if more t more t wate	A > 13.9 A £ 13.9 averag the annua that 125 Jan er usage ir	P, N = 1 P,	+ 1.76 x ater usag hot water person per Mar day for ea	ge in litre usage by day (all w Apr ach month 90.53	es per da 5% if the d vater use, I May Vd,m = fal 86.84	ay Vd,av welling is not and co Jun ctor from 1	erage = designed id) Jul Table 1c x 83.14	(25 x N) to achieve Aug (43) 86.84	+ 36 a water us Sep	Oct 94.23 Fotal = Su	9) 92 Nov 97.92 m(44) ₁₁₂ =	Dec 101.62	1108.55	
if TF, if TF, innual educe is the more of the thick that the thick	A > 13.9 A £ 13.9 averag the annua that 125 Jan er usage ir 101.62 content of 150.69	P, N = 1 P, N = 1 P, N = 1 P hot was all average litres per p Peb n litres per 97.92 hot water 131.8	+ 1.76 x ater usag hot water person per Mar day for ea 94.23 used - calc 136	ge in litre usage by day (all w Apr ach month 90.53 culated mo	es per da 5% if the da 5% if th	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r	erage = designed in did) Jul Table 1c x 83.14 m x nm x E 90.98	(25 x N) to achieve Aug (43) 86.84 27m / 3600 104.4	+ 36 a water us Sep 90.53 0 kWh/mon 105.64	Oct 94.23 Fotal = Su th (see Ta	9) Nov 97.92 m(44) ₁₁₂ = ables 1b, 1	Dec 101.62 = c, 1d) 145.94	1108.55	
if TF, if TF, in the interest of the interest	A > 13.9 A £ 13.9 averag the annua that 125 Jan r usage ir 101.62 content of 150.69 aneous w	P, N = 1 P, N = 1 P, N = 1 P hot was A average Iitres per p Peb Politres per P7.92 hot water 131.8	+ 1.76 x ater usag hot water person per Mar day for ea 94.23 used - calc 136	Apr ach month 90.53 culated mo 118.57	es per da 5% if the d rater use, I May Vd,m = far 86.84 onthly = 4.	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18	erage = designed in designed i	(25 x N) to achieve Aug (43) 86.84 DTm / 3600 104.4 boxes (46)	+ 36 a water us Sep 90.53 0 kWh/mon 105.64	Oct 94.23 Fotal = Su 123.12 Fotal = Su	9) 92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39 m(45) ₁₁₂ =	Dec 101.62 = c, 1d) 145.94		
if TF, if TF, in	A > 13.9 A £ 13.9 averag the annua that 125 Jan ar usage ir 101.62 content of 150.69 aneous w 22.6	P, N = 1 P,	+ 1.76 x ater usag hot water person per Mar day for ea 94.23 used - calc 136	ge in litre usage by day (all w Apr ach month 90.53 culated mo	es per da 5% if the da 5% if th	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r	erage = designed in did) Jul Table 1c x 83.14 m x nm x E 90.98	(25 x N) to achieve Aug (43) 86.84 27m / 3600 104.4	+ 36 a water us Sep 90.53 0 kWh/mon 105.64	Oct 94.23 Fotal = Su th (see Ta	9) 92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39	Dec 101.62 = c, 1d) 145.94		
if TF, if TF, nnual duce: t more t watee ergy c ergy c nnstant stant:	A > 13.9 A £ 13.9 averag the annual that 125 Jan r usage ir 101.62 content of 150.69 aneous w 22.6 storage	P, N = 1 P, N = 1 P, N = 1 P hot was al average litres per p Peb P litres per P7.92 Phot water P131.8 Pater heatin P19.77 POSS:	ter usaghot water person per Mar day for ea 94.23 used - calc 136 ag at point 20.4	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no	es per da 5% if the di sater use, l' May Vd,m = fai	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18	erage = designed in did) Jul Table 1c x 83.14 m x nm x E 90.98 enter 0 in 13.65	(25 x N) to achieve Aug (43) 86.84 DTm / 3600 104.4 boxes (46)	+ 36 a water us Sep 90.53 0 kWh/mon 105.64 15.85	94.23 Total = Su th (see Ta 123.12 Total = Su 18.47	9) 92 Nov 97.92 m(44) ₁₁₂ = sibles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 = c, 1d) 145.94		
if TF. if	A > 13.9 A £ 13.9 averag the annua that 125 Jan 101.62 content of 150.69 aneous w 22.6 storage e volum	P, N = 1 P, N = 1 P, N = 1 P hot was all average litres per p Peb n litres per 97.92 hot water 131.8 rater heatin 19.77 loss: e (litres)	+ 1.76 x ater usag hot water person per Mar day for ea 94.23 used - calc 136 ag at point 20.4 includin	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no	es per da 5% if the di sater use, l' May Vd,m = fai	ay Vd,av welling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage),	erage = designed id) Jul Table 1c x 83.14 m x nm x E 90.98 enter 0 in 13.65 storage	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa	+ 36 a water us Sep 90.53 0 kWh/mon 105.64 15.85	94.23 Total = Su th (see Ta 123.12 Total = Su 18.47	9) 92 Nov 97.92 m(44) ₁₁₂ = sibles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 = c, 1d) 145.94 = 21.89		
if TF, if TF, nnual duce: t more t wate ergy c ergy c nstant ater: orage	A > 13.9 A £ 13.9 averag the annual that 125 Jan r usage ir 101.62 content of 150.69 aneous w 22.6 storage e volum munity h	P, N = 1 P,	ter usaghot water person per Mar day for ea 94.23 used - calcate 136 ng at point 20.4 including nd no talcate 136	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no	es per da 5% if the d rater use, f May Vd,m = fac 86.84 113.77 hot water 17.07 plar or W relling, e	ay Vd,av welling is not and co Jun ctor from 1 83.14 190 x Vd,r 98.18 storage), 14.73	erage = designed idd) Jul Table 1c x 83.14 m x nm x E 90.98 enter 0 in 13.65 storage	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa	+ 36 a water us Sep 90.53 0 kWh/mon 105.64 0 to (61) 15.85 ame vess	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	9) Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 = c, 1d) 145.94 = 21.89		
if TF. if TF. innual educe if t more if wate if wate if wate if mergy of if mergy of if water if wa	A > 13.9 A £ 13.9 averag the annua that 125 Jan 101.62 content of 150.69 aneous w 22.6 storage e volum nunity h vise if no	P, N = 1 P, N = 1 P, N = 1 P + N = 1 P + N = 1 P + N = 1 P + N = 1 P + P + N = 1 P + P + N = 1 P	+ 1.76 x ater usag hot water person per Mar day for ea 94.23 used - calc 136 ag at point 20.4 includir nd no ta hot water	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so nk in dw er (this in	es per da 5% if the d rater use, I May Vd,m = far 86.84 2011 2011 2011 2012 2013 2013 2014 2015	ay Vd,av welling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar	erage = designed id) Jul Table 1c x 83.14 90.98 enter 0 in 13.65 storage litres in neous co	(25 x N) to achieve Aug (43) 86.84 DTm / 3600 104.4 boxes (46) 15.66 within said (47)	+ 36 a water us Sep 90.53 0 kWh/mon 105.64 0 to (61) 15.85 ame vess	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	9) Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 = c, 1d) 145.94 = 21.89		
if TF, if TF, in	A > 13.9 A £ 13.9 averag the annual that 125 Jan 101.62 tontent of 150.69 aneous w 22.6 storage e volum munity h vise if no storage anufact	P, N = 1 P,	+ 1.76 x ater usag hot water person per Mar day for ea 94.23 used - calc 136 ag at point 20.4 includin nd no tal hot water	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ank in dw er (this in	es per da 5% if the d rater use, f May Vd,m = fac 86.84 113.77 hot water 17.07 plar or W relling, e	ay Vd,av welling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar	erage = designed id) Jul Table 1c x 83.14 90.98 enter 0 in 13.65 storage litres in neous co	(25 x N) to achieve Aug (43) 86.84 DTm / 3600 104.4 boxes (46) 15.66 within said (47)	+ 36 a water us Sep 90.53 0 kWh/mon 105.64 0 to (61) 15.85 ame vess	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	9) 92 Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 c, 1d) 145.94 21.89 0		
if TF, if TF, if TF, innual educe is to more to twate the more to twate the more than the more th	A > 13.9 A £	P, N = 1 P,	ter usaghot water berson per Mar day for ear 94.23 used - calc 136 ag at point 20.4 including the including the twater the calc and the calc and the calc and the calc are discovered by the calc are discovere	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ank in dw er (this in oss facto 2b	es per da 5% if the d sater use, f May Vd,m = fac 86.84 113.77 hot water 17.07 clar or W velling, e acludes i	ay Vd,av welling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar	erage = designed idd) Jul Table 1c x 83.14 90.98 enter 0 in 13.65 storage litres in neous con/day):	(25 x N) to achieve Aug (43) 86.84 DTm / 3600 104.4 boxes (46) 15.66 within sa (47) pmbi boil	+ 36 a water us Sep 90.53 105.64 105.64 15.85 ame vess ers) ente	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	9) 92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39 m(45) ₁₁₂ = 20.16	2.38 Dec 101.62 c, 1d) 145.94 21.89 0		
if TF, if TF, if TF, innual educe is to more the mergy of	A > 13.9 A £ 13.9 average the annual that 125 Jan 101.62 tontent of 150.69 aneous w 22.6 storage e volum munity he vise if no storage anufaction anufactio	P, N = 1 P,	ter usaghot water usaghot water usage hot water person per Mar day for ear 94.23 used - calc 136 136 136 includin nd no talc hot water eclared less torage	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ank in dw er (this in oss facto 2b , kWh/ye	es per da 5% if the d sater use, f May Vd,m = fac 86.84 113.77 hot water 17.07 clar or W velling, e acludes i	ay Vd,av Iwelling is not and co Jun etor from 7 83.14 190 x Vd,r 98.18 r storage), 14.73 /WHRS nter 110 nstantar	erage = designed of ld) Jul Table 1c x 83.14 90.98 enter 0 in 13.65 storage litres in neous con/day):	(25 x N) to achieve Aug (43) 86.84 DTm / 3600 104.4 boxes (46) 15.66 within said (47)	+ 36 a water us Sep 90.53 105.64 105.64 15.85 ame vess ers) ente	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	9) 92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 c, 1d) 145.94 21.89 0		
if TF. if TF. innual educe: t more twate 4)m= totstant formation formatio	A > 13.9 A £ 13.9 average the annual of that 125 Jan 101.62 content of 150.69 aneous w 22.6 storage e volum munity he vise if no storage anufaction anufa	P, N = 1 P, N = 1 P, N = 1 P + N = 1 P + N = 1 P + N = 1 P + N = 1 P + P + N = 1 P + P + N = 1 P + P + N = 1 P + P + N = 1 P +	ter usage hot water overson per Mar day for ear 94.23 used - calcate 136 including at point 20.4 including at point water eclared less torage eclared of factor fr	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ink in dw er (this in oss facto 2b , kWh/ye cylinder l com Tabl	es per da 5% if the d rater use, I May Vd,m = far 86.84 113.77 hot water 17.07 clar or W velling, e acludes i or is knowear	ay Vd,av Iwelling is not and co Jun Ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar wn (kWh	erage = designed id d) Jul Table 1c x 83.14 90.98 enter 0 in 13.65 storage 0 litres in neous con/day): known:	(25 x N) to achieve Aug (43) 86.84 DTm / 3600 104.4 boxes (46) 15.66 within sa (47) pmbi boil	+ 36 a water us Sep 90.53 105.64 105.64 15.85 ame vess ers) ente	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	9) 92 Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	2.38 Dec 101.62 c, 1d) 145.94 21.89 0		(, (, (, (, (, (, (, (, (, (, (, (, (, (
if TF, if TF, if TF, innual educe is to more the mergy of	A > 13.9 A £ 13.9 average the annual that 125 Jan 101.62 tontent of 150.69 aneous w 22.6 storage e volum munity he vise if no storage anufaction anufactio	P, N = 1 P, N = 1 P, N = 1 P + N = 1 P + N = 1 P + N = 1 P + N = 1 P + P + N = 1 P + P + N = 1 P + P + N = 1 P + P + N = 1 P +	ter usage hot water person per Mar day for ear 94.23 used - calculation and no talculation and and talculation and and and and and and and and and an	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ink in dw er (this in oss facto 2b , kWh/ye cylinder l com Tabl	es per da 5% if the d rater use, I May Vd,m = far 86.84 113.77 hot water 17.07 clar or W relling, e ncludes i or is knows	ay Vd,av Iwelling is not and co Jun Ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar wn (kWh	erage = designed id d) Jul Table 1c x 83.14 90.98 enter 0 in 13.65 storage 0 litres in neous con/day): known:	(25 x N) to achieve Aug (43) 86.84 DTm / 3600 104.4 boxes (46) 15.66 within sa (47) pmbi boil	+ 36 a water us Sep 90.53 105.64 105.64 15.85 ame vess ers) ente	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	9) 92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39 m(45) ₁₁₂ = 20.16	2.38 Dec 101.62 c, 1d) 145.94 21.89 0 0 0		

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0		(54)
Enter (50) or (54) in (55) Water storage loss calculated for each month	$((56)m = (55) \times (41)n$		0		(55)
	· · · · · · · · · · · · · · · · · · ·			1	(56)
(56)m =		0 0 m where (H11) i			(30)
(57)m =	- 1 - 1	0 0		Ī	(57)
	1 1		0		(58)
Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷	÷ 365 × (41)m		0		(00)
(modified by factor from Table H5 if there is solar water he	` '	r thermostat)			
(59)m= 0 0 0 0 0 0 0		0 0	1		(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × ((41)m				
(61)m= 50.96 45.07 48.02 44.65 44.25 41 42.3	<u> </u>	48.02 48.2	29 50.96		(61)
Total heat required for water heating calculated for each more	nth (62)m = 0.85 × ((45)m + (46)r	m + (57)m +	(59)m + (61)m	
(62)m= 201.65 176.87 184.02 163.22 158.02 139.18 133.3		171.13 182		1	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative qua	antity) (enter '0' if no sola	r contribution to	water heating)	l	
(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= 201.65 176.87 184.02 163.22 158.02 139.18 133.	.34 148.65 150.29	171.13 182	.68 196.9		
	Output from wa	ater heater (ann	ual) ₁₁₂	2005.95	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45	5)m + (61)m] + 0.8 >	([(46)m + (57	7)m + (59)m]	
(65)m= 62.85 55.09 57.23 50.59 48.89 42.89 40.8	84 45.77 46.29	52.94 56.	76 61.26		(65)
include (57)m in calculation of (65)m only if cylinder is in the	he dwelling or hot w	ater is from c	community b	·	
5. Internal gains (see Table 5 and 5a):			John Humby 11	eating	
o. Internal game (see Table o and oa).			Community in	eating	
			Johnnanity II	eating	
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju	ıl Aug Sep		ov Dec	eating	
Metabolic gains (Table 5), Watts			ov Dec		(66)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju	48 122.48 122.48	Oct N	ov Dec		(66)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48 122.48 122.48), also see Table 5	Oct N	ov Dec .48 122.48		(66) (67)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48 122.48 122.48), also see Table 5 5 9.42 12.64	Oct N 122.48 122 16.05 18.	ov Dec .48 122.48		
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48	Oct N 122.48 122 16.05 18.	ov Dec .48 122.48 74 19.97		
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48 122.48 122.48), also see Table 5 9.42 12.64 L13a), also see Ta 166.52	Oct N 122.48 122 16.05 18. ble 5 178.66 193	ov Dec .48 122.48 74 19.97		(67)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48	Oct N 122.48 122 16.05 18. ble 5 178.66 193	ov Dec .48 122.48 74 19.97 .98 208.37		(67)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	48	Oct N 122.48 122 16.05 18. ble 5 178.66 193 5	ov Dec .48 122.48 74 19.97 .98 208.37		(67) (68)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	.48 122.48	Oct N 122.48 122 16.05 18. ble 5 178.66 193 5	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25		(67) (68)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	48	Oct N 122.48 122 16.05 18. ble 5 178.66 193 5 35.25 35.	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25		(67) (68) (69)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48	Oct N 122.48 122 16.05 18. ble 5 178.66 193 5 35.25 35.	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3		(67) (68) (69)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	48	Oct No. 122.48 122 16.05 18. 125 178.66 193 5 35.25 35.3 3 3	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3		(67) (68) (69) (70)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	122.48 122	Oct No. 122.48 122 16.05 18. 125 178.66 193 5 35.25 35.3 3 3	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3 .99 -97.99		(67) (68) (69) (70)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	48	Oct No. 122.48 122 16.05 18. 125 16.05 193 5 178.66 193 5 35.25 35. 35. 35. 35. 35. 35. 35. 35. 35. 35	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3 .99 -97.99 83 82.35		(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	122.48 122	Oct No. 122.48 122 16.05 18. 125 16.05 193 5 178.66 193 5 35.25 35. 35. 35. 35. 35. 35. 35. 35. 35. 35	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3 .99 -97.99 83 82.35 (72)m		(67) (68) (69) (70) (71)

Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com

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	0.76	x	11.28	x	0.63	x	0.7	=	2.62	(75)
Northeast _{0.9x} 0.77	X	0.76	x	22.97	x	0.63	X	0.7	=	5.33	(75)
Northeast 0.9x 0.77	X	0.76	x	41.38	x	0.63	X	0.7	=	9.61	(75)
Northeast _{0.9x} 0.77	x	0.76	x	67.96	x	0.63	x	0.7] =	15.78	(75)
Northeast _{0.9x} 0.77	X	0.76	x	91.35	x	0.63	X	0.7	=	21.22	(75)
Northeast 0.9x 0.77	X	0.76	x	97.38	x	0.63	X	0.7	=	22.62	(75)
Northeast _{0.9x} 0.77	X	0.76	x	91.1	X	0.63	X	0.7	=	21.16	(75)
Northeast _{0.9x} 0.77	X	0.76	x	72.63	x	0.63	X	0.7	=	16.87	(75)
Northeast _{0.9x} 0.77	x	0.76	x	50.42	x	0.63	X	0.7] =	11.71	(75)
Northeast _{0.9x} 0.77	x	0.76	x	28.07	x	0.63	X	0.7	=	6.52	(75)
Northeast _{0.9x} 0.77	X	0.76	x	14.2	x	0.63	X	0.7	=	3.3	(75)
Northeast _{0.9x} 0.77	X	0.76	x	9.21	x	0.63	X	0.7	=	2.14	(75)
Southeast 0.9x 0.77	X	4.92	x	36.79	x	0.63	X	0.7	=	55.32	(77)
Southeast 0.9x 0.77	X	4.92	x	62.67	x	0.63	X	0.7	=	94.24	(77)
Southeast 0.9x 0.77	X	4.92	x	85.75	x	0.63	X	0.7	=	128.94	(77)
Southeast 0.9x 0.77	X	4.92	x	106.25	x	0.63	X	0.7	=	159.76	(77)
Southeast 0.9x 0.77	X	4.92	x	119.01	x	0.63	X	0.7	=	178.95	(77)
Southeast 0.9x 0.77	X	4.92	x	118.15	x	0.63	X	0.7	=	177.65	(77)
Southeast 0.9x 0.77	X	4.92	x	113.91	x	0.63	X	0.7	=	171.28	(77)
Southeast 0.9x 0.77	x	4.92	x	104.39	X	0.63	X	0.7	=	156.96	(77)
Southeast 0.9x 0.77	x	4.92	x	92.85	x	0.63	X	0.7	=	139.61	(77)
Southeast 0.9x 0.77	X	4.92	x	69.27	x	0.63	X	0.7	=	104.15	(77)
Southeast 0.9x 0.77	X	4.92	x	44.07	x	0.63	X	0.7	=	66.27	(77)
Southeast 0.9x 0.77	X	4.92	x	31.49	x	0.63	X	0.7	=	47.35	(77)
Southwest _{0.9x} 0.77	X	3.53	x	36.79		0.63	X	0.7	=	39.69	(79)
Southwest _{0.9x} 0.77	X	3.53	X	62.67]	0.63	X	0.7	=	67.61	(79)
Southwest _{0.9x} 0.77	X	3.53	x	85.75]	0.63	X	0.7	=	92.51	(79)
Southwest _{0.9x} 0.77	X	3.53	X	106.25		0.63	X	0.7	=	114.63	(79)
Southwest _{0.9x} 0.77	X	3.53	x	119.01]	0.63	X	0.7	=	128.39	(79)
Southwest _{0.9x} 0.77	X	3.53	X	118.15		0.63	X	0.7	=	127.46	(79)
Southwest _{0.9x} 0.77	X	3.53	X	113.91		0.63	X	0.7	=	122.89	(79)
Southwest _{0.9x} 0.77	X	3.53	x	104.39		0.63	X	0.7	=	112.62	(79)
Southwest _{0.9x} 0.77	X	3.53	X	92.85		0.63	X	0.7	=	100.17	(79)
Southwest _{0.9x} 0.77	X	3.53	X	69.27		0.63	X	0.7	=	74.73	(79)
Southwest _{0.9x} 0.77	X	3.53	x	44.07]	0.63	X	0.7	=	47.54	(79)
Southwest _{0.9x} 0.77	X	3.53	x	31.49]	0.63	X	0.7	=	33.97	(79)
Northwest 0.9x 0.77	X	1.16	x	11.28	x	0.63	X	0.7	=	8	(81)
Northwest 0.9x 0.77	X	3.7	x	11.28	x	0.63	X	0.7	=	12.76	(81)
Northwest 0.9x 0.77	X	1.16	×	22.97	x	0.63	×	0.7	=	16.28	(81)

Northwest 0.9x 0.77	 ,		0.7		00.07	1	0.00	¬ " г		— _ i	05.07	7(04)
N # 1	,	누	3.7	X	22.97	X	0.63	_	0.7	=	25.97	(81)
N " '	,	늗	1.16	X	41.38	X	0.63	_	0.7	╡ -	29.34	(81)
Northwest 0.9x 0.77	,	늗	3.7	X	41.38	X	0.63	_	0.7	=	46.79	(81)
Northwest 0.9x 0.77	,	늗	1.16	X	67.96	X	0.63	_ X L	0.7	=	48.18	(81)
Northwest 0.9x 0.77	,	Ļ	3.7	X	67.96	X	0.63	_ ×	0.7	_ =	76.84	(81)
Northwest 0.9x 0.77	,	Ļ	1.16	X	91.35	X	0.63	_ X	0.7	_ =	64.77	(81)
Northwest 0.9x 0.77	,	Ļ	3.7	X	91.35	X	0.63	_	0.7	_ =	103.29	(81)
Northwest 0.9x 0.77)	Ļ	1.16	X	97.38	X	0.63	_ x [0.7	_ =	69.05	(81)
Northwest 0.9x 0.77	,	Ļ	3.7	X	97.38	X	0.63	_ x [0.7	=	110.12	(81)
Northwest 0.9x 0.77	,	Ļ	1.16	X	91.1	X	0.63	_ x [0.7	=	64.59	(81)
Northwest 0.9x 0.77)	Ĺ	3.7	X	91.1	X	0.63	x	0.7	=	103.01	(81)
Northwest 0.9x 0.77	· ·	L	1.16	X	72.63	X	0.63	x	0.7	=	51.49	(81)
Northwest 0.9x 0.77)	: <u>L</u>	3.7	X	72.63	X	0.63	X	0.7	=	82.12	(81)
Northwest 0.9x 0.77)		1.16	X	50.42	X	0.63	x	0.7	=	35.75	(81)
Northwest 0.9x 0.77)		3.7	X	50.42	X	0.63	x	0.7	=	57.01	(81)
Northwest 0.9x 0.77)		1.16	x	28.07	X	0.63	x	0.7	=	19.9	(81)
Northwest 0.9x 0.77)		3.7	X	28.07	X	0.63	x	0.7	=	31.74	(81)
Northwest 0.9x 0.77)		1.16	X	14.2	X	0.63	x	0.7	=	10.07	(81)
Northwest 0.9x 0.77)		3.7	x	14.2	x	0.63	_ x [0.7	=	16.05	(81)
Northwest 0.9x 0.77)		1.16	X	9.21	x	0.63	x [0.7	=	6.53	(81)
Northwest 0.9x 0.77)		3.7	X	9.21	x	0.63	x	0.7	=	10.42	(81)
Rooflights _{0.9x} 1)	Ē	2.6	x	18.07	x	0.63	x	0.7	=	18.63	(82)
Rooflights 0.9x 1	<u> </u>	Ē	2.6	x	37.96	x	0.63	x	0.7	<u> </u>	39.13	(82)
Rooflights 0.9x 1)	Ē	2.6	x	71.02	x	0.63	x	0.7	=	73.21	(82)
Rooflights 0.9x 1	<u> </u>	Ē	2.6	X	119.98	х	0.63	_ x [0.7	=	123.68	(82)
Rooflights 0.9x 1	<u> </u>	Ē	2.6	x	163.58	x	0.63	x	0.7	-	168.63	(82)
Rooflights 0.9x 1)	Ē	2.6	x	175.24	x	0.63	x	0.7	=	180.65	(82)
Rooflights 0.9x 1)	Ē	2.6	x	163.61	x	0.63	- x	0.7	=	168.65	(82)
Rooflights 0.9x 1)	Ē	2.6	x	129.11	x	0.63	×	0.7	=	133.1	(82)
Rooflights 0.9x 1	,	Ē	2.6	x	87.66	x	0.63		0.7	<u> </u>	90.37	(82)
Rooflights 0.9x 1	,	Ē	2.6	X	47.1	X	0.63	i x	0.7	=	48.55	(82)
Rooflights 0.9x 1	,	Ē	2.6	x	22.95	X	0.63	x	0.7	=	23.66	(82)
Rooflights 0.9x 1	,	Ė	2.6	x	14.62) x	0.63	 x	0.7	= =	15.07	(82)
		L				J						` ′
Solar gains in watts, ca	alculate	d fo	or each mont	h		(83)m	ı = Sum(74)m	.(82)m				
(83)m= 137.02 248.57	380.4	$\overline{}$	538.88 665.24		87.55 651.58	553		285.59	166.89	115.48		(83)
Total gains – internal a	and sola	r (8	84)m = (73)m	ı + (83)m , watts		•		-			
(84)m= 521.67 630.81	748.65	8	384.93 988.74	1 9	89.28 939.55	847	.68 740.83	614.2	521.17	488.92		(84)
7. Mean internal temp	oera <u>ture</u>	(h	eating seaso	n) _								
Temperature during h		_			area from Tal	ole 9	Th1 (°C)				21	(85)
Utilisation factor for g	_			•		•	` '				<u> </u>	
Jan Feb	Mar		Apr May	Ť	Jun Jul	Α	ug Sep	Oct	Nov	Dec		
	•	•	•	•	•	•					•	

(86)m=	1	0.99	0.98	0.93	0.82	0.64	0.49	0.56	0.82	0.97	0.99	1		(86)
Mean	internal	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)				'	
(87)m=	19.51	19.71	20.03	20.45	20.78	20.95	20.99	20.98	20.84	20.4	19.87	19.47		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, Ti	–––– h2 (°C)				1	
(88)m=	19.78	19.78	19.78	19.79	19.79	19.8	19.8	19.8	19.8	19.79	19.79	19.78		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling, l	h2,m (se	e Table	9a)	•				1	
(89)m=	1	0.99	0.97	0.91	0.76	0.54	0.36	0.42	0.73	0.95	0.99	1		(89)
Mean	internal	l temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	ps 3 to 7	7 in Tabl	e 9c)			I	
(90)m=	17.81	18.1	18.57	19.17	19.59	19.77	19.8	19.8	19.68	19.11	18.36	17.77		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.35	(91)
Mean	internal	l temper	ature (fo	r the wh	ole dwel	lina) = fl	LA × T1	+ (1 – fL	A) × T2					_
(92)m=		18.66	19.08	19.61	20	20.18	20.21	20.2	20.08	19.55	18.88	18.36		(92)
Apply	adjustn	nent to t	he mear	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	18.4	18.66	19.08	19.61	20	20.18	20.21	20.2	20.08	19.55	18.88	18.36		(93)
8. Sp	ace hea	ting requ	uirement											
				mperatur		ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	ulate	
ine ui	Jan	Feb	Mar	using Ta Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
Utilisa			ains, hm	<u> </u>	iviay	Juli	Jui	Aug	Оер	Oct	INOV	Dec		
(94)m=		0.99	0.97	0.91	0.77	0.58	0.41	0.47	0.75	0.95	0.99	1	İ	(94)
		hmGm .	, W = (94	1 4)m x (8₄	1)m									
(95)m=	518.59	622.45	723.6	801.5	764.19	569.78	381.81	398.22	557.97	580.92	515.08	486.71		(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)
				al tempe			<u> </u>	- · · ·	<u> </u>	ī —			Ī	
	1548.17			1158.99	896.56	596.71	386.27	406.49	642.49	967.04		1541.31		(97)
•			i	r each m		Wh/mont	h = 0.02	24 x [(97])m – (95 l)m] x (4 287.27	ŕ	704.62	1	
(98)m=	766.01	594.7	484.72	257.39	98.49	U	U				548.72	784.63	2024.02	(98)
					,			Tota	ıl per year	(KWII/yeai) – Sum(9	0)15,912 -	3821.93	╣
·		• •		kWh/m²									48.19	(99)
			nts – Indi	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
•	e heatir	•	ot from c	econdar	/supple	montory	cyctom							(201)
	•			•	• • •	mentary	•	(202) = 1 -	(201) -				0	≓ ```
	•			nain syst	` ,					(202)] -			1	(202)
			_	main sys				(204) = (2	02) × [1 –	(203)] =			1	(204)
	•	•		ing syste									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/ye	ar
Space		<u> </u>	· `	alculate			_	_	_				Ī	
	766.01	594.7	484.72	257.39	98.49	0	0	0	0	287.27	548.72	784.63		
(211)m				00 ÷ (20		_	_	_	_			0.5	I	(211)
	820.13	636.72	518.98	275.58	105.45	0	0	0 Tota	0	307.57	587.5	840.07		7,64
								rota	ıl (kWh/yea	ai) –Sum(2	- 1 1) _{15,1012}	Γ	4092	(211)

Space heating fuel (secondary), kWh/month							
= {[(98)m x (201)] } x 100 ÷ (208)	. .	<u> </u>	<u> </u>	T .	Ι.	1	
(215)m= 0 0 0 0 0	0 0	0 0	0 (voor) = Sum(0	0	_	7(045)
Makes beaution		rotai (KWII	/year) =Sum(Z13) _{15,1012}	2	0	(215)
Water heating Output from water heater (calculated above)							
	139.18 133.34	148.65 150.	29 171.13	182.68	196.9		
Efficiency of water heater	•			•	•	80.3	(216)
(217)m= 88.09 87.87 87.38 86.19 83.9	80.3 80.3	80.3 80.	86.35	87.65	88.18		(217)
Fuel for water heating, kWh/month $(219)m = (64)m \times 100 \div (217)m$				_			
(219)m= 228.92 201.29 210.61 189.36 188.35	173.32 166.06	185.11 187.		208.43	223.3		_
		Total = Su	m(219a) ₁₁₂ =			2360.11	(219)
Annual totals Space heating fuel used, main system 1			k	Wh/yeai	٢	kWh/year	7
						4092	_
Water heating fuel used						2360.11	
Electricity for pumps, fans and electric keep-hot						-	
central heating pump:					30		(230c)
boiler with a fan-assisted flue					45		(230e)
Total electricity for the above, kWh/year		sum of (23	0a)(230g) =	=		75	(231)
Electricity for lighting						343.21	(232)
Total delivered energy for all uses (211)(221) +	+ (231) + (232)	(237b) =				6870.33	(338)
12a. CO2 emissions – Individual heating system	ns including mi	icro-CHP					
	Energy kWh/year			ion fac 2/kWh	tor	Emissions kg CO2/yea	ar
Space heating (main system 1)	(211) x		0.2	16	=	883.87	(261)
Space heating (secondary)	(215) x		0.5	19	=	0	(263)
Water heating	(219) x		0.2	16	=	509.78	(264)
Space and water heating	(261) + (262)	+ (263) + (264) =				1393.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.5	19	=	38.93	(267)
Electricity for lighting	(232) x		0.5	19	=	178.13	(268)
Total CO2, kg/year		su	m of (265)(271) =		1610.71	(272)
							٦

TER =

(273)

20.31

		l Isar-E	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	<u> </u>	Strom Softwa	_				0016363 on: 1.0.5.51	
Software Name.	-	Property	Address				VEISIC	л. т.о.э.эт	
Address :									
1. Overall dwelling dime	ensions:								
O			a(m²)			ight(m)	٦,, ,	Volume(m ³	<u>^</u>
Ground floor				(1a) x	2	2.7	(2a) =	136.19	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	50.44	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	136.19	(5)
2. Ventilation rate:	main accorde		other		40401			ma3 man hav	
	main seconda heating heating	<u> </u>	otner		total			m³ per hou	ır —
Number of chimneys	0 + 0	╛╵┖	0	_ = <u>L</u>	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	X :	20 =	0	(6b)
Number of intermittent fa	ns				2	X	10 =	20	(7a)
Number of passive vents					0	X	10 =	0	(7b)
Number of flueless gas fi	ires			Ī	0	X 4	40 =	0	(7c)
				_					_
	 (0.) (0.)	_	<i>(</i> -)	_				nanges per ho	_
•	ys, flues and fans = (6a)+(6b)+(een carried out or is intended, proced			continue fr	20		÷ (5) =	0.15	(8)
Number of storeys in the		50 to (11),	ourerwise (onunae n	om (9) to ((10)		0	(9)
Additional infiltration	• · · ·					[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o			•	ruction			0	(11)
if both types of wall are pri deducting areas of openir	resent, use the value corresponding t nas): if equal user 0.35	o the grea	ter wall are	a (after					
• ,	floor, enter 0.2 (unsealed) or ().1 (seale	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	, ,	-			0	(15)
Infiltration rate	50		(8) + (10)					0	(16)
·	q50, expressed in cubic metrity value, then $(18) = [(17) \div 20] +$	•	•	•	etre of e	envelope	area	5	$= \begin{pmatrix} (17) \\ (18) \end{pmatrix}$
•	es if a pressurisation test has been do				is being u	sed		0.4	(18)
Number of sides sheltere								2	(19)
Shelter factor			(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•		(21) = (18) x (20) =				0.34	(21)
Infiltration rate modified for	 		 			1	-	1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		Τ , ,	1 27		T 42	1 45	1.7	1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	I	
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		

Adjusted infiltra	tion rate (allov	vina for sl	helter ar	nd wind s	speed) =	(21a) x	(22a)m					
0.43	0.42 0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4]	
Calculate effect	_	rate for t	he appli	cable ca	se	<u>!</u>	<u>!</u>	!	<u> </u>	!	J	
If mechanical											0	(23a)
If exhaust air hea		,	, ,	,	. ,	• •	•) = (23a)			0	(23b)
If balanced with I		-	_								0	(23c)
a) If balanced			1		- ` `	- 	ŕ	- ` `	- 	- `) ÷ 100] 1	(0.4-)
(24a)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24a)
b) If balanced		1	1	1	- 	- ^ `	ŕ	 	- 		1	(0.41-)
(24b)m= 0	0 0	0	0	0	0	0	0	0	0	0	J	(24b)
c) If whole ho if (22b)m	< 0.5 × (23b),		-	•				.5 × (23b))			
(24c)m= 0	0 0	0	0	0	0	0	0	0	0	0]	(24c)
d) If natural voit if (22b)m	entilation or w = 1, then (24d			•				0.5]		•	•	
(24d)m= 0.59	0.59 0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58]	(24d)
Effective air c	hange rate - e	enter (24a	a) or (24l	b) or (24	c) or (24	d) in bo	x (25)				ı	
(25)m= 0.59	0.59 0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58]	(25)
2 Heatleses	and backlass		- W.									
3. Heat losses ELEMENT	Gross	Openir		Net Ar		U-val		AXU		k-value		A X k
_	area (m²)	n	1 ²	A ,r	m²	W/m2	2K	(W/I	K)	kJ/m²·	K	kJ/K
Doors				1.99	X	1	=	1.99	_			(26)
Windows Type	1			1.37	x1	/[1/(1.4)+	0.04] =	1.82				(27)
Windows Type	2			4.65	х1	/[1/(1.4)+	0.04] =	6.16				(27)
Windows Type	3			1.54	х1	/[1/(1.4)+	0.04] =	2.04				(27)
Walls Type1	55.8	8.93	3	46.87	7 X	0.18	=	8.44				(29)
Walls Type2	22.49	1.99	9	20.5	X	0.18	=	3.69				(29)
Total area of ele	ements, m²			78.29	9							(31)
Party wall				9.64	X	0	=	0	\neg			(32)
Party floor				50.44	1						= =	(32a)
Party ceiling				50.44	<u>=</u>				Ĭ		7 F	(32b)
* for windows and re					ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	ıs given in	paragraph	1 3.2	
Fabric heat loss			•			(26)(30)) + (32) =				25.96	(33)
Heat capacity C	m = S(A x k)						((28).	(30) + (32	2) + (32a).	(32e) =	18066.3	3 (34)
Thermal mass p	oarameter (TM	1P = Cm -	÷ TFA) iı	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assessn can be used instead			construct	tion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridges	s : S (L x Y) ca	alculated	using Aր	pendix l	K						5.69	(36)
if details of thermal Total fabric hea		known (36) :	= 0.05 x (3	31)			(33) +	(36) =			31.65	(37)
Ventilation heat		ed monthl	V					= 0.33 × (25)m x (5))	<u> </u>	(01)
Jan	Feb Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	

	1						I					T		(22)
` ′ _	26.63	26.47	26.31	25.56	25.43	24.78	24.78	24.66	25.03	25.43	25.71	26		(38)
Heat tra								T -0.0	· · · ·	= (37) + (
(39)m=	58.27	58.11	57.95	57.21	57.07	56.42	56.42	56.3	56.67	57.07	57.35	57.65		(39)
Heat los	ss para	meter (H	HLP), W	m²K						= (39)m ÷	Sum(39) ₁ .	12 /12=	57.21	(39)
(40)m=	1.16	1.15	1.15	1.13	1.13	1.12	1.12	1.12	1.12	1.13	1.14	1.14		_
Number	of day	s in mor	nth (Tab	le 1a)					/	Average =	Sum(40) _{1.}	12 /12=	1.13	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
_								•			!			
4. Wate	er heat	ing ener	rgy requi	rement:								kWh/ye	ar:	
Assume	nd occu	nanov I	NI.											(40)
if TFA), N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		.7		(42)
Annual		•	ater usad	ge in litre	s per da	ıy Vd,av	erage =	(25 x N)	+ 36		74	.65		(43)
Reduce th	ne annua	l average	hot water	usage by	5% if the d	welling is	designed t	to achieve		se target o				()
not more t				aay (all w	ater use, r	not and co	<u> </u>				1			
Hot water	Jan	Feb	Mar day for or	Apr	May	Jun	Jul Table 10 Y	Aug	Sep	Oct	Nov	Dec		
Г							ı	<u>, ,</u>						
(44)m=	82.11	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11		7(44)
Energy co	ontent of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	895.77	(44)
(45)m=	121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		
If instanta	neous w	ater heatii	na at noint	of use (no	hot water	storage)	enter () in	hoves (46		Γotal = Su	m(45) ₁₁₂ =		1174.5	(45)
_	18.27	15.98	16.48	14.37						14.00	16.00	17.60		(46)
(46)m= Water st			10.46	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(40)
Storage	volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comm	unity h	eating a	nd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
			hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water st	U		ا امسمام	ft-	an ia lena		- /-l , -\ .					_		(40)
•			eclared l		DI IS KITO	WII (KVVI	i/uay).					0		(48)
Tempera					or			(40) × (40)				0		(49)
Energy I b) If ma			storage eclared o	-		or is not		(48) x (49)) –			0		(50)
Hot wate				•								0		(51)
If comm	-	•		on 4.3										
Volume				OI-							-	0		(52)
Tempera												0		(53)
Energy I Enter (5			_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Water st	, ,	, ,	•	or each	month			((56)m = (55) × (11)	m		0		(55)
_							ı				Ι ,			(56)
(56)m=	0 contains	0 dedicate	0 d solar sto	0 rage. (57)	0 n = (56)m	0 x [(50) – (0 H11)1 ÷ (5	0 0), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 om Appendix	x H	(56)
			ı								· ·		- · ·	(57)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) fro	om Table 3				0	((58)
Primary circuit loss calculated)m = (58) ÷ 36	5 × (41)m			ı	
(modified by factor from Tab	le H5 if there is sola	ar water heatin	ng and a cylind	der thermostat	:)	_	
(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= 41.84 36.42 38.8		3.13 34.24	35.76 36.08	38.8 39	9.02 41.84	((61)
Total heat required for water he	eating calculated for	r each month	(62)m = 0.85	× (45)m + (46)m + (57)m +	(59)m + (61)m	
(62)m= 163.61 142.92 148.7		12.46 107.75	120.12 121.4	- 	7.62 159.77	1 ` ′ ` ′	(62)
Solar DHW input calculated using App				olar contribution to	water heating)		
(add additional lines if FGHRS					- ··-···g/		
(63)m= 0 0 0	0 0	0 0	0 0	0	0 0	1	(63)
Output from water heater		! <u>l</u>	<u> </u>	_	<u> </u>	ļ	
(64)m= 163.61 142.92 148.7	131.89 127.69 11	12.46 107.75	120.12 121.4	4 138.29 14	7.62 159.77		
(0.7)				water heater (an		1622.26	(64)
Heat gains from water heating,	kWh/month 0.25 1	[0.85 x (45)m					` '
(65)m= 50.95 44.52 46.24		4.66 33	36.99 37.4		5.86 49.67	1	(65)
` '	! ! !	!!			ļ		(00)
include (57)m in calculation	. ,	ider is in the d	iweiling or not	water is from	community n	eaung	
5. Internal gains (see Table 5	•						
Metabolic gains (Table 5), Wat				1		I	
Jan Feb Mar	 	Jun Jul	Aug Se	·	Nov Dec		(00)
(66)m= 85.15 85.15 85.15	85.15 85.15 85	5.15 85.15	85.15 85.15	5 85.15 85	5.15 85.15	((66)
Lighting gains (calculated in Ap	 	L9 or L9a), al	so see Table	5	•	1	
(67)m= 13.55 12.03 9.79	7.41 5.54 4	4.68 5.05	6.57 8.81	11.19 13	3.06 13.92	((67)
Appliances gains (calculated in	ո Appendix L, equati	ion L13 or L13	3a), also see	Table 5			
(68)m= 148.38 149.92 146.04	137.78 127.35 11	17.55 111	109.46 113.3	4 121.6 13	2.03 141.83	((68)
Cooking gains (calculated in A	ppendix L, equation	L15 or L15a)	, also see Tal	ole 5			
(69)m= 31.52 31.52 31.52	31.52 31.52 3°	1.52 31.52	31.52 31.52	2 31.52 3°	1.52 31.52	((69)
Pumps and fans gains (Table 5	 ōa)					1	
(70)m= 3 3 3	3 3	3 3	3 3	3	3 3	((70)
Losses e.g. evaporation (nega	tive values) (Table 5	 5)	•		•	I	
(71)m= -68.12 -68.12 -68.12	 	68.12 -68.12	-68.12 -68.1	2 -68.12 -6	8.12 -68.12		(71)
Water heating gains (Table 5)	<u> </u>		I	<u> </u>		ı	
(72)m= 68.48 66.24 62.15	56.77 53.1 48	8.14 44.36	49.72 51.95	5 57.5 6	3.7 66.76	1	(72)
Total internal gains =		(66)m + (67)m		+ (70)m + (71)m		l	
(73)m= 281.95 279.74 269.52	253.5 237.54 22	21.91 211.96	217.29 225.6	 	0.34 274.06	1 ((73)
6. Solar gains:	200.0 201.01 22	211.00	211.20 220.0	211.01 20	0.01 271.00		
Solar gains are calculated using sola	r flux from Table 6a and	associated equat	tions to convert to	the applicable o	rientation.		
Orientation: Access Factor	Area	Flux	g_		F	Gains	
Table 6d	m²	Table 6a	Table 6			(W)	
Northeast _{0.9x} 0.77 x	4.65 ×	11.28	x 0.63	x	0.7	16.03	(75)
Northeast 0.9x 0.77 x		11.28	x 0.63	^	0.7 =		(75)
0.11 A	1.04	11.20	0.03	^	V.1	5.51	(. 5)

Jan		Mar	Apr Ma	Ť	Jun	Jul	A	ug Sep	Oct	Nov	Dec		
Utilisation fac	•	•		_			, כי פיונ	(0)					(00)
7. Mean inter Temperature					area f	rom Tah	ole 0	Th1 (°C)				21	(85)
					.00.01	71 3.00	2	330.79	332.9	7 024.1	317.00	<u></u>	(04)
(84)m= 334.1		9.61	$\frac{(84)\text{m} = (73)\text{r}}{471.03} = 510$	`	63)III ,	479.68	442	.1 398.79	352.9	4 324.1	317.86]	(84)
(83)m= 52.15 Total gains – ii		60.09 solar	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		83.16	267.73	224	81 173.14	111.1	63.76	43.8]	(83)
Solar gains in		$\overline{}$		$\overline{}$	02 42 1			= Sum(74)m .			40.0	1	(02)
_		_		-			•						
Southwest _{0.9x}	0.77	X	1.37	x	3	1.49	j	0.63	x	0.7	=	26.37	(79)
Southwest _{0.9x}	0.77	X	1.37	x	4	4.07	j	0.63	x	0.7	=	36.9	(79)
Southwest _{0.9x}	0.77	x	1.37	×	6	9.27	j	0.63	×	0.7	= =	58	(79)
Southwest _{0.9x}	0.77	X	1.37	×		2.85	j	0.63	×	0.7	= =	77.75	(79)
Southwest _{0.9x}	0.77	X	1.37	X		4.39		0.63	×	0.7	╡ =	87.41	(79)
Southwest _{0.9x}	0.77		1.37] x	_	3.91	! 	0.63	x	0.7	= =	95.39	(79)
Southwest _{0.9x}	0.77	^ x	1.37	」 ^] x		8.15	! 	0.63	$\exists \hat{x}$	0.7	╡ -	98.94	(79)
Southwest _{0.9x}	0.77	」 ^ □ x	1.37] ^] x		9.01	 	0.63	^ x	0.7	╡ -	99.66	(79)
Southwest _{0.9x}	0.77	┤ ^ ┤ x	1.37] ^] x		06.25	 	0.63	- x	0.7	╡ -	88.97	(79)
Southwest _{0.9x}	0.77	_	1.37]		2.67 5.75]]	0.63	-	0.7	╡ -	52.48 71.81	(79)
Southwest _{0.9x}	0.77	」 × □ ×	1.37] X] x		6.79]]	0.63	X X	0.7		30.81	(79)
Southwest _{0.9x}	0.77	」 ×	1.54] X] _v		20	X	0.63	X √	0.7	┥ -	4.34	(79)
Northeast 0.9x	0.77	」 ×	4.65] X] _v	_	21	X l v	0.63	X x	0.7	┥ -	13.09	(75)
Northeast 0.9x	0.77	」 ×	1.54] X] _v		4.2	X	0.63	X √	0.7	=	6.68	(75)
Northeast 0.9x	0.77	」 ×	4.65] X] _v	-	4.2	X	0.63	X √	0.7	_	20.18	(75)
Northeast 0.9x	0.77	」 × ¬ 、	1.54	」× T ↓		8.07	X	0.63	→ ×	0.7	=	13.21	(75)
Northeast 0.9x	0.77	」 × ¬ 、	4.65	」× T		8.07	l x	0.63	→ × → ×	0.7	=	39.89	(75)
Northeast _{0.9x}	0.77	」 × □ ∵	1.54] X]		0.42	X	0.63	_ X	0.7	 	23.73	(75)
Northeast 0.9x	0.77	X	4.65] X]		0.42	X	0.63	X	0.7	_ = _	71.65	(75)
Northeast 0.9x	0.77	X	1.54	X		2.63	X	0.63	X	0.7	_ =	34.18	(75)
Northeast 0.9x	0.77	X	4.65	X	_	2.63	X	0.63	X	0.7	_ =	103.21	(75)
Northeast 0.9x	0.77	X	1.54	X	g	1.1	X	0.63	×	0.7	_ =	42.88	(75)
Northeast _{0.9x}	0.77	X	4.65	×	9	1.1	X	0.63	X	0.7	=	129.46	(75)
Northeast 0.9x	0.77	X	1.54	x	9	7.38	X	0.63	×	0.7	=	45.83	(75)
Northeast 0.9x	0.77	X	4.65	X	9	7.38	X	0.63	X	0.7	=	138.39	(75)
Northeast 0.9x	0.77	X	1.54	X	9	1.35	X	0.63	X	0.7	=	42.99	(75)
Northeast 0.9x	0.77	X	4.65	x	9	1.35	x	0.63	X	0.7	=	129.81	(75)
Northeast 0.9x	0.77	X	1.54	x	6	7.96	x	0.63	X	0.7	=	31.98	(75)
Northeast 0.9x	0.77	X	4.65	x	6	7.96	x	0.63	X	0.7	=	96.57	(75)
Northeast 0.9x	0.77	x	1.54	x	4	1.38	X	0.63	x	0.7	=	19.47	(75)
Northeast 0.9x	0.77	x	4.65	×	4	1.38	x	0.63	x	0.7	=	58.8	(75)
Northeast 0.9x	0.77	×	1.54	x	2:	2.97	x	0.63	×	0.7	=	10.81	(75)
Northeast _{0.9x}	0.77	X	4.65	X	2	2.97	X	0.63	X	0.7	=	32.64	(75)

(86)m=	1	0.99	0.98	0.95	0.85	0.67	0.51	0.57	0.83	0.97	0.99	1		(86)
Mean i	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Table	e 9c)				•	
(87)m=	19.81	19.95	20.2	20.54	20.82	20.96	20.99	20.99	20.89	20.53	20.11	19.79		(87)
Tempe	erature	durina h	eating p	eriods ir	rest of	dwellina	from Ta	ble 9, Tl	h2 (°C)		•		ı	
(88)m=	19.96	19.96	19.96	19.97	19.98	19.99	19.99	19.99	19.98	19.98	19.97	19.97		(88)
Litilisat	tion fac	tor for a	ains for i	est of d	welling l	h2 m (se	e Table	9a)					l	
(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.4	0.45	0.75	0.96	0.99	1		(89)
Mean i	internal	temper	ature in	the rest	of dwelli	na T2 (fa	ollow ste	eps 3 to 7	7 in Tabl	e 9c)			l	
(90)m=	18.38	18.59	18.95	19.44	19.8	19.96	19.98	19.98	19.89	19.43	18.83	18.35		(90)
_	!								<u> </u>	L fLA = Livin	g area ÷ (4	4) =	0.54	(91)
Meani	internal	temner	ature (fo	r the wh	ole dwel	lling) = fl	Δ × T1	+ (1 – fL	Δ) x T2					_
(92)m=	19.16	19.33	19.63	20.04	20.36	20.5	20.53	20.53	20.43	20.03	19.53	19.13		(92)
Apply	adjustn	nent to the	ne mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	19.16	19.33	19.63	20.04	20.36	20.5	20.53	20.53	20.43	20.03	19.53	19.13		(93)
8. Spa	ice heat	ting requ	uirement											
				•		ed at ste	ep 11 of	Table 9b	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the util	1			using Ta		lun	led	Διια	Con	Oct	Nov	Doo		
_ L Itilieat	Jan tion fac	Feb tor for a	Mar ains, hm	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.99	0.98	0.93	0.82	0.63	0.46	0.52	0.79	0.96	0.99	1		(94)
				1)m x (84										, ,
_	332.35	371.95	409.92	439.6	419.34	318.66	219.57	228.35	314.87	337.59	320.82	316.55		(95)
Month	ly avera	age exte	rnal tem	perature	from Ta	able 8							l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat lo	oss rate	for mea		al tempe	erature, l	Lm , W =	=[(39)m :	x [(93)m-	– (96)m]	ı	ı		
` ′ L	865.71	838.62	761.17	637.35	494.01	333.15	221.86	232.46	358.9	538.22	712.81	860.7		(97)
· -	i	<u> </u>						24 x [(97)	``	′ 	ı ´		1	
(98)m=	396.82	313.6	261.33	142.38	55.55	0	0	0	0	149.26	282.23	404.85		7,000
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2006.02	(98)
Space	heating	g require	ement in	kWh/m²	/year								39.77	(99)
9a. Ene	ergy req	uiremer	ıts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	heatin	•	4.6									ĺ		7,004
				econdar	• •	mentary	•	(000)	(224)				0	(201)
				ain syst	()			(202) = 1 -					1	(202)
			•	main sys				(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ncy of r	nain spa	ce heat	ing syste	m 1								93.4	(206)
Efficie	ncy of s	econda	ry/supple	ementar	y heating	g system	ո, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space				alculate	d above))		i		ī			ı	
	396.82	313.6	261.33	142.38	55.55	0	0	0	0	149.26	282.23	404.85		
(211)m				00 ÷ (20									l	(211)
	424.86	335.76	279.79	152.44	59.48	0	0	0	0	159.81	302.17	433.46		_
								Гota	ı (KWh/yea	ar) =Sum(2	211) _{15,1012}	2=	2147.77	(211)

$= \{ [(98)m \times (201)] \} \times 100 \div (208)$ $(215)m = $	0	0	0	0	0	0	0	1	
(213)111- 0 0 0 0		U		_	ar) =Sum(2	_	_		7(045)
			TOLA	ii (KVVII/yea	ar) –Surri(2	213) _{15,1012}	2	0	(215)
Water heating Output from water heater (calculated above)									
	112.46	107.75	120.12	121.44	138.29	147.62	159.77		
Efficiency of water heater								80.3	(216)
(217)m= 87.2 86.98 86.46 85.24 83.12	80.3	80.3	80.3	80.3	85.24	86.66	87.29		(217)
Fuel for water heating, kWh/month	-		-	-	-	-	-		
(219) m = (64) m x $100 \div (217)$ m (219)m = 187.63 164.32 171.99 154.72 153.63	140.06	134.18	149.58	151.24	162.22	170.35	183.03		
(2.10)	110.00	101.10	<u> </u>	I = Sum(2	<u> </u>	170.00	100.00	1922.96	(219)
Annual totals					k'	Wh/yeaı	r	kWh/year	」 ` `
Space heating fuel used, main system 1								2147.77	
Water heating fuel used								1922.96	7
Electricity for pumps, fans and electric keep-hot							!		_
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								239.24	(232)
Total delivered energy for all uses (211)(221)	+ (231)	+ (232).	(237b)	=				4384.98	(338)
12a. CO2 emissions – Individual heating syster	ms inclu	ıding mi	cro-CHF)					_
	En	ergy			Emiss	ion fac	tor	Emissions	;
	kW	/h/year			kg CO	2/kWh		kg CO2/yea	ar
Space heating (main system 1)	(211	I) x			0.2	16	=	463.92	(261)
Space heating (secondary)	(215	5) x			0.5	19	=	0	(263)
Water heating	(219	9) x			0.2	16	=	415.36	(264)
Space and water heating	(261	1) + (262)	+ (263) + ((264) =				879.28	(265)
Electricity for pumps, fans and electric keep-hot	(231	l) x			0.5	19	=	38.93	(267)
Electricity for lighting	(232	2) x			0.5	19	=	124.17	(268)
Total CO2, kg/year				sum o	of (265)(2	271) =		1042.37	(272)

			User D	etaile:						
A a a a a a a a a a a a a a a a a a a a	Chair Haalmall		USEI L		- M	la a		CTDO	046060	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 20	12		Stroma Softwa	-				016363 on: 1.0.5.51	
Continuito Italiio:			operty i	Address:				7 01010	7111 11010101	
Address :			·							
1. Overall dwelling dime	ensions:									
Ground floor				a(m²)	(1a) x		ight(m)	(2a) =	Volume(m³	(3a)
	-) . (4 h) . (4 -) . (4 d) . (4	-) . (4)					2.7	(2a) –	191.81	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(16	∌)+(III _,)7	1.04	(4)) - (O) - (O	1) - (0) -	(0.)		_
Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	(3n) =	191.81	(5)
2. Ventilation rate:	main s	econdary	,	other		total			m³ per hou	r
Number of chimenous	heating	neating	, J + ∟] = [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					L	0		10 =	0	(7b)
Number of flueless gas f	ires					0	X	40 =	0	(7c)
								Air ch	nanges per ho	our
Infiltration due to chimne	evs. flues and fans = (6	Sa)+(6b)+(7a	a)+(7b)+(7c) =	Г	30		÷ (5) =	0.16	(8)
If a pressurisation test has l					ontinue fr			(0)	0.10	
Number of storeys in t	he dwelling (ns)								0	(9)
Additional infiltration		_					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	0.25 for steel or timber present, use the value corres				•	uction			0	(11)
deducting areas of openi		sponding to	ine great	er wan are	a (anter					
If suspended wooden	floor, enter 0.2 (unsea	led) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, er									0	(13)
Percentage of window	s and doors draught s	tripped							0	(14)
Window infiltration				0.25 - [0.2			. (45) -		0	(15)
Infiltration rate		-: 4		(8) + (10)					0	(16)
Air permeability value, If based on air permeabi	•		•	-	•	etre of e	envelope	area	5	(17)
Air permeability value applie	-					is beina u	sed		0.41	(18)
Number of sides sheltered				, ,					2	(19)
Shelter factor				(20) = 1 -	0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor			(21) = (18)	x (20) =				0.35	(21)
Infiltration rate modified	for monthly wind spee	d								
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 = (2	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]	
						<u> </u>	Ь		J	

Adjusted infiltra	ation rate ((allowir	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41		
Calculate effec		•	ate for t	he appli	cable ca	se							
If mechanica			ndiv N (2	3h) - (23a) × Emy (auation (NEV otho	nvico (23h	\ = (22a)			0	(23a)
If balanced with) – (23a)			0	(23b)
		-	-	_					21- \ <i>(</i>	005) [4 (00-)	0 . 4001	(23c)
a) If balance	ed mecnan	o T	ntilation	with ne	at recove	ery (MV)	HR) (248	$\frac{1}{0} = \frac{2}{2}$	2b)m + (2 0	23b) × [1 – (23c)	÷ 100] I	(24a)
`			-										(244)
b) If balance		o T	0	without 0	0		0 (24))	0	23D) 0	0		(24b)
c) If whole h	<u> </u>												(= .5)
,	n < 0.5 × (2			•	•				5 × (23b))			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural	ventilation	or who	ole hous	e positiv	/e input	ventilati	on from	loft	ļ	ļ		l	
,	n = 1, then			•					0.5]				
(24d)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(24d)
Effective air	change ra	ate - en	ter (24a) or (24k	o) or (24	c) or (24	d) in bo	x (25)					
(25)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(25)
3. Heat losse	s and heat	t loss n	paramete	er:									
ELEMENT	Gross area (m		Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/I	〈)	k-value		A X k kJ/K
Doors	(,			1.99		1	= I	1.99	$\stackrel{\prime}{\lnot}$			(26)
Windows Type	e 1				1.37	=	/[1/(1.4)+	0.04] =	1.82	=			(27)
Windows Type	2				0.9		/[1/(1.4)+	0.04] =	1.19	=			(27)
Windows Type					5.79		/[1/(1.4)+	0.04] =	7.68	=			(27)
Windows Type					2.19	<u></u>	/[1/(1.4)+	0.04] =	2.9	=			(27)
Walls Type1	75.26	\neg	15.73	3	59.53	=	0.18		10.72	=			(29)
Walls Type2	27.91	\dashv	1.99	=	25.92	=	0.18	=	4.67	룩 ;		╡	(29)
Total area of e		 n²	1.00		103.1	=	0.10		4.01				(31)
Party wall	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				10.99	=	0	= I	0				(32)
Party floor					71.04	_			0			╡┝	(32a)
Party ceiling						_				L		╡	(32b)
* for windows and	roof windows	/S 1150 01	ffective wi	ndow I I-vs	71.04		n formula 1	/[/1/ ₋ valı	ıe)+∩ ∩41 a	L s aiven in	naragrant		(320)
** include the area						atou using	, ioiiiiaia i	7[(17 0 -vaic	ic) 10.0+j a	is giveir iii	paragrapi	0.2	
Fabric heat los	ss, W/K = 5	S (A x	U)				(26)(30) + (32) =				38.23	(33)
Heat capacity	Cm = S(A	xk)						((28).	(30) + (32	2) + (32a).	(32e) =	23186	.5 (34)
Thermal mass	paramete	r (TMP	? = Cm ÷	- TFA) ir	ı kJ/m²K			Indica	tive Value:	Medium		250	(35)
For design assess can be used instead				construct	ion are no	t known pi	recisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L x	Y) calc	culated ı	using Ap	pendix I	<						8.13	(36)
if details of therma		e not kno	own (36) =	= 0.05 x (3	1)								
Total fabric he	at loss							(33) +	(36) =			46.36	(37)

2				l monthly		1, ,,_	1,,1	۸	· · ·		(25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(0
88)m=	37.79	37.55	37.32	36.22	36.01	35.06	35.06	34.88	35.42	36.01	36.43	36.86		(3
leat tr		coefficier	_						``	= (37) + (38)m			
89)m=	84.14	83.91	83.67	82.57	82.37	81.41	81.41	81.24	81.78	82.37	82.78	83.22		–
leat lo	oss para	meter (F	HLP), W/	/m²K						4verage = = (39)m ÷	Sum(39) ₁ · (4)	12 /12=	82.57	(3
10)m=	1.18	1.18	1.18	1.16	1.16	1.15	1.15	1.14	1.15	1.16	1.17	1.17		
,			<u> </u>	ļ		<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u>I </u>	Sum(40) ₁	12 /12=	1.16	(4
lumbe	er of day	s in mor	nth (Tab	le 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. Wa	ater heat	ing ener	rgy requi	irement:								kWh/ye	ar:	
		ipancy, I		[1 ovn	(0 0003	240 v /TE	-Λ 12 O)2)] + 0.0	1012 v /	TEA 12		27		(
	A 2 13.8		T 1.70 X	[i - exp	(-0.0003	949 X (11	-A -13.9)2)] + 0.0) X C1 UC	IFA - 13.	.9)			
		,	ater usad	ge in litre	s per da	ay Vd,av	erage =	(25 x N)	+ 36		88	3.14		
educe	the annua	al average	hot water	usage by	5% if the a	welling is	designed t	to achieve		se target o				
t more	e 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		
ot wate	er usage ir	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)	-	-	-			
4)m=	96.95	93.43	89.9	86.38	82.85	79.32	79.32	82.85	86.38	89.9	93.43	96.95		
ļ			I				I			Total = Su	m(44) ₁₁₂ =	-	1057.67	
nergy o	content of	hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mon	nth (see Ta	ables 1b, 1	c, 1d)		
5)m=	143.78	125.75	129.76	113.13	108.55	93.67	86.8	99.6	100.79	117.47	128.22	139.24		
									-	Total = Su	m(45) ₁₁₂ =	=	1386.77	
instant	taneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)			_		
6)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.89		(
/ater	storage	loss:					•	•			·			
torag	e volum	e (litres)) includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		
comr	munity h	eating a	ınd no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
			hot wate	er (this in	ıcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	storage					(1.54/1	/ I \							
•				oss facto	or is kno	wn (Kvvr	n/day):					0		(
empe	erature fa	actor fro	m Table	2b								0		
			_	, kWh/ye				(48) x (49)) =			0		
•				cylinder l										
		_		om Tabl	e Z (KVV	n/litre/da	iy)					0		
	-	from Ta	ee section	011 4.3										
			่มเe ∠a m Table	2h								0		(
					oor			/A7\ \ /E4	\ v (EQ) (E2) -				
empe		ın water	-	, kWh/ye	al			(47) x (51)) X (52) X (53) =	-	0		(
empe nergy		5/1\ in /5	551											
empe nergy Enter	(50) or ((54) in (5	•					((50)	FE) (11)			0		(
empe nergy Enter	(50) or (•	for each	month			((56)m = (55) × (41)	m		0		

If cylinder conta	ains dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circ	uit loss (ar	nual) fro	m Table	3	-	-	-	-			0		(58)
Primary circ				•	,	,	, ,						
(modified	by factor f	rom Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)		•	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 49.4	1 43	45.81	42.6	42.22	39.12	40.42	42.22	42.6	45.81	46.07	49.41		(61)
Total heat re	equired 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= 193. ⁻	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		(62)
Solar DHW inp	ut calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add additio	nal lines if	FGHRS	and/or \	VWHRS	applies	, see Ap	pendix (3)				_	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	ter										_	
(64)m= 193. ⁻	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		_
							Outp	out from wa	ater heate	r (annual)₁	12	1915.45	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	א 8.0 + [ר	(46)m	+ (57)m	+ (59)m]	
(65)m= 60.1	6 52.56	54.6	48.26	46.65	40.93	38.97	43.67	44.16	50.51	54.15	58.65		(65)
include (5	7)m in cal	culation of	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga	ains (Table	e 5), Wat	ts										
Jai		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.5	56 113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56		(66)
Lighting gai	ns (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				-	
(67)m= 17.8	1 15.82	12.86	9.74	7.28	6.15	6.64	8.63	11.58	14.71	17.17	18.3		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	-	-		
(68)m= 199.7	71 201.78	196.56	185.44	171.41	158.22	149.41	147.34	152.56	163.68	177.71	190.9		(68)
Cooking gai	ns (calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5			•	
(69)m= 34.3	6 34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36		(69)
Pumps and	fans gains	(Table 5	5a)				•	•		•	•	•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)	•	•				•	•	
(71)m= -90.8	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84		(71)
Water heati	ng gains (1	able 5)								!	!	•	
(72)m= 80.8	6 78.22	73.39	67.03	62.7	56.84	52.37	58.7	61.34	67.89	75.21	78.83		(72)
Total intern	al gains =				(66)	m + (67)m	ı + (68)m +	+ (69)m + ((70)m + (7	1)m + (72))m	•	
(73)m= 358.4	14 355.88	342.88	322.28	301.45	281.27	268.49	274.73	285.55	306.34	330.16	348.1		(73)
6. Solar ga	ins:	•											
Solar gains a	re calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to co	nvert to th	e applicat	ole orientat	tion.		
Orientation:	Access F Table 6d		Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	Ta	FF able 6c		Gains (W)	

N		1		1		1		ı		1		-
Northeast _{0.9x}	0.77	X	0.9	X	11.28	X	0.63	X	0.7] =	3.1	(75)
Northeast _{0.9x}	0.77	X	0.9	Х	22.97	X	0.63	X	0.7	=	6.32	(75)
Northeast _{0.9x}	0.77	X	0.9	X	41.38	X	0.63	X	0.7] =	11.38	(75)
Northeast _{0.9x}	0.77	X	0.9	X	67.96	X	0.63	X	0.7	=	18.69	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.35	X	0.63	X	0.7	=	25.12	(75)
Northeast _{0.9x}	0.77	X	0.9	X	97.38	X	0.63	X	0.7	=	26.79	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.1	X	0.63	X	0.7	=	25.06	(75)
Northeast _{0.9x}	0.77	X	0.9	X	72.63	X	0.63	X	0.7	=	19.98	(75)
Northeast _{0.9x}	0.77	X	0.9	X	50.42	X	0.63	X	0.7	=	13.87	(75)
Northeast _{0.9x}	0.77	X	0.9	X	28.07	X	0.63	X	0.7	=	7.72	(75)
Northeast _{0.9x}	0.77	X	0.9	x	14.2	X	0.63	X	0.7] =	3.9	(75)
Northeast _{0.9x}	0.77	X	0.9	X	9.21	X	0.63	X	0.7	=	2.53	(75)
Southeast _{0.9x}	0.77	X	5.79	x	36.79	X	0.63	X	0.7	=	65.11	(77)
Southeast _{0.9x}	0.77	X	5.79	X	62.67	X	0.63	X	0.7	=	110.9	(77)
Southeast 0.9x	0.77	X	5.79	X	85.75	X	0.63	X	0.7	=	151.74	(77)
Southeast 0.9x	0.77	X	5.79	x	106.25	x	0.63	x	0.7	=	188.01	(77)
Southeast 0.9x	0.77	X	5.79	x	119.01	x	0.63	x	0.7	=	210.59	(77)
Southeast 0.9x	0.77	X	5.79	x	118.15	X	0.63	x	0.7	=	209.07	(77)
Southeast _{0.9x}	0.77	X	5.79	x	113.91	X	0.63	X	0.7	=	201.56	(77)
Southeast _{0.9x}	0.77	X	5.79	x	104.39	X	0.63	X	0.7] =	184.72	(77)
Southeast _{0.9x}	0.77	X	5.79	x	92.85	X	0.63	X	0.7] =	164.3	(77)
Southeast _{0.9x}	0.77	x	5.79	x	69.27	x	0.63	x	0.7] =	122.57	(77)
Southeast _{0.9x}	0.77	X	5.79	x	44.07	x	0.63	x	0.7] =	77.98	(77)
Southeast _{0.9x}	0.77	X	5.79	x	31.49	x	0.63	x	0.7] =	55.72	(77)
Northwest _{0.9x}	0.77	X	1.37	x	11.28	x	0.63	x	0.7] =	23.62	(81)
Northwest _{0.9x}	0.77	X	2.19	x	11.28	x	0.63	x	0.7] =	7.55	(81)
Northwest _{0.9x}	0.77	X	1.37	x	22.97	x	0.63	x	0.7] =	48.08	(81)
Northwest _{0.9x}	0.77	x	2.19	x	22.97	x	0.63	x	0.7] =	15.37	(81)
Northwest _{0.9x}	0.77	x	1.37	x	41.38	x	0.63	x	0.7] =	86.62	(81)
Northwest 0.9x	0.77	x	2.19	x	41.38	x	0.63	x	0.7	j =	27.69	(81)
Northwest _{0.9x}	0.77	x	1.37	х	67.96	x	0.63	x	0.7	j =	142.26	(81)
Northwest _{0.9x}	0.77	x	2.19	х	67.96	X	0.63	x	0.7	j =	45.48	(81)
Northwest 0.9x	0.77	x	1.37	х	91.35	x	0.63	x	0.7	j =	191.23	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.35	x	0.63	x	0.7	j =	61.14	(81)
Northwest _{0.9x}	0.77	X	1.37	x	97.38	x	0.63	x	0.7	j =	203.87	(81)
Northwest _{0.9x}	0.77	X	2.19	x	97.38	x	0.63	x	0.7	j =	65.18	(81)
Northwest _{0.9x}	0.77	x	1.37	x	91.1	x	0.63	x	0.7	j =	190.72	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.1	x	0.63	x	0.7	i =	60.97	(81)
Northwest 0.9x	0.77	X	1.37	x	72.63	X	0.63	x	0.7] =	152.04	(81)
Northwest 0.9x	0.77	X	2.19	x	72.63	X	0.63	x	0.7] =	48.61	(81)
Northwest 0.9x	0.77	X	1.37	×	50.42	X	0.63	X	0.7] =	105.55	(81)
L		1		ı				ı		1		

Northwest 0.9x	0.77	2.	19	x	50.42	X		0.63	x	0.7	=	33.75	(81)
Northwest 0.9x	0.77	1.5	37	x	28.07	X		0.63	x	0.7	=	58.76	(81)
Northwest 0.9x	0.77	2.	19	x	28.07	X		0.63	x	0.7	=	18.79	(81)
Northwest 0.9x	0.77	1.3	37	x	14.2	X		0.63	x	0.7	=	29.72	(81)
Northwest 0.9x	0.77	2.	19	x	14.2	X		0.63	x	0.7	=	9.5	(81)
Northwest 0.9x	0.77	1.0	37	x	9.21	X		0.63	x	0.7	=	19.29	(81)
Northwest 0.9x	0.77	2.	19	x	9.21	X		0.63	x	0.7	=	6.17	(81)
						_							
Solar gains in wat	s, calculate	d for eac	h month			(83)m	n = Si	um(74)m .	(82)m				
(**)).67 277.44		488.08	504.9		405	5.34	317.47	207.83	121.11	83.71		(83)
Total gains – inter			`	<u> </u>	·							Ī	
(84)m= 457.82 53	620.32	716.73	789.53	786.1	7 746.8	680	80.0	603.02	514.17	451.27	431.81		(84)
7. Mean internal	emperature	e (heating	season)									
Temperature dur	ng heating	periods i	n the livi	ng are	a from Ta	ble 9	, Th	1 (°C)				21	(85)
Utilisation factor	or gains for	living are	ea, h1,m	(see	Table 9a)							•	
Jan F	eb Mar	Apr	May	Jur	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 1 0.	99 0.98	0.94	0.82	0.63	0.47	0.5	54	0.81	0.97	0.99	1		(86)
Mean internal ter	nperature ir	ı living ar	ea T1 (fo	ollow s	teps 3 to	7 in T	Γable	e 9c)					
(87)m= 19.75 19	.92 20.21	20.57	20.84	20.97	20.99	20.	.99	20.9	20.53	20.07	19.73		(87)
Temperature dur	ng heating	neriods i	n rest of	dwellii	na from Ta	able 9	 9 Th	12 (°C)		•	•	•	
· — —	.94 19.94	19.95	19.95	19.96	<u> </u>	19.		19.96	19.95	19.95	19.94		(88)
Litilization factor	or going for	root of d	L	h2 m /	ann Table	. 00)				Ţ			
Utilisation factor (89)m= 1 0.	99 0.98	0.92	0.77	0.54	0.37	9a) 0.4	12	0.73	0.95	0.99	1		(89)
· · ·	<u> </u>	<u> </u>		<u> </u>		<u> </u>				0.00	<u> </u>		()
Mean internal ter	- -	1			<u>`</u>	i				10.70	40.05	1	(90)
(90)m= 18.28 18	.53 18.94	19.46	19.81	19.94	19.96	19.	.96	19.88	19.41	18.76	18.25	0.00	—
								'	LA - LIVII	ng area ÷ (4	·) -	0.39	(91)
Mean internal ter	· 	1				- `					i	1	
` ′	.07 19.43	19.89	20.21	20.34		20.		20.27	19.84	19.27	18.82		(92)
Apply adjustment (93)m= 18.85 19		1		1		1			·	10.07	10.00		(93)
` '	.07 19.43	19.89	20.21	20.34	20.36	20.	.36	20.27	19.84	19.27	18.82		(93)
8. Space heating Set Ti to the mea			ro obtoir	od at	stop 11 of	Tabl	la Ok	o co tha	t Ti m-/	76\m an	d ro colo	vulata	
the utilisation fac				icu at	step i i oi	Tabl	ie si), 50 li la	L 11,111—(10)III ali	u ie-caic	uiaic	
Jan F	eb Mar	Apr	May	Jur	Jul	Α	ug	Sep	Oct	Nov	Dec		
Utilisation factor	or gains, hr	n:			•								
(94)m= 0.99 0.	99 0.97	0.91	0.78	0.58	0.41	0.4	47	0.75	0.95	0.99	1		(94)
Useful gains, hm		94)m x (8	4)m		_					•		•	
` '	0.62 602.6	655.18	615.69	452.8	6 304.09	317	'.63	453.53	488.16	446.63	430.15		(95)
Monthly average		-i	 	1	-					1	1	1	
` '	.9 6.5	8.9	11.7	14.6	16.6	16		14.1	10.6	7.1	4.2		(96)
Heat loss rate for							_		ī —	1007.01	1010 5	1	(07)
(97)m= 1224.18 118			700.72	467.2		321		504.74	761.12	1007.21	1216.5		(97)
Space heating re (98)m= 571.88 44	quirement 1 2.33 356.39	1	63.26	/vn/mc	$\frac{\text{onth} = 0.00}{0}$	24 X I	- ` í)m – (95 0)MJ X (4 203.09	1)m 403.62	585.04		
(30)111- 37 1.00 44	330.39	101.30	03.20			1 '		U	203.08	700.02	303.04		

					Tota	ıl per year	(kWh/yeaı	r) = Sum(9	8)15,912 =	2806.99	(98)
Space heating requirement i	n kWh/m²	²/year								39.51	(99)
9a. Energy requirements – In	dividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heating:	aaaandar	v/auppla	monton	, avatam					i		(201)
Fraction of space heat from Fraction of space heat from			memary	-	(202) = 1	_ (201) =				0	(202)
Fraction of total heating from	-	` ,			(204) = (2	, ,	(203)1 =			1	(204)
Efficiency of main space hea	_				(204) (2	02) ** [1	(200)]			1 02.4	(206)
Efficiency of secondary/supp	0,		a cycton	o 0/ ₂						93.4	(208)
				r	Ι	0	l 0-4	l Nave		0	`
Jan Feb Mar Space heating requirement (<u> </u>	May d above	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
571.88 442.33 356.39	`	63.26	0	0	0	0	203.09	403.62	585.04		
$(211)m = \{[(98)m \times (204)] \} x$	100 ÷ (20)6)	l .			Į	<u> </u>	<u> </u>	<u>. </u>	ı	(211)
612.29 473.59 381.58		67.73	0	0	0	0	217.44	432.14	626.38		` ,
	-	•			Tota	l (kWh/yea	ar) =Sum(2	211),15,101	=	3005.34	(211)
Space heating fuel (seconda	• ,	month							•		_
$= \{[(98)m \times (201)]\} \times 100 \div (201)$	1									l	
(215)m= 0 0 0	0	0	0	0	0 Tota	0 II (kWh/yea	0 ar) =Sum('	0	0		7(245)
Water heating					Tota	ii (KVVII/yea	ar) –ourri(z	2 1 3) _{15,1012}	2	0	(215)
Water heating Output from water heater (cal	culated a	bove)									
193.18 168.75 175.57		150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		
Efficiency of water heater										80.3	(216)
(217)m= 87.62 87.37 86.8	85.44	83.04	80.3	80.3	80.3	80.3	85.6	87.1	87.71		(217)
Fuel for water heating, kWh/n (219) m = (64) m x $100 \div (217)$											
(219)m= 220.49 193.16 202.28	1	181.56	165.37	158.43	176.62	178.57	190.74	200.12	215.08		
<u> </u>	-1				Tota	l = Sum(2	19a) ₁₁₂ =			2264.68	(219)
Annual totals							k'	Wh/yeaı	, '	kWh/yea	<u>-</u>
Space heating fuel used, mai	n system	1								3005.34	
Water heating fuel used										2264.68	
Electricity for pumps, fans and	d electric	keep-ho	t								
central heating pump:									30		(230c)
boiler with a fan-assisted flu	Э								45		(230e)
Total electricity for the above,	kWh/yea	ır			sum	of (230a).	(230g) =			75	(231)
Electricity for lighting										314.48	(232)
Total delivered energy for all	uses (211)(221)	+ (231)	+ (232).	(237b)	=			[5659.5	(338)
12a. CO2 emissions – Indivi	`	, , ,	, ,	` ′	` ′						
				i ergy /h/year			kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	

Space heating (main system 1)	(211) x	0.216	=	649.15	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	489.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1138.32	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	163.22	(268)
Total CO2, kg/year	sum	of (265)(271) =		1340.47	(272)

Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com

TER =

(273)

18.87

		He	ser Details:						
Access an Names	Chair I I a also all	US		- M	la a		CTDO	046060	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 201	2	Stroma Softwa					016363 on: 1.0.5.51	
Continuito Italiio:			erty Address:				7 01010	11010101	
Address :		·	, i						
1. Overall dwelling dime	ensions:								
Ground floor		· -	Area(m²)	(1a) x		ight(m)	(2a) =	Volume(m³	(3a)
	-) (41-) (4-) (4-)	\ \ \(\(\(\(\(\) \) \) \(\(\)				2.7	(2a) –	136.19	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e	;)+(In) [50.44	(4)) - (0) - (0	D : (0) :	(0.)		_
Dwelling volume				(3a)+(3b)+(3c)+(3c	l)+(3e)+	.(3n) =	136.19	(5)
2. Ventilation rate:	main se	econdary	other		total			m³ per hou	r
Number of chippensys	heating h	eating		1 = F			40 =	-	_
Number of chimneys				<u> </u>	0			0	(6a)
Number of open flues	0 +	0	0] = [0		20 =	0	(6b)
Number of intermittent fa				Ĺ	2		10 =	20	(7a)
Number of passive vents	3			L	0	X '	10 =	0	(7b)
Number of flueless gas f	ires				0	X 4	40 =	0	(7c)
							Air ch	anges per ho	our
Infiltration due to chimne	eys flues and fans = (6	a)+(6b)+(7a)+(7b)+(7c) =	Г	20		÷ (5) =	0.15	(8)
	peen carried out or is intende			ontinue fr			(0)	0.13	
Number of storeys in t	he dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber t			•	uction			0	(11)
deducting areas of openi	resent, use the value corres _i ngs); if equal user 0.35	ponaing to the	greater wall are	a (aπer					
If suspended wooden	floor, enter 0.2 (unseal	ed) or 0.1 (s	sealed), 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)
Window infiltration			0.25 - [0.2					0	(15)
Infiltration rate			(8) + (10)					0	(16)
Air permeability value,	•	•	-	•	etre of e	envelope	area	5	(17)
If based on air permeabi Air permeability value applie	-				io boina u	and		0.4	(18)
Number of sides sheltere		s been done or	a degree air per	пеаышу	is being u	seu		2	(19)
Shelter factor			(20) = 1 -	0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18)	x (20) =				0.34	(21)
Infiltration rate modified	for monthly wind speed	I							_
Jan Feb	Mar Apr May	Jun J	lul 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	3.7	4	4.3	4.5	4.7		
Wind Easter (22a)m = (2	2\m ÷ 4								
Wind Factor (22a)m = (2 $(22a)m = 1.27$ 1.25	2)m ÷ 4 1.23	0.95 0.	95 0.92	1	1.08	1.12	1.18]	
1.27	1.1 1.00	0.00	0.32		1.00	1.12	1.10	I	

Adjusted infiltr	ation rate	e (allowi	ing for sl	nelter an	ıd wind s	speed) =	(21a) x	(22a)m					
0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4]	
Calculate effe		•	rate for t	he appli	cable ca	se	•	•	•	•		<u>-</u>	(00 -)
If exhaust air h			endiv N (S	23h) = (23a	a) x Emy (4	equation (1	N5N othe	rwise (23h) = (23a)			0	(23a)
If balanced with) (20u)			0	(23b) (23c)
a) If balance		-	•	_					2h)m + (23h) x [1 – (23c		(230)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If balance	ed mecha	ı anical ve	ı entilation	without	heat red	coverv (N	и VV) (24k)m = (22	2b)m + (;	1 23b)		_	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If whole h				•	•				- (00)		!	4	
	n < 0.5 ×	r Ó	<u> </u>	ŕ	í –	· ·	ŕ	ŕ	· ` ·	ŕ	1 ,	1	(24a)
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If natural if (22b)r	ventilation n = 1, the			•	•				0.5]				
(24d)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58]	(24d)
Effective air	change	rate - er	nter (24a) or (24l	o) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(25)
3. Heat losse	s and he	eat loss	paramet	er:									
ELEMENT	Gros area		Openin	igs 1²	Net Ar A ,r		U-val W/m2		A X U (W/I		k-valu kJ/m²·		A X k kJ/K
Doors		()			1.99		1		1.99				(26)
Windows Type	e 1				1.37	x1	/[1/(1.4)+	0.04] =	1.82	Ħ			(27)
Windows Type	e 2				4.65	x1	/[1/(1.4)+	0.04] =	6.16				(27)
Windows Type	e 3				1.54	x1	/[1/(1.4)+	0.04] =	2.04	=			(27)
Walls Type1	55.8	8	8.93	3	46.87	7 X	0.18	i	8.44	Ħ ſ			(29)
Walls Type2	22.4	19	1.99	,	20.5	x	0.18	= i	3.69	F i			(29)
Total area of e	elements	, m²			78.29								(31)
Party wall					9.64	x	0	= [0				(32)
Party floor					50.44	1						7 F	(32a)
Party ceiling					50.44	1				Ĭ			(32b)
* for windows and ** include the area						ated using	formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapi	h 3.2	
Fabric heat los							(26)(30) + (32) =				25.96	(33)
Heat capacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	18066.	3 (34)
Thermal mass	parame	ter (TMF	⊃ = Cm -	+ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assess				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	K						5.39	(36)
if details of therma	•	•			•								` ′
Total fabric he	at loss							(33) +	(36) =			31.35	(37)
Ventilation hea		r	1	<u> </u>					= 0.33 × ([25)m x (5]) 	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	

	1		I				I				I			(22)
` ′ _	26.63	26.47	26.31	25.56	25.43	24.78	24.78	24.66	25.03	25.43	25.71	26		(38)
Heat tran								1	· · · ·	= (37) + (0-		
(39)m=	57.98	57.81	57.66	56.91	56.77	56.13	56.13	56.01	56.38	56.77	57.06	57.35		(39)
Heat loss	s paraı	meter (H	HLP), W	m²K						= (39)m ÷	Sum(39) _{1.}	12 /12=	56.91	(39)
(40)m=	1.15	1.15	1.14	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.14		_
Number	of dav	s in moı	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.13	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wate	er heati	ing enei	rgy requi	rement:								kWh/ye	ar:	
A = = : : : = = = =	d		N I											(40)
	> 13.9	, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		.7		(42)
if TFA Annual a		•	ater usac	ae in litre	s per da	ıv Vd.av	erage =	(25 x N)	+ 36		74	.65		(43)
Reduce the	e annua	l average	hot water	usage by	5% if the d	welling is	designed t			se target o		.00		(10)
not more th	hat 125 i	litres per _l	person per	day (all w	ater use, f	not and co	ld) 1					T 1		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water ι							ı	<u>, , , , , , , , , , , , , , , , , , , </u>						
(44)m= 8	82.11	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11		— (40)
Energy con	ntent of I	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x D	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	895.77	(44)
(45)m= 1	121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		
If instantan	aeous wa	ater heatii	na at noint	of use (no	hot water	storage)	enter () in	hoves (46		Γotal = Su	m(45) ₁₁₂ =		1174.5	(45)
_	18.27	15.98	16.48	14.37						14.00	16.20	17.60		(46)
(46)m= 1 Water sto			10.40	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(40)
Storage	•) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If commu	unity h	eating a	ınd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwis			hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water sto	•		ا اممسمام	ft-	an ia lena		- /-l -> -\ .					_		(40)
a) If mar					DI IS KITO	WII (KVVI	i/uay).					0		(48)
Tempera					or			(40) × (40)				0		(49)
Energy lo			_	-		or is not		(48) x (49)) =			0		(50)
Hot wate				•								0		(51)
If commu	•	_		on 4.3										
Volume f				OI.								0		(52)
Tempera												0		(53)
Energy lo Enter (5			_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	0		(54)
Water sto	, ,	, ,	•	or each	month			((56)m = (55) × (11)	m		0		(55)
							ı							(56)
(56)m=	0 contains	0 dedicate	0 d solar sto	0 rage. (57)ı	0 n = (56)m	0 x [(50) – (0 H11)1 ÷ (5	0 0), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Appendi	x H	(56)
_													•••	(57)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) fro	om Table 3				0		(58)
Primary circuit loss calculated		9)m = (58) ÷ 36	5 × (41)m				
(modified by factor from Tab	le H5 if there is sol	lar water heatin	ng and a cylind	er thermostat)			
(59)m= 0 0 0	0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each	month (61)m = (60	0) ÷ 365 × (41)	m				
(61)m= 41.84 36.42 38.8	, , , , , , , , , , , , , , , , , , , 	33.13 34.24	35.76 36.08	38.8 39.02	41.84		(61)
Total heat required for water h	eating calculated fo	or each month	(62)m = 0.85 ×	(45)m + (46)m +	 · (57)m +	(59)m + (61)m	
(62)m= 163.61 142.92 148.7		112.46 107.75	120.12 121.44	`````	159.77		(62)
Solar DHW input calculated using App		!		I I I I I I I I I I I I I I I I I I I	er heating)		
(add additional lines if FGHRS							
(63)m= 0 0 0	0 0	0 0	0 0	0 0	0		(63)
Output from water heater	<u> </u>	II	<u> </u>				
(64)m= 163.61 142.92 148.7	131.89 127.69 1	112.46 107.75	120.12 121.44	138.29 147.62	159.77		
(0.7)				water heater (annual)	1	1622.26	(64)
Heat gains from water heating	kWh/month 0.25 ′	′ [0 85 x (45)m			'		1,
(65)m= 50.95 44.52 46.24		34.66 33	36.99 37.4	42.78 45.86	49.67		(65)
` '		!!			ļ		(00)
include (57)m in calculation	. ,	inder is in the d	iweiling or not	water is from con	imunity n	eaung	
5. Internal gains (see Table 5	•						
Metabolic gains (Table 5), Wat				1		1	
Jan Feb Mar	Apr May	Jun Jul	Aug Sep		Dec		(00)
(66)m= 85.15 85.15 85.15	85.15 85.15 8	85.15 85.15	85.15 85.15	85.15 85.15	85.15	I	(66)
Lighting gains (calculated in A	· · · · ·	n L9 or L9a), al	so see Table 5	5		•	
(67)m= 13.55 12.03 9.79	7.41 5.54	4.68 5.05	6.57 8.81	11.19 13.06	13.92	I	(67)
Appliances gains (calculated in	n Appendix L, equa	ntion L13 or L13	3a), also see T	able 5			
(68)m= 148.38 149.92 146.04	137.78 127.35 1	117.55 111	109.46 113.34	121.6 132.03	141.83		(68)
Cooking gains (calculated in A	ppendix L, equatio	n L15 or L15a)	, also see Tabl	e 5			
(69)m= 31.52 31.52 31.52	31.52 31.52 3	31.52 31.52	31.52 31.52	31.52 31.52	31.52		(69)
Pumps and fans gains (Table s	5a)			-			
(70)m= 3 3 3	3 3	3 3	3 3	3 3	3		(70)
Losses e.g. evaporation (nega	tive values) (Table	5)	•		•		
(71)m= -68.12 -68.12 -68.12	 	-68.12 -68.12	-68.12 -68.12	-68.12 -68.12	-68.12		(71)
Water heating gains (Table 5)	I I		·	I I			
(72)m= 68.48 66.24 62.15	56.77 53.1	48.14 44.36	49.72 51.95	57.5 63.7	66.76		(72)
Total internal gains =		!		+ (70)m + (71)m + (72			
(73)m= 281.95 279.74 269.52	253.5 237.54 2	221.91 211.96	217.29 225.65		274.06		(73)
6. Solar gains:	200.0 201.04 2	21.01	217.23 220.00	241.04 200.04	274.00		(1-)
Solar gains are calculated using sola	ır flux from Table 6a and	d associated equat	tions to convert to	the applicable orienta	tion.		
Orientation: Access Factor	Area	Flux	g_	FF		Gains	
Table 6d	m²	Table 6a	Table 6			(W)	
Northeast _{0.9x} 0.77 x	4.65 ×	11.28	x 0.63	x 0.7		16.03	(75)
Northeast 0.9x 0.77 x		11.28	x 0.63	x 0.7	 	5.31	(75)
0.77 A	1.07	11.20	0.00			0.01	1,, 0,

Jan		Mar	Apr Ma	Ť	Jun	Jul	Αι	ug Sep	Oct	Nov	Dec		
Utilisation fac	•	•		_			, פיטוכ	(0)					
7. Mean inter Temperature	· · · · · · · · · · · · · · · · · · ·				area f	rom Tah	nle 0	Th1 (°C)				21	(85)
					.00.01	713.00	L	330.79	552.32	7 324.1	317.00	<u></u>	(=+)
(84)m= 334.1		Solar 19.61	$\frac{(84)\text{m} = (73)\text{m}}{471.03} = 510$	`	63)III ,	479.68	442	.1 398.79	352.94	1 324.1	317.86]	(84)
(83)m= 52.15 Total gains – ii		50.09 solar	$\begin{array}{c c} 217.53 & 272.4 \\ \hline (84)m = (73)i \end{array}$		83.16	267.73	224	81 173.14	111.1	63.76	43.8]	(83)
Solar gains in			-		02 42 1			= Sum(74)m .		00.70	40.0	1	(02)
_		_		_			•		_				_
Southwest _{0.9x}	0.77	X	1.37	X	3	1.49	j	0.63	X	0.7	=	26.37	(79)
Southwest _{0.9x}	0.77	X	1.37	×		4.07	j i	0.63	X	0.7	╡ =	36.9	(79)
Southwest _{0.9x}	0.77	X	1.37	X	6	9.27	j	0.63	×	0.7	= =	58	(79)
Southwest _{0.9x}	0.77	X	1.37	X		2.85		0.63	X	0.7	_ =	77.75	(79)
Southwest _{0.9x}	0.77	→ x	1.37] x		4.39	, 	0.63	×	0.7	╡ -	87.41	(79)
Southwest _{0.9x}	0.77	X	1.37]	_	3.91	, 	0.63	X	0.7	= =	95.39	(79)
Southwest _{0.9x}	0.77	^ x	1.37	」 ^ x		8.15] 	0.63	$\frac{1}{x}$	0.7	╡ -	98.94	(79)
Southwest _{0.9x}	0.77	 	1.37	」 ^] x		9.01]]	0.63	-	0.7	╡ -	99.66	(79)
Southwest _{0.9x}	0.77	-	1.37	」 ^] x		6.25]]	0.63	-	0.7	╡ -	88.97	$= \frac{(79)}{(79)}$
Southwest _{0.9x}	0.77		1.37	」 ^] _×		2.67 5.75]]	0.63	_	0.7	╡ -	52.48 71.81	= (79)
Southwest _{0.9x}	0.77	」 × □ ×	1.37	」 ×] x		6.79 2.67]]	0.63	x x	0.7		30.81	(79)
Southwest _{0.9x}	0.77	」 ×	1.54	」× □ ↓		.21	X	0.63	■ ×	0.7	┥ -	4.34	(79)
Northeast 0.9x	0.77	X ۲	4.65	」× ┐、	_	.21	X I v	0.63	X y	0.7	┥ -	13.09	(75)
Northeast 0.9x	0.77	」 ×	1.54	」× T ↓		4.2	X	0.63	_ X	0.7	=	6.68	(75)
Northeast 0.9x	0.77	→ × → ×	4.65	」× □ ↓	-	4.2	X	0.63	■ ×	0.7	_	20.18	(75)
Northeast 0.9x	0.77	」 ×	1.54	」× ┐、		3.07	X l v	0.63	→ × → ×	0.7	=	13.21	(75)
Northeast 0.9x	0.77	」 ×	4.65	」× ┐、		3.07	X	0.63	X → V	0.7	=	39.89	(75)
Northeast _{0.9x}	0.77	」 ×	1.54] X]		0.42	X	0.63	X	0.7	 	23.73	= (75)
Northeast 0.9x	0.77	X	4.65	X		0.42	X	0.63	X	0.7	_ =	71.65	(75)
Northeast 0.9x	0.77	X	1.54	X		2.63	X	0.63	X	0.7	_ =	34.18	(75)
Northeast 0.9x	0.77	X	4.65	X	_	2.63	X	0.63	×	0.7	_ =	103.21	(75)
Northeast 0.9x	0.77	X	1.54	X	g	1.1	X	0.63	X	0.7	_ =	42.88	(75)
Northeast 0.9x	0.77	X	4.65	X	9	1.1	X	0.63	X	0.7	=	129.46	(75)
Northeast 0.9x	0.77	X	1.54	X	9	7.38	X	0.63	X	0.7	=	45.83	(75)
Northeast _{0.9x}	0.77	X	4.65	X	9	7.38	X	0.63	X	0.7	=	138.39	(75)
Northeast _{0.9x}	0.77	X	1.54	X	9	1.35	X	0.63	X	0.7	=	42.99	(75)
Northeast 0.9x	0.77	X	4.65	X	9	1.35	X	0.63	X	0.7	=	129.81	(75)
Northeast 0.9x	0.77	X	1.54	X	6	7.96	X	0.63	X	0.7	=	31.98	(75)
Northeast 0.9x	0.77	X	4.65	X	6	7.96	x	0.63	X	0.7	=	96.57	(75)
Northeast 0.9x	0.77	X	1.54	X	4	1.38	X	0.63	X	0.7	=	19.47	(75)
Northeast 0.9x	0.77	X	4.65	X	4	1.38	x	0.63	X	0.7	=	58.8	(75)
Northeast 0.9x	0.77	×	1.54	X	2	2.97	X	0.63	x	0.7	=	10.81	(75)
Northeast _{0.9x}	0.77	X	4.65	X		2.97	X	0.63	X	0.7	=	32.64	(75)

(86)m=	1	0.99	0.98	0.95	0.85	0.67	0.51	0.57	0.83	0.97	0.99	1		(86)
Mean	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Table	e 9c)				1	
(87)m=	19.82	19.96	20.21	20.55	20.82	20.96	20.99	20.99	20.89	20.54	20.12	19.79		(87)
Temp	erature	durina h	eating p	eriods ir	rest of	dwellina	from Ta	ble 9. Ti	h2 (°C)				I	
(88)m=	19.96	19.96	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.97		(88)
Utilisa	ition fac	tor for a	ains for	rest of d	wellina.	h2.m (se	ee Table	9a)			•		I	
(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.39	0.45	0.75	0.96	0.99	1		(89)
Mean	internal	temper	ature in	the rest	of dwelli	na T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)			J	
(90)m=	18.39	18.6	18.97	19.45	19.81	19.97	19.99	19.99	19.9	19.44	18.84	18.36		(90)
_									f	LA = Livin	ig area ÷ (4	4) =	0.54	(91)
Mean	internal	temper	ature (fo	r the wh	ole dwel	llina) = fl	A × T1	+ (1 – fl	A) × T2					
(92)m=	19.17	19.34	19.64	20.05	20.36	20.51	20.53	20.53	20.44	20.04	19.54	19.14	İ	(92)
Apply	adjustn	nent to the	ne mear	internal	temper	uture fro	m Table	4e, whe	ere appro	priate		ļ	1	
(93)m=	19.17	19.34	19.64	20.05	20.36	20.51	20.53	20.53	20.44	20.04	19.54	19.14		(93)
8. Spa	ace hea	ting requ	uirement											
				•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the uti				using Ta		lun	led	Aug	Con	Oct	Nov	Doo]	
] ceilitl I	Jan ition fac	Feb tor for a	Mar ains, hm	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.99	0.98	0.93	0.82	0.63	0.46	0.51	0.79	0.96	0.99	1		(94)
L				1)m x (84								·		, ,
(95)m=	332.36	371.95	409.87	439.36	418.62	317.55	218.63	227.42	314.23	337.49	320.82	316.55		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8							ļ	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]		ı	· 1	
(97)m=	861.95	834.97	757.85	634.53	491.77	331.58	220.83	231.38	357.28	535.85	709.68	856.92		(97)
· .				r each m					``	ŕ - `	·		I	
(98)m=	394.02	311.15	258.9	140.52	54.43	0	0	0	0	147.58	279.98	402.03		٦,,,,,,
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1988.61	(98)
Space	e heating	g require	ement in	kWh/m²	/year								39.43	(99)
9a. Ene	ergy red	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatir	•			, .									¬
	•			econdar		mentary	•						0	(201)
				nain syst	` ,			(202) = 1 -					1	(202)
Fraction	on of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of s	econda	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		g require	ement (c	alculate	d above))				•			•	
	394.02	311.15	258.9	140.52	54.43	0	0	0	0	147.58	279.98	402.03		
(211)m	= {[(98)m x (20	4)] } x 1	00 ÷ (20	6)	•	•	•	•	•			•	(211)
	421.86	333.14	277.19	150.45	58.27	0	0	0	0	158.01	299.77	430.44		_
								Tota	i (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2129.13	(211)

215)m= 0 0 0 0 0	0 0	0 0	0	0	0		
		Total (kWh/y	ear) =Sum(21	5) _{15,1012}	<u> </u>	0	(21
Water heating					L		_
Output from water heater (calculated above)	140 40 407 75	100 40 1404 4	1 100 00 1	447.00	450 77		
163.61	112.46 107.75	120.12 121.44	138.29	147.62	159.77	80.3	(216
	80.3 80.3	80.3 80.3	85.22	86.64	87.28	00.3	(21) (21)
Fuel for water heating, kWh/month			1				•
219)m = (64)m x 100 ÷ (217)m		l l			[]		
219)m= 187.67 164.36 172.04 154.78 153.71 1	140.06 134.18	149.58 151.24 Total = Sum		170.38	183.06	1000.00	٦,,,,
Annual totals		Total – Sulli		/h/year	<i>.</i>	1923.33 kWh/year	(219
Space heating fuel used, main system 1			KVV	iii y cai		2129.13	7
Nater heating fuel used					[1923.33	Ħ
Electricity for pumps, fans and electric keep-hot					L		_
central heating pump:					30		(23
boiler with a fan-assisted flue					45		(23)
otal electricity for the above, kWh/year		sum of (230a	a)(230g) =			75	(23
Electricity for lighting		`	, (0,		[[239.24](23)
	(221) ± (222)	(227h) -			[[╡
Fotal delivered energy for all uses (211)(221) +	. , , , ,	, ,				4366.71	(338
12a. CO2 emissions – Individual heating system	is including mi	Cro-CHP					
	Engrav		Emissio		tor	Emissions kg CO2/yea	
	Energy kWh/year		kg CO2	/kWh		•	
Space heating (main system 1)			kg CO2/ 0.216		= [459.89	(26
Space heating (main system 1) Space heating (secondary)	kWh/year			3	= [= [459.89	(26 (26
Space heating (secondary)	kWh/year		0.216)	L		_
Space heating (secondary) Vater heating	kWh/year (211) x (215) x (219) x	+ (263) + (264) =	0.216)	= [0	(26
	kWh/year (211) x (215) x (219) x	+ (263) + (264) =	0.216 0.519 0.216	3	= [0 415.44 875.33] (26] (26
Space heating (secondary) Vater heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262)	+ (263) + (264) =	0.216	5) 5)	= [0 415.44](26](26](26

TER =

(273)

20.59

		User D	etails:						
Assessor Name:	Chris Hocknell		Strom	a Num	her		STRO	016363	
Software Name:	Stroma FSAP 2012		Softwa					n: 1.0.5.51	
		Property A	Address	: Flat-30	1-LEAN				
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			a(m²)	(4-)		ight(m)	7(0-) -	Volume(m³	_
				(1a) x		2.7	(2a) =	191.81	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1n)	1.04	(4)					_
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	191.81	(5)
2. Ventilation rate:								2 1	
	main second heating heating	•	other	_	total			m³ per hou	r
Number of chimneys	0 + 0	+	0] = [0	X	40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	X	20 =	0	(6b)
Number of intermittent fa	ins			Γ	3	X	10 =	30	(7a)
Number of passive vents	;			Ī	0	x	10 =	0	(7b)
Number of flueless gas f	ires			Ē	0	X	40 =	0	(7c)
				_					
							Air ch	anges per ho	ur
	ys, flues and fans = $(6a)+(6b)+$				30		÷ (5) =	0.16	(8)
If a pressurisation test has be Number of storeys in t	peen carried out or is intended, proce	eed to (17), o	otherwise (continue fr	om (9) to	(16)			(9)
Additional infiltration	ne dwelling (ns)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame	or 0.35 foi	r masoni	y constr	uction	2()	•	0	(11)
	resent, use the value corresponding	to the great	er wall are	a (after					
deducting areas of openii	ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or	0 1 (seale	ed) else	enter 0				0	(12)
If no draught lobby, en	,	0.1 (000.0	, a,, c.cc	ontor o				0	(13)
• •	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic met	•	•	•	etre of e	envelope	area	5	(17)
·	lity value, then $(18) = [(17) \div 20]$				ta batana			0.41	(18)
Number of sides sheltere	es if a pressurisation test has been d ed	one or a deg	gree air pe	rmeability	is being u	sea		2	(19)
Shelter factor	,,,		(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18) x (20) =				0.35	(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 = (2	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		
. ,	1 1 1 1 1 1 1 1 1			•				I	

Adjusted infiltra	ation rate (all	owing for s	helter an	d wind s	speed) =	(21a) x	(22a)m					
0.44	0.43 0.4	2 0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41]	
Calculate effec		ge rate for t	he appli	cable ca	se			•	!	•		
If mechanica		Annondiy N. (1)3h) - (23a	a) × Emy (aguation (NEV otho	anviso (23h	v) = (23a)			0	(23a)
If balanced with)) = (23a)			0	(23b)
	-	-	_					Ol- \ /	005) [4 (00-)	0	(23c)
a) If balance	o mechanica		with ne	at recove	ery (MV)	HR) (248	$\frac{1}{0} = \frac{2}{2}$	2b)m + (23b) × [1 - (23c)) ÷ 100]]	(24a)
` ′								<u> </u>			J	(244)
b) If balance (24b)m= 0				0		0 (24)	0	26)m + (. 0	230)	0	1	(24b)
c) If whole h											J	(210)
,	ouse exiraci า < 0.5 × (23I		•	•				.5 × (23b	o)			
(24c)m= 0	0 0		0	0	0	0	0	0	0	0	1	(24c)
d) If natural	ventilation or	whole hous	se positiv	ve input	ventilati	on from	loft	<u> </u>		Į	J	
,	n = 1, then (2		•	•				0.5]			_	
(24d)m= 0.6	0.59 0.5	9 0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(24d)
Effective air	change rate	- enter (24a	a) or (24b	o) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 0.6	0.59 0.5	9 0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(25)
3. Heat losses	s and heat lo	ss paramet	er:									
ELEMENT	Gross area (m²)	Openir		Net Ar A ,r		U-val W/m2		A X U (W/I		k-value	_	A X k kJ/K
Doors	()			1.99		1		1.99	$\stackrel{\prime}{\Box}$			(26)
Windows Type	: 1			1.37	=	/[1/(1.4)+	· 0.04] =	1.82	=			(27)
Windows Type				0.9	_	/[1/(1.4)+	· 0.04] =	1.19	\exists			(27)
Windows Type				5.79	=	/[1/(1.4)+	_	7.68	=			(27)
Windows Type				2.19	= .	/[1/(1.4)+		2.9	=			(27)
Walls Type1	75.26	15.7	3	59.53	=	0.18		10.72	╡┌			(29)
Walls Type2	27.91	1.99	=	25.92	=	0.18		4.67	믁 ¦		- -	(29)
Total area of e		1.98	<u>, </u>		=	0.10		4.07	[
Party wall	iements, m			103.1	=							(31)
Party floor				10.99	=	0	=	0				(32)
•				71.04	_				Ĺ		- -	(32a)
Party ceiling	roof windows	oo offootivo w	indou II w	71.04		y formula 1	1/5/1/11 val	(0) 1 0 0 0 1 1		noroaronl		(32b)
* for windows and ** include the area					ateu using	j iorriula i	/[(16)+0.0 4] a	is giveri ili	paragrapi	1 3.2	
Fabric heat los	s, W/K = S (4 x U)				(26)(30) + (32) =				38.23	(33)
Heat capacity	Cm = S(A x k	()					((28).	(30) + (32	2) + (32a).	(32e) =	23186	(34)
Thermal mass	parameter (TMP = Cm	÷ TFA) ir	n kJ/m²K			Indica	ntive Value	: Medium		250	(35)
For design assess can be used instea			construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L x Y)	calculated	using Ap	pendix I	K						8.1	(36)
if details of therma	l bridging are no	ot known (36)	= 0.05 x (3	1)								
Total fabric hea	at loss						(33) +	(36) =			46.33	(37)

/entila	ition hea	nt loss ca	alculated	l monthly	y				(38)m	= 0.33 × ((25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
38)m=	37.79	37.55	37.32	36.22	36.01	35.06	35.06	34.88	35.42	36.01	36.43	36.86		(38
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
39)m=	84.12	83.88	83.64	82.55	82.34	81.39	81.39	81.21	81.75	82.34	82.76	83.19		
Heat Id	oss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷	Sum(39) ₁ . (4)	12 /12=	82.55	(39
40)m=	1.18	1.18	1.18	1.16	1.16	1.15	1.15	1.14	1.15	1.16	1.16	1.17		
Numbe	er of day	s in moi	nth (Tab	le 1a)			•	•		Average =	Sum(40) ₁	12 /12=	1.16	(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. Wa	ater heat	ing ene	rgy requi	irement:								kWh/ye	ar:	
۸۵۵۰۰۳	ned occu	unanay l	N I											(4)
			м + 1.76 х	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13		27		(42
	A £ 13.9				`	,		, ,-	,					
			ater usag hot water							se target o		3.14		(43
			person per					io acmeve	a water at	ic larger o	1			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot wate			day for ea						ОСР	000	1407	_ <u></u>		
44)m=	96.95	93.43	89.9	86.38	82.85	79.32	79.32	82.85	86.38	89.9	93.43	96.95		
,			<u> </u>	ļ	ļ	ļ	<u> </u>	!		<u>l</u> Total = Su	<u>I</u> m(44) ₁₁₂ =	=	1057.67	(44
Energy	content 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=	143.78	125.75	129.76	113.13	108.55	93.67	86.8	99.6	100.79	117.47	128.22	139.24		
f instan	taneous w	ater heati	ng at point	of use (no	hot water	r storage)	enter O in	hoves (46		Total = Su	m(45) ₁₁₂ =	=	1386.77	(4
				·	i	· · ·		` '	` ′	17.00	1,000			(4)
46)m= Vater	21.57 storage	18.86 loss:	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.89		(4
	_) includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(4
_		, ,	ınd no ta	•			_							·
	•	•	hot wate		•			` '	ers) ente	er '0' in ((47)			
	storage													
•			eclared l		or is kno	wn (kWł	n/day):					0		(4
Гетре	erature f	actor fro	m Table	2b								0		(4
			storage	-		:		(48) x (49)) =			0		(5
•			eclared of factor fr	-								0		(5
		_	ee secti		_ (, ,	.))					<u> </u>		(0
/olum	e factor	from Ta	ble 2a									0		(5
Emne	erature f	actor fro	m Table	2b								0		(5
Cilipe	/ lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(5
•	, 1001 110											0		(5
Energy	(50) or ((54) in (5	55)									U		(-
Energy Enter	(50) or (55) culated 1	for each	month			((56)m = (55) × (41)	m		0		(-

If cylinder conta	ains dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circ	uit loss (ar	nual) fro	m Table	3	-	-	-	-			0		(58)
Primary circ				•	,	,	, ,						
(modified	by factor f	rom Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)		•	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 49.4	1 43	45.81	42.6	42.22	39.12	40.42	42.22	42.6	45.81	46.07	49.41		(61)
Total heat re	equired 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= 193. ⁻	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		(62)
Solar DHW inp	ut calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add additio	nal lines if	FGHRS	and/or \	VWHRS	applies	, see Ap	pendix (3)				_	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	ter										_	
(64)m= 193. ⁻	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		_
							Outp	out from wa	ater heate	r (annual)₁	12	1915.45	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	א 8.0 + [ר	(46)m	+ (57)m	+ (59)m]	
(65)m= 60.1	6 52.56	54.6	48.26	46.65	40.93	38.97	43.67	44.16	50.51	54.15	58.65		(65)
include (5	7)m in cal	culation of	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga	ains (Table	e 5), Wat	ts										
Jai		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.5	56 113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56		(66)
Lighting gai	ns (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				-	
(67)m= 17.8	1 15.82	12.86	9.74	7.28	6.15	6.64	8.63	11.58	14.71	17.17	18.3		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	-	-		
(68)m= 199.7	71 201.78	196.56	185.44	171.41	158.22	149.41	147.34	152.56	163.68	177.71	190.9		(68)
Cooking gai	ns (calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5			•	
(69)m= 34.3	6 34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36		(69)
Pumps and	fans gains	(Table 5	5a)				•			•	•	•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)	•	•				•	•	
(71)m= -90.8	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84		(71)
Water heati	ng gains (1	able 5)								!	!	•	
(72)m= 80.8	6 78.22	73.39	67.03	62.7	56.84	52.37	58.7	61.34	67.89	75.21	78.83		(72)
Total intern	al gains =				(66)	m + (67)m	ı + (68)m +	+ (69)m + ((70)m + (7	1)m + (72))m	•	
(73)m= 358.4	14 355.88	342.88	322.28	301.45	281.27	268.49	274.73	285.55	306.34	330.16	348.1		(73)
6. Solar ga	ins:												
Solar gains a	re calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to co	nvert to th	e applicat	ole orientat	tion.		
Orientation:	Access F Table 6d		Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	Ta	FF able 6c		Gains (W)	

N		1		1		1		ı		1		٦
Northeast _{0.9x}	0.77	X	0.9	X	11.28	X	0.63	X	0.7] =	3.1	(75)
Northeast _{0.9x}	0.77	X	0.9	Х	22.97	X	0.63	X	0.7	=	6.32	(75)
Northeast _{0.9x}	0.77	X	0.9	X	41.38	X	0.63	X	0.7] =	11.38	(75)
Northeast _{0.9x}	0.77	X	0.9	X	67.96	X	0.63	X	0.7	=	18.69	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.35	X	0.63	X	0.7	=	25.12	(75)
Northeast _{0.9x}	0.77	X	0.9	X	97.38	X	0.63	X	0.7	=	26.79	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.1	X	0.63	X	0.7	=	25.06	(75)
Northeast _{0.9x}	0.77	X	0.9	X	72.63	X	0.63	X	0.7	=	19.98	(75)
Northeast _{0.9x}	0.77	X	0.9	X	50.42	X	0.63	X	0.7	=	13.87	(75)
Northeast _{0.9x}	0.77	X	0.9	X	28.07	X	0.63	X	0.7	=	7.72	(75)
Northeast _{0.9x}	0.77	X	0.9	x	14.2	X	0.63	X	0.7] =	3.9	(75)
Northeast _{0.9x}	0.77	X	0.9	x	9.21	X	0.63	X	0.7	=	2.53	(75)
Southeast _{0.9x}	0.77	X	5.79	X	36.79	X	0.63	X	0.7	=	65.11	(77)
Southeast _{0.9x}	0.77	X	5.79	X	62.67	X	0.63	X	0.7	=	110.9	(77)
Southeast 0.9x	0.77	X	5.79	x	85.75	x	0.63	x	0.7	=	151.74	(77)
Southeast 0.9x	0.77	X	5.79	x	106.25	X	0.63	X	0.7	=	188.01	(77)
Southeast _{0.9x}	0.77	X	5.79	x	119.01	X	0.63	X	0.7] =	210.59	(77)
Southeast _{0.9x}	0.77	X	5.79	x	118.15	X	0.63	X	0.7] =	209.07	(77)
Southeast _{0.9x}	0.77	X	5.79	x	113.91	x	0.63	x	0.7	=	201.56	(77)
Southeast _{0.9x}	0.77	X	5.79	x	104.39	x	0.63	x	0.7] =	184.72	(77)
Southeast _{0.9x}	0.77	X	5.79	x	92.85	X	0.63	X	0.7] =	164.3	(77)
Southeast 0.9x	0.77	x	5.79	x	69.27	x	0.63	x	0.7] =	122.57	(77)
Southeast _{0.9x}	0.77	x	5.79	x	44.07	x	0.63	x	0.7] =	77.98	(77)
Southeast _{0.9x}	0.77	X	5.79	x	31.49	x	0.63	x	0.7] =	55.72	(77)
Northwest _{0.9x}	0.77	X	1.37	x	11.28	x	0.63	x	0.7] =	23.62	(81)
Northwest _{0.9x}	0.77	X	2.19	x	11.28	x	0.63	x	0.7] =	7.55	(81)
Northwest _{0.9x}	0.77	X	1.37	x	22.97	x	0.63	x	0.7] =	48.08	(81)
Northwest _{0.9x}	0.77	x	2.19	x	22.97	x	0.63	x	0.7] =	15.37	(81)
Northwest _{0.9x}	0.77	x	1.37	x	41.38	x	0.63	x	0.7] =	86.62	(81)
Northwest 0.9x	0.77	x	2.19	x	41.38	x	0.63	x	0.7	j =	27.69	(81)
Northwest _{0.9x}	0.77	x	1.37	x	67.96	x	0.63	x	0.7	j =	142.26	(81)
Northwest _{0.9x}	0.77	x	2.19	x	67.96	x	0.63	x	0.7	j =	45.48	(81)
Northwest 0.9x	0.77	x	1.37	x	91.35	x	0.63	x	0.7	j =	191.23	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.35	x	0.63	x	0.7	j =	61.14	(81)
Northwest _{0.9x}	0.77	X	1.37	x	97.38	x	0.63	x	0.7	j =	203.87	(81)
Northwest _{0.9x}	0.77	X	2.19	x	97.38	x	0.63	x	0.7	j =	65.18	(81)
Northwest _{0.9x}	0.77	x	1.37	x	91.1	x	0.63	x	0.7	j =	190.72	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.1	x	0.63	x	0.7	i =	60.97	(81)
Northwest 0.9x	0.77	X	1.37	x	72.63	X	0.63	x	0.7] =	152.04	(81)
Northwest 0.9x	0.77	X	2.19	x	72.63	X	0.63	x	0.7] =	48.61	(81)
Northwest 0.9x	0.77	X	1.37	×	50.42	X	0.63	X	0.7] =	105.55	(81)
L		1		ı								

Northwest _{0.9x}	0.77	x	2.1	9	x	5	0.42	X		0.63	x	0.7	=	33.75	(81)
Northwest _{0.9x}	0.77	x	1.3	7	x	2	8.07	X		0.63	x	0.7	=	58.76	(81)
Northwest _{0.9x}	0.77	x	2.1	9	x	2	8.07	X		0.63	x	0.7	=	18.79	(81)
Northwest _{0.9x}	0.77	x	1.3	7	x	1	14.2	X		0.63	x	0.7	=	29.72	(81)
Northwest _{0.9x}	0.77	x	2.1	9	x	1	14.2	X		0.63	x	0.7	=	9.5	(81)
Northwest _{0.9x}	0.77	x	1.3	7	x	9	9.21	x		0.63	x	0.7	=	19.29	(81)
Northwest 0.9x	0.77	x	2.1	9	x	ç	9.21	X		0.63	x	0.7	=	6.17	(81)
Solar gains in wa	tts, calcula	ated	for each	n month				(83)m	ı = Sı	um(74)m .	(82)m	_			
(11)	30.67 277.		394.45	488.08		04.9	478.31	405	.34	317.47	207.83	121.11	83.71		(83)
Total gains – inte	i	_	` 	, ,	<u>`</u>									Ī	
(84)m= 457.82 53	36.55 620	.32	716.73	789.53	78	6.17	746.8	680	.08	603.02	514.17	451.27	431.81		(84)
7. Mean internal	temperat	ure (heating	season)										
Temperature du	ring heatir	ng pe	eriods in	the livi	ng a	area f	rom Tab	ole 9,	, Th	1 (°C)				21	(85)
Utilisation factor	for gains	for li	ving are	a, h1,m	(se	е Та	ble 9a)					_		•	_
Jan	Feb M	ar	Apr	May	J	Jun	Jul	Αı	ug	Sep	Oct	Nov	Dec		
(86)m= 1 (0.99	8	0.94	0.82	0.	.63	0.47	0.5	54	0.8	0.97	0.99	1		(86)
Mean internal te	mperature	in li	ving are	ea T1 (fo	ollov	w ste	ps 3 to 7	' in T	able	e 9c)					
(87)m= 19.75 1	9.93 20.2	21	20.57	20.84	20).97	20.99	20.	99	20.9	20.53	20.07	19.73		(87)
Temperature du	ring heatin	na ne	eriods in	rest of	dwe	ellina	from Ta	hle 9	 G Th	n2 (°C)		•			
·	9.94 19.9	Ť	19.95	19.95	r -	9.96	19.96	19.		19.96	19.95	19.95	19.94		(88)
` '	for voice	<u> </u>		بر مالایم بر	L		a Tabla	O-2\	!						
Utilisation factor	0.99 0.9		0.92	0.77	1	n (se	0.37	9a) 0.4	12	0.73	0.95	0.99	1		(89)
	<u> </u>							<u> </u>				0.99	'		(00)
Mean internal te			T		Ť			r i				T ==		İ	(00)
(90)m= 18.28 1	8.53 18.9	94	19.46	19.81	18	9.94	19.96	19.	96	19.88	19.41	18.76	18.25		(90)
											LA - LIVII	ng area ÷ (4	+) -	0.39	(91)
Mean internal te					Ť	··		`						Ī	
` '	9.07 19.4		19.89	20.21		0.34	20.36	20.		20.27	19.84	19.27	18.82		(92)
Apply adjustmer			T T		1			ī				10.07	40.00	1	(02)
` ′	9.07 19.4		19.89	20.21	20	0.34	20.36	20.	36	20.27	19.84	19.27	18.82		(93)
8. Space heating	•		noratur	o obtoin	o d	at ata	n 11 of	Tabl	a 0h	oo tha	t Ti m=	76\m an	dro oolo	vulata	
Set Ti to the me the utilisation fac					leu	al Sie	р п ог	rabi	e si	o, so ma	L 11,111—((76)III ali	u re-caic	uiale	
		ar	Apr	May	J	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation factor	for gains,	hm:	· · ·		!									ı	
(94)m= 0.99 (0.99	7	0.91	0.78	0.	.58	0.41	0.4	17	0.75	0.95	0.99	1		(94)
Useful gains, hn	nGm , W =	(94)m x (84	1)m								_		•	
(95)m= 455.52 53	30.62 602	2.6	655.16	615.61	45	2.75	304.01	317	.55	453.46	488.15	446.63	430.15		(95)
Monthly average	<u> </u>				able	8								Ī	
` ′	4.9 6.5		8.9	11.7	<u> </u>	4.6	16.6	16.		14.1	10.6	7.1	4.2		(96)
Heat loss rate fo					_		-		- -			1000 = 1	4040 :=	Ī	(07)
(97)m= 1223.85 11			906.85	700.53		7.11	306.04	321		504.6	760.92	1006.94	1216.17		(97)
Space heating re (98)m= 571.64 44	equiremer 42.12 356.		each m	63.17		mont 0	h = 0.02	24 x [0	Ť	m – (95 0)m] x (4 202.94	1)m 403.42	584.8		
(30)111- 37 1.04 44	12.12 300.	. 10	101.22	03.17	<u> </u>	U	U		<u>'</u>	U	202.94	403.42	J04.0		

			Tota	ıl per year	(kWh/yeaı	r) = Sum(9	08) _{15,912} =	2805.5	(98)
Space heating requirement in kWh/m²/year							Ī	39.49	(99)
9a. Energy requirements – Individual heating	systems i	including	micro-C	CHP)			_		
Space heating:							г		_
Fraction of space heat from secondary/supp	olementary	•		,			ļ	0	(201)
Fraction of space heat from main system(s)			(202) = 1	, ,			ļ	1	(202)
Fraction of total heating from main system 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1							ļ	93.4	(206)
Efficiency of secondary/supplementary heat	ing systen	n, %						0	(208)
Jan Feb Mar Apr Ma		Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement (calculated above	i	Ι ,			202.04	102.42	T 504 0		
571.64 442.12 356.18 181.22 63.17	0	0	0	0	202.94	403.42	584.8		(0.1.1)
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$ $612.03 473.36 381.35 194.03 67.64$	1 0	0	0	0	217.28	431.93	626.12		(211)
012.03 470.00 301.03 194.00 07.05	· °	"		l (kWh/yea				3003.75	(211)
Space heating fuel (secondary), kWh/month	1				,	7 10, 101	_		` ′
$= \{[(98)\text{m x } (201)]\} \times 100 \div (208)$	•								
(215)m= 0 0 0 0 0	0	0	0	0	0	0	0		
			Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,101}	= 2	0	(215)
Water heating									
Output from water heater (calculated above) 193.18 168.75 175.57 155.73 150.7	7 132.79	127.22	141.82	143.39	163.28	174.3	188.65		
Efficiency of water heater	. .0=0	1		1.0.00	100.20		1 .00.00	80.3	(216)
(217)m= 87.62 87.36 86.8 85.43 83.04	80.3	80.3	80.3	80.3	85.6	87.1	87.71		(217)
Fuel for water heating, kWh/month	!			ı					
(219) m = (64) m x $100 \div (217)$ m (219) m = $(220.49 \ 193.16 \ 202.29 \ 182.28 \ 181.5$	6 165 27	158.43	176.62	178.57	100.75	200.12	215.08		
(219)m= 220.49 193.16 202.29 182.28 181.5	6 165.37	100.43		I = Sum(2	190.75 19a), ,, =	200.12	215.06	2264.71	(219)
Annual totals						Wh/yea	<u>,</u>	kWh/yea	
Space heating fuel used, main system 1							· [3003.75	
Water heating fuel used							Ì	2264.71	Ħ
Electricity for pumps, fans and electric keep-l	not						L		
central heating pump:							30		(2300
boiler with a fan-assisted flue							45		(230e
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =			75	(231)
Electricity for lighting				. /	. 0,		L T	314.48	(232)
	11) + /004)	(000)	(0075)	_			[=
Total delivered energy for all uses (211)(22	, , ,	` ,	` ′				L	5657.94	(338)
12a. CO2 emissions – Individual heating sys	stems incl	uding mi	cro-CHF)					
		nergy Vh/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	

Space heating (main system 1)	(211) x	0.216	648.81 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	489.18 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1137.99 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	163.22 (268)
Total CO2, kg/year	sum o	of (265)(271) =	1340.13 (272)

TER =

(273)

18.86

			User D	etaile:						
A a a a a a a a a a a a a a a a a a a a	Ob vio I la alva all				- M	la a		CTDO	046060	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 201	2		Stroma Softwa	-				016363 on: 1.0.5.51	
Continuite Hame:	Stroma i Gra Zon			Address:				VOICE	71. 1.0.0.01	
Address :										
1. Overall dwelling dime	ensions:									
Ground floor				a(m²)	(1a) x		ight(m)	(2a) =	Volume(m³) (3a)
	_	.). (1)					2.7	(2a) –	136.19	(3a)
Total floor area TFA = (1	(a)+(1b)+(1c)+(1d)+(1e	e)+(III)	5	0.44	(4)) - (O) - (O	1) - (0) -	(0.)		_
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	136.19	(5)
2. Ventilation rate:	main s	econdary	•	other		total			m³ per hou	r
Number of chimenous	heating	neating	1 + [] ₌ [40 =		_
Number of chimneys		0	!	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	3					0	X	10 =	0	(7b)
Number of flueless gas f	īres					0	X 4	40 =	0	(7c)
								Air ch	nanges per ho	our
Infiltration due to chimne	evs_flues and fans = (6	a)+(6b)+(7a	ı)+(7b)+(7c) =	Г	20		÷ (5) =	0.15	(8)
	been carried out or is intende				ontinue fr			(0)	0.13	
Number of storeys in t	the dwelling (ns)								0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber				•	uction			0	(11)
deducting areas of openi	present, use the value corres ings); if equal user 0.35	sponaing to ti	ne great	er wall are	a (aπer					
If suspended wooden	floor, enter 0.2 (unsea	led) or 0.1	(seale	ed), else	enter 0				0	(12)
If no draught lobby, er	nter 0.05, else enter 0								0	(13)
Percentage of window	s and doors draught s	tripped							0	(14)
Window infiltration				0.25 - [0.2			>		0	(15)
Infiltration rate				(8) + (10)					0	(16)
Air permeability value,	•		•	-	•	etre of e	envelope	area	5	(17)
If based on air permeabi	=					is heina u	sed		0.4	(18)
Number of sides sheltere		3 Deen done	or a acg	jice ali pei	meability	is being u	300		2	(19)
Shelter factor				(20) = 1 -	0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor			(21) = (18)	x (20) =				0.34	(21)
Infiltration rate modified	for monthly wind speed	t								
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 = (2	92)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]	
` '									J	

Adjusted infiltr	ation rate	e (allowi	ing for sl	nelter an	ıd wind s	speed) =	(21a) x	(22a)m					
0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4]	
Calculate effe		•	rate for t	he appli	cable ca	se	•	•	•	•		<u>-</u>	(00 -)
If exhaust air h			endiv N (S	23h) = (23a	a) x Emy (4	equation (1	N5N othe	rwise (23h) = (23a)			0	(23a)
If balanced with) (20u)			0	(23b) (23c)
a) If balance		-	•	_					2h)m + (23h) x [1 – (23c		(230)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If balance	ed mecha	ı anical ve	ı entilation	without	heat red	coverv (N	и VV) (24k)m = (22	2b)m + (;	1 23b)		_	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If whole h				•	•				- (00)		!	4	
	n < 0.5 ×	r Ó	<u> </u>	ŕ	í –	· ·	ŕ	ŕ	· ` ·	ŕ	1 ,	1	(24a)
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)r	ventilation n = 1, the			•	•				0.5]				
(24d)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58]	(24d)
Effective air	change	rate - er	nter (24a) or (24l	o) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(25)
3. Heat losse	s and he	eat loss	paramet	er:									
ELEMENT	Gros area		Openin	igs 1²	Net Ar A ,r		U-val W/m2		A X U (W/I		k-valu kJ/m²·		A X k kJ/K
Doors		()			1.99		1		1.99				(26)
Windows Type	e 1				1.37	x1	/[1/(1.4)+	0.04] =	1.82	Ħ			(27)
Windows Type	e 2				4.65	x1	/[1/(1.4)+	0.04] =	6.16				(27)
Windows Type	e 3				1.54	x1	/[1/(1.4)+	0.04] =	2.04	=			(27)
Walls Type1	55.8	8	8.93	3	46.87	7 X	0.18	i	8.44	Ħ ſ			(29)
Walls Type2	22.4	19	1.99	,	20.5	x	0.18	= i	3.69	F i			(29)
Total area of e	elements	, m²			78.29								(31)
Party wall					9.64	x	0	= [0				(32)
Party floor					50.44	1						7 F	(32a)
Party ceiling					50.44	1				Ì			(32b)
* for windows and ** include the area						ated using	formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapi	h 3.2	
Fabric heat los							(26)(30) + (32) =				25.96	(33)
Heat capacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	18066.	3 (34)
Thermal mass	parame	ter (TMF	⊃ = Cm -	+ TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assess				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridg	es : S (L	x Y) cal	culated	using Ap	pendix l	K						5.39	(36)
if details of therma	•	•			•								` ′
Total fabric he	at loss							(33) +	(36) =			31.35	(37)
Ventilation hea		r	1	<u> </u>					= 0.33 × ([25)m x (5]) 	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	

	1		I				I				I			(22)
` ′ _	26.63	26.47	26.31	25.56	25.43	24.78	24.78	24.66	25.03	25.43	25.71	26		(38)
Heat tran								1	· · · ·	= (37) + (0-		
(39)m=	57.98	57.81	57.66	56.91	56.77	56.13	56.13	56.01	56.38	56.77	57.06	57.35		(39)
Heat loss	s paraı	meter (H	HLP), W	m²K						= (39)m ÷	Sum(39) _{1.}	12 /12=	56.91	(39)
(40)m=	1.15	1.15	1.14	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.14		_
Number	of dav	s in moı	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.13	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wate	er heati	ing enei	rgy requi	rement:								kWh/ye	ar:	
A = = : : : = = = =	d		N I											(40)
	> 13.9	, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		.7		(42)
if TFA Annual a		•	ater usad	ae in litre	s per da	ıv Vd.av	erage =	(25 x N)	+ 36		7.4	.65		(43)
Reduce the	e annua	l average	hot water	usage by	5% if the d	welling is	designed t			se target o		.00		(10)
not more th	hat 125 i	litres per _l	person per	day (all w	ater use, f	not and co	ld) 1					T 1		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water ι							ı	<u>, , , , , , , , , , , , , , , , , , , </u>						
(44)m= 8	82.11	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11		— (40)
Energy con	ntent of I	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x D	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	895.77	(44)
(45)m= 1	121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		
If instantan	aeous wa	ater heatii	na at noint	of use (no	hot water	storage)	enter () in	hoves (46		Γotal = Su	m(45) ₁₁₂ =		1174.5	(45)
_	18.27	15.98	16.48	14.37						14.00	16.20	17.60		(46)
(46)m= 1 Water sto			10.40	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(40)
Storage	•) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If commu	unity h	eating a	ınd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwis			hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water sto	•		ا اممسمام	ft-	an ia lena		- /-l -> -\ .					_		(40)
a) If mar					DI IS KITO	WII (KVVI	i/uay).					0		(48)
Tempera					or			(40) × (40)				0		(49)
Energy lo			_	-		or is not		(48) x (49)) =			0		(50)
Hot wate				•								0		(51)
If commu	•	_		on 4.3										
Volume f				OI.								0		(52)
Tempera												0		(53)
Energy lo Enter (5			_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	-	0		(54)
Water sto	, ,	, ,	•	or each	month			((56)m = (55) × (11)	m		0		(55)
							ı							(56)
(56)m=	0 contains	0 dedicate	0 d solar sto	0 rage. (57)ı	0 n = (56)m	0 x [(50) – (0 H11)1 ÷ (5	0 0), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Appendi	x H	(56)
_													•••	(57)
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) fro	om Table 3				0		(58)
Primary circuit loss calculated		9)m = (58) ÷ 36	5 × (41)m				
(modified by factor from Tab	le H5 if there is sol	lar water heatin	ng and a cylind	er thermostat)			
(59)m= 0 0 0	0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each	month (61)m = (60	0) ÷ 365 × (41)	m				
(61)m= 41.84 36.42 38.8	, , , , , , , , , , , , , , , , , , , 	33.13 34.24	35.76 36.08	38.8 39.02	41.84		(61)
Total heat required for water h	eating calculated fo	or each month	(62)m = 0.85 ×	(45)m + (46)m +	 · (57)m +	(59)m + (61)m	
(62)m= 163.61 142.92 148.7		112.46 107.75	120.12 121.44	`````	159.77		(62)
Solar DHW input calculated using App		!		I I I I I I I I I I I I I I I I I I I	er heating)		
(add additional lines if FGHRS							
(63)m= 0 0 0	0 0	0 0	0 0	0 0	0		(63)
Output from water heater	<u> </u>	II	<u> </u>				
(64)m= 163.61 142.92 148.7	131.89 127.69 1	112.46 107.75	120.12 121.44	138.29 147.62	159.77		
(0.7)				water heater (annual)	1	1622.26	(64)
Heat gains from water heating	kWh/month 0.25 ′	′ [0 85 x (45)m			'		1,
(65)m= 50.95 44.52 46.24		34.66 33	36.99 37.4	42.78 45.86	49.67		(65)
` '		!!			ļ		(00)
include (57)m in calculation	. ,	inder is in the d	iweiling or not	water is from con	imunity n	eaung	
5. Internal gains (see Table 5	•						
Metabolic gains (Table 5), Wat				1		1	
Jan Feb Mar	Apr May	Jun Jul	Aug Sep		Dec		(00)
(66)m= 85.15 85.15 85.15	85.15 85.15 8	85.15 85.15	85.15 85.15	85.15 85.15	85.15	I	(66)
Lighting gains (calculated in A	· · · · ·	n L9 or L9a), al	so see Table 5	5		•	
(67)m= 13.55 12.03 9.79	7.41 5.54	4.68 5.05	6.57 8.81	11.19 13.06	13.92	I	(67)
Appliances gains (calculated in	n Appendix L, equa	ntion L13 or L13	3a), also see T	able 5			
(68)m= 148.38 149.92 146.04	137.78 127.35 1	117.55 111	109.46 113.34	121.6 132.03	141.83		(68)
Cooking gains (calculated in A	ppendix L, equatio	n L15 or L15a)	, also see Tabl	e 5			
(69)m= 31.52 31.52 31.52	31.52 31.52 3	31.52 31.52	31.52 31.52	31.52 31.52	31.52		(69)
Pumps and fans gains (Table s	5a)			-			
(70)m= 3 3 3	3 3	3 3	3 3	3 3	3		(70)
Losses e.g. evaporation (nega	tive values) (Table	5)	•		•		
(71)m= -68.12 -68.12 -68.12	 	-68.12 -68.12	-68.12 -68.12	-68.12 -68.12	-68.12		(71)
Water heating gains (Table 5)	I I		·	I I			
(72)m= 68.48 66.24 62.15	56.77 53.1	48.14 44.36	49.72 51.95	57.5 63.7	66.76		(72)
Total internal gains =		!		+ (70)m + (71)m + (72			
(73)m= 281.95 279.74 269.52	253.5 237.54 2	221.91 211.96	217.29 225.65		274.06		(73)
6. Solar gains:	200.0 201.04 2	21.01	217.23 220.00	241.04 200.04	274.00		(1-)
Solar gains are calculated using sola	ır flux from Table 6a and	d associated equat	tions to convert to	the applicable orienta	tion.		
Orientation: Access Factor	Area	Flux	g_	FF		Gains	
Table 6d	m²	Table 6a	Table 6			(W)	
Northeast _{0.9x} 0.77 x	4.65 ×	11.28	x 0.63	x 0.7		16.03	(75)
Northeast 0.9x 0.77 x		11.28	x 0.63	x 0.7	 	5.31	(75)
0.77 A	1.07	11.20	0.00			0.01	1,, 0,

Jan		Mar	Apr Ma	Ť	Jun	Jul	Αι	ug Sep	Oct	Nov	Dec		
Utilisation fac	•	•		_			, פיטוכ	(0)					
7. Mean inter Temperature	· · · · · · · · · · · · · · · · · · ·				area f	rom Tah	nle 0	Th1 (°C)				21	(85)
					.00.01	713.00	L	330.79	552.32	7 324.1	317.00	<u></u>	(=+)
(84)m= 334.1		Solar 19.61	$\frac{(84)\text{m} = (73)\text{m}}{471.03} = 510$	`	63)III ,	479.68	442	.1 398.79	352.94	1 324.1	317.86]	(84)
(83)m= 52.15 Total gains – ii		50.09 solar	$\begin{array}{c c} 217.53 & 272.4 \\ \hline (84)m = (73)a \end{array}$		83.16	267.73	224	81 173.14	111.1	63.76	43.8]	(83)
Solar gains in			-		02 42 1			= Sum(74)m .		00.70	40.0	1	(02)
_		_		_			•		_				_
Southwest _{0.9x}	0.77	X	1.37	X	3	1.49	j	0.63	X	0.7	=	26.37	(79)
Southwest _{0.9x}	0.77	X	1.37	×		4.07	j i	0.63	X	0.7	╡ =	36.9	(79)
Southwest _{0.9x}	0.77	X	1.37	X	6	9.27	j	0.63	×	0.7	= =	58	(79)
Southwest _{0.9x}	0.77	X	1.37	X		2.85		0.63	X	0.7	_ =	77.75	(79)
Southwest _{0.9x}	0.77	→ x	1.37] x		4.39	, 	0.63	×	0.7	╡ -	87.41	(79)
Southwest _{0.9x}	0.77	X	1.37]	_	3.91	, 	0.63	X	0.7	= =	95.39	(79)
Southwest _{0.9x}	0.77	^ x	1.37	」 ^ x		8.15] 	0.63	$\frac{1}{x}$	0.7	╡ -	98.94	(79)
Southwest _{0.9x}	0.77	 	1.37	」 ^] x		9.01]]	0.63	-	0.7	╡ -	99.66	(79)
Southwest _{0.9x}	0.77	-	1.37	」 ^] x		6.25]]	0.63	-	0.7	╡ -	88.97	$= \frac{(79)}{(79)}$
Southwest _{0.9x}	0.77		1.37	」 ^] _×		2.67 5.75]]	0.63	_	0.7	╡ -	52.48 71.81	= (79)
Southwest _{0.9x}	0.77	」 × □ ×	1.37	」 ×] x		6.79 2.67]]	0.63	x x	0.7		30.81	(79)
Southwest _{0.9x}	0.77	」 ×	1.54	」× □ ↓		.21	X	0.63	■ ×	0.7	┥ -	4.34	(79)
Northeast 0.9x	0.77	X ۲	4.65	」× ┐、	_	.21	X I v	0.63	X y	0.7	┥ -	13.09	(75)
Northeast 0.9x	0.77	」 ×	1.54	」× T ↓		4.2	X	0.63	_ X	0.7	=	6.68	(75)
Northeast 0.9x	0.77	→ × → ×	4.65	」× □ ↓	-	4.2	X	0.63	■ ×	0.7	_	20.18	(75)
Northeast 0.9x	0.77	」 ×	1.54	」× ┐、		3.07	X l v	0.63	→ × → ×	0.7	=	13.21	(75)
Northeast 0.9x	0.77	」 ×	4.65	」× ┐、		3.07	X	0.63	X → V	0.7	=	39.89	(75)
Northeast _{0.9x}	0.77	」 ×	1.54] X]		0.42	X	0.63	X	0.7	 	23.73	= (75)
Northeast 0.9x	0.77	X	4.65	X		0.42	X	0.63	X	0.7	_ =	71.65	(75)
Northeast 0.9x	0.77	X	1.54	X		2.63	X	0.63	X	0.7	_ =	34.18	(75)
Northeast 0.9x	0.77	X	4.65	X	_	2.63	X	0.63	×	0.7	_ =	103.21	(75)
Northeast 0.9x	0.77	X	1.54	X	g	1.1	X	0.63	X	0.7	_ =	42.88	(75)
Northeast 0.9x	0.77	X	4.65	X	9	1.1	X	0.63	X	0.7	=	129.46	(75)
Northeast 0.9x	0.77	X	1.54	X	9	7.38	X	0.63	X	0.7	=	45.83	(75)
Northeast _{0.9x}	0.77	X	4.65	X	9	7.38	X	0.63	X	0.7	=	138.39	(75)
Northeast _{0.9x}	0.77	X	1.54	X	9	1.35	X	0.63	X	0.7	=	42.99	(75)
Northeast 0.9x	0.77	X	4.65	X	9	1.35	X	0.63	X	0.7	=	129.81	(75)
Northeast 0.9x	0.77	X	1.54	X	6	7.96	X	0.63	X	0.7	=	31.98	(75)
Northeast 0.9x	0.77	X	4.65	X	6	7.96	x	0.63	X	0.7	=	96.57	(75)
Northeast 0.9x	0.77	X	1.54	X	4	1.38	X	0.63	X	0.7	=	19.47	(75)
Northeast 0.9x	0.77	X	4.65	X	4	1.38	x	0.63	X	0.7	=	58.8	(75)
Northeast 0.9x	0.77	×	1.54	X	2	2.97	X	0.63	x	0.7	=	10.81	(75)
Northeast _{0.9x}	0.77	X	4.65	X		2.97	X	0.63	X	0.7	=	32.64	(75)

(86)m=	1	0.99	0.98	0.95	0.85	0.67	0.51	0.57	0.83	0.97	0.99	1		(86)
Mean	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Table	e 9c)				1	
(87)m=	19.82	19.96	20.21	20.55	20.82	20.96	20.99	20.99	20.89	20.54	20.12	19.79		(87)
Temp	erature	durina h	eating p	eriods ir	rest of	dwellina	from Ta	ble 9. Ti	h2 (°C)				I	
(88)m=	19.96	19.96	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.97		(88)
Utilisa	ition fac	tor for a	ains for	rest of d	wellina.	h2.m (se	ee Table	9a)			•		I	
(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.39	0.45	0.75	0.96	0.99	1		(89)
Mean	internal	temper	ature in	the rest	of dwelli	na T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)			J	
(90)m=	18.39	18.6	18.97	19.45	19.81	19.97	19.99	19.99	19.9	19.44	18.84	18.36		(90)
_									f	LA = Livin	ig area ÷ (4	4) =	0.54	(91)
Mean	internal	temper	ature (fo	r the wh	ole dwel	llina) = fl	A × T1	+ (1 – fl	A) × T2					
(92)m=	19.17	19.34	19.64	20.05	20.36	20.51	20.53	20.53	20.44	20.04	19.54	19.14	İ	(92)
Apply	adjustn	nent to the	ne mear	internal	temper	uture fro	m Table	4e, whe	ere appro	priate		ļ	1	
(93)m=	19.17	19.34	19.64	20.05	20.36	20.51	20.53	20.53	20.44	20.04	19.54	19.14		(93)
8. Spa	ace hea	ting requ	uirement											
				•		ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the uti				using Ta		lun	led	Aug	Con	Oct	Nov	Doo]	
] ceilitl I	Jan ition fac	Feb tor for a	Mar ains, hm	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.99	0.99	0.98	0.93	0.82	0.63	0.46	0.51	0.79	0.96	0.99	1		(94)
L				1)m x (84								·		, ,
(95)m=	332.36	371.95	409.87	439.36	418.62	317.55	218.63	227.42	314.23	337.49	320.82	316.55		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8							ļ	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]		ı	· 1	
(97)m=	861.95	834.97	757.85	634.53	491.77	331.58	220.83	231.38	357.28	535.85	709.68	856.92		(97)
· .				r each m					``	ŕ - `	·		I	
(98)m=	394.02	311.15	258.9	140.52	54.43	0	0	0	0	147.58	279.98	402.03		٦,,,,,,
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1988.61	(98)
Space	e heating	g require	ement in	kWh/m²	/year								39.43	(99)
9a. Ene	ergy red	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatir	•			, .									¬
	•			econdar		mentary	•						0	(201)
				nain syst	` ,			(202) = 1 -					1	(202)
Fraction	on of to	tal heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								93.4	(206)
Efficie	ency of s	econda	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		g require	ement (c	alculate	d above))				•				
	394.02	311.15	258.9	140.52	54.43	0	0	0	0	147.58	279.98	402.03		
(211)m	= {[(98)m x (20	4)] } x 1	00 ÷ (20	6)	•	•	•	•	•			•	(211)
	421.86	333.14	277.19	150.45	58.27	0	0	0	0	158.01	299.77	430.44		_
								Tota	i (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	2129.13	(211)

215)m= 0 0 0 0 0	0 0	0 0	0	0	0		
		Total (kWh/y	ear) =Sum(21	5) _{15,1012}	<u> </u>	0	(21
Water heating					L		_
Output from water heater (calculated above)	140 40 407 75	100 40 1404 4	1 100 00 1	447.00	450 77		
163.61	112.46 107.75	120.12 121.44	138.29	147.62	159.77	80.3	(216
	80.3 80.3	80.3 80.3	85.22	86.64	87.28	00.3	(21) (21)
Fuel for water heating, kWh/month			1				•
219)m = (64)m x 100 ÷ (217)m		l l			[]		
219)m= 187.67 164.36 172.04 154.78 153.71 1	140.06 134.18	149.58 151.24 Total = Sum		170.38	183.06	1000.00	٦,,,,
Annual totals		Total – Sulli		/h/year	<i>.</i>	1923.33 kWh/year	(219
Space heating fuel used, main system 1			KVV	iii y cai		2129.13	7
Nater heating fuel used					[1923.33	Ħ
Electricity for pumps, fans and electric keep-hot					L		_
central heating pump:					30		(23
boiler with a fan-assisted flue					45		(23)
otal electricity for the above, kWh/year		sum of (230a	a)(230g) =			75	(23
Electricity for lighting		`	, (0,		l [239.24](23)
	(221) ± (222)	(227h) -			[[╡
Fotal delivered energy for all uses (211)(221) +	. , , , ,	, ,				4366.71	(338
12a. CO2 emissions – Individual heating system	is including mi	Cro-CHP					
	Engrav		Emissio		tor	Emissions kg CO2/yea	
	Energy kWh/year		kg CO2	/kWh		•	
Space heating (main system 1)			kg CO2/ 0.216		= [459.89	(26
Space heating (main system 1) Space heating (secondary)	kWh/year			3	= [= [459.89	(26 (26
Space heating (secondary)	kWh/year		0.216)	L		_
Space heating (secondary) Vater heating	kWh/year (211) x (215) x (219) x	+ (263) + (264) =	0.216)	= [0	(26
	kWh/year (211) x (215) x (219) x	+ (263) + (264) =	0.216 0.519 0.216	3	= [0 415.44 875.33] (26] (26
Space heating (secondary) Vater heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262)	+ (263) + (264) =	0.216	5) 5)	= [0 415.44](26](26](26

TER =

(273)

20.59

		l lear E	Details:						
Assessor Name:	Chris Hocknell	<u> </u>	Strom	_				016363	
Software Name:	Stroma FSAP 2012		Softwa				Versio	on: 1.0.5.51	
Address :	ŀ	roperty	Address	Flat-40	1-LEAN				
1. Overall dwelling dimen	sions:								
<u> </u>		Are	a(m²)		Av. He	ight(m)		Volume(m³)
Ground floor		7	71.04	(1a) x	2	2.7	(2a) =	191.81	(3a)
Total floor area TFA = (1a))+(1b)+(1c)+(1d)+(1e)+(1	1) T	71.04	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	191.81	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	r
Number of chimneys	0 + 0	+	0] = [0	X e	40 =	0	(6a)
Number of open flues	0 + 0	- + -	0	Ī = Ē	0	x :	20 =	0	(6b)
Number of intermittent fan:	s <u> </u>			, <u> </u>	3	x	10 =	30	(7a)
Number of passive vents				F	0	x	10 =	0	(7b)
Number of flueless gas fire	es			_ [0	x	40 =	0	(7c)
_				L					``
							Air ch	nanges per ho	our
•	s, flues and fans = $(6a)+(6b)+(6b)$				30		÷ (5) =	0.16	(8)
If a pressurisation test has been Number of storeys in the	en carried out or is intended, procee e dwelling (ns)	d to (17),	otherwise o	ontinue fr	om (9) to	(16)		0	(9)
Additional infiltration	o awaiiing (no)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2	5 for steel or timber frame o	0.35 fo	r masoni	y constr	uction			0	(11)
	sent, use the value corresponding to	the great	ter wall are	a (after					
deducting areas of opening If suspended wooden flo	s), ii equal user 0.35 oor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente	r 0.05, else enter 0	•	,.					0	(13)
Percentage of windows	and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)					0	(16)
	50, expressed in cubic metre	•	•	•	etre of e	envelope	area	5	(17)
·	y value, then $(18) = [(17) \div 20] + (18)$ if a pressurisation test has been do.				is heina u	sed		0.41	(18)
Number of sides sheltered			g. 00 a po.		.e .e			2	(19)
Shelter factor			(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporating	ng shelter factor		(21) = (18) x (20) =				0.35	(21)
Infiltration rate modified for	monthly wind speed		_		1			1	
Jan Feb N	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe								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.	23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltration rate (allowing for shelter and	d wind speed)	= (21a) x (22a	ı)m				
0.44 0.43 0.42 0.38 0.37	0.33 0.33	0.32 0.3	′	0.39	0.41		
Calculate effective air change rate for the applic	cable case	1		<u>l</u>	!		
If mechanical ventilation:	\ -	(NEX) (I	(001) (00)			0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a)	, , ,	. ,,	(23b) = (23a)			0	(23b)
If balanced with heat recovery: efficiency in % allowing for		•				0	(23c)
a) If balanced mechanical ventilation with hea		1 ^ ` 	`` 		- ` 	÷ 100] I	(0.4 -)
(24a)m= 0 0 0 0 0	0 0	0 (0	0		(24a)
b) If balanced mechanical ventilation without		` 	` 			İ	(0.41-)
(24b)m= 0 0 0 0 0	0 0	0 (0	0		(24b)
c) If whole house extract ventilation or positive	•			.)			
if $(22b)m < 0.5 \times (23b)$, then $(24c) = (23b)$ (24c)m =		0 0	`_	0	0	l	(24c)
, , , , , , , , , , , , , , , , , , , ,			, •				(210)
d) If natural ventilation or whole house positiv if (22b)m = 1, then (24d)m = (22b)m other	•		n² x 0.5]				
(24d)m= 0.6 0.59 0.59 0.57 0.57	0.55 0.55	0.55 0.5	56 0.57	0.58	0.58		(24d)
Effective air change rate - enter (24a) or (24b)	o) or (24c) or (2	4d) in box (25	5)		•	•	
(25)m= 0.6 0.59 0.59 0.57 0.57	0.55 0.55	0.55 0.5	56 0.57	0.58	0.58		(25)
3. Heat losses and heat loss parameter:							
ELEMENT Gross Openings	Net Area	U-value	AXU		k-value		A X k
area (m²) m²	A ,m²	W/m2K	(W/	K)	kJ/m²·l	(kJ/K
Doors	1.99 ×		= 1.99	╡			(26)
Windows Type 1		1/[1/(1.4)+ 0.04]		ᆜ			(27)
Windows Type 2		1/[1/(1.4)+ 0.04]		_			(27)
Windows Type 3	5.79 ×	1/[1/(1.4)+ 0.04]	7.68	_			(27)
Windows Type 4	2.19 X	1/[1/(1.4)+ 0.04]	2.9				(27)
Walls Type1 75.26 15.73	59.53 ×	0.18	= 10.72				(29)
Walls Type2 27.91 1.99	25.92 ×	0.18	= 4.67				(29)
Roof 75.26 0	75.26 ×	0.13	= 9.78				(30)
Total area of elements, m²	178.43						(31)
Party wall	10.99 x	0	= 0				(32)
Party floor	71.04						(32a)
* for windows and roof windows, use effective window U-val		g formula 1/[(1/U	l-value)+0.04] a	s given in	paragraph	3.2	
Fabric heat loss, W/K = S (A x U)		(26)(30) + (32	2) =			48.01	(33)
Heat capacity Cm = S(A x k)		(((28)(30) + (32	2) + (32a).	(32e) =	21732.64	=
Thermal mass parameter (TMP = Cm ÷ TFA) in	kJ/m²K	lr	ndicative Value	: Medium		250	(35)
For design assessments where the details of the construction can be used instead of a detailed calculation.		precisely the indic	ative values of	TMP in Ta	able 1f		`` ′
Thermal bridges: S (L x Y) calculated using App	pendix K					27.58	(36)
if details of thermal bridging are not known (36) = $0.05 \times (31)$	•						(0)
Total fabric heat loss		(3	33) + (36) =			75.59	(37)

entila	tion hea	it loss ca	alculated	monthly	y				` ′	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
88)m=	37.79	37.55	37.32	36.22	36.01	35.06	35.06	34.88	35.42	36.01	36.43	36.86		(3
leat tr	ansfer c	coefficier	nt, W/K						(39)m	= (37) + (38)m			
89)m=	113.37	113.14	112.9	111.8	111.6	110.64	110.64	110.47	111.01	111.6	112.01	112.45		
						-	-	-		•	Sum(39) ₁	12 /12=	111.8	(3
		<u> </u>	HLP), W/						` '	= (39)m ÷	<u> </u>			
l0)m=	1.6	1.59	1.59	1.57	1.57	1.56	1.56	1.55	1.56	1.57	1.58	1.58		— ,
lumbe	er of dav	s in mor	nth (Tab	le 1a)					,	4verage =	Sum(40) ₁	12 /12=	1.57	(4
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
↓1)m=	31	28	31	30	31	30	31	31	30	31	30	31		(4
, I							<u> </u>	I			<u> </u>			
4 \\/-	4 l 4	·										1-10/1- /		
₽. vva	iter neat	ing ener	rgy requi	rement:								kWh/yea	ar:	
		ıpancy, I										.27		(
			+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.	.9)			
	A £ 13.9	,	ater usac	ne in litre	s ner da	y Vd av	erane =	(25 x N)	+ 36			144		
								to achieve		se target o		3.14		
t 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		
ot wate	r usage ii	n litres per	day for ea	<u> </u>		ctor from T	Table 1c x							
4)m=	96.95	93.43	89.9	86.38	82.85	79.32	79.32	82.85	86.38	89.9	93.43	96.95		
· I			<u> </u>	ļ				<u> </u>		Γotal = Su	<u>I</u> m(44) ₁₁₂ =	-	1057.67	
nergy c	ontent of	hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	th (see Ta	ables 1b, 1	c, 1d)		_
5)m=	143.78	125.75	129.76	113.13	108.55	93.67	86.8	99.6	100.79	117.47	128.22	139.24		
							ı	!		Total = Su	m(45) ₁₁₂ =	=	1386.77	
instant	aneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)			_		
6)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.89		(
	storage													
orag	e volum	e (litres)	includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		
	-	•	nd no ta		_			, ,						
			hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	storage		eclared l	oss facto	or ie kno	wn (k\//k	n/day):							
-					טווא פו וכ	wii (Kvvi	i/uay).					0		(
•			m Table					(40) (40)				0		•
			storage eclared o			or is not		(48) x (49)	, =			0		(
•			factor fr	-								0		(
		_	ee secti		. (=, =,	,							•
	•	from Tal										0		(
empe	rature f	actor fro	m Table	2b							_	0		(
nergy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(
		(54) in (5	_	,				• •	, ,		-	0		(
/ater	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
					0	0	0	0	0	0	0	0		(
6)m=	0	0	0	0										

If cylinder conta	ains dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circ	uit loss (ar	nual) fro	m Table	3	-	-	-	-			0		(58)
Primary circ				•	,	,	, ,						
(modified	by factor f	rom Tab	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)		•	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 49.4	1 43	45.81	42.6	42.22	39.12	40.42	42.22	42.6	45.81	46.07	49.41		(61)
Total heat re	equired 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= 193. ⁻	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		(62)
Solar DHW inp	ut calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add additio	nal lines if	FGHRS	and/or \	VWHRS	applies	, see Ap	pendix (3)				_	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	ter										_	
(64)m= 193. ⁻	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		_
							Outp	out from wa	ater heate	r (annual)₁	12	1915.45	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	א 8.0 + [ר	(46)m	+ (57)m	+ (59)m]	
(65)m= 60.1	6 52.56	54.6	48.26	46.65	40.93	38.97	43.67	44.16	50.51	54.15	58.65		(65)
include (5	7)m in cal	culation of	of (65)m	only if c	ylinder is	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga	ains (Table	e 5), Wat	ts										
Jai		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.5	56 113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56		(66)
Lighting gai	ns (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				-	
(67)m= 17.8	1 15.82	12.86	9.74	7.28	6.15	6.64	8.63	11.58	14.71	17.17	18.3		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	-	-		
(68)m= 199.7	71 201.78	196.56	185.44	171.41	158.22	149.41	147.34	152.56	163.68	177.71	190.9		(68)
Cooking gai	ns (calcula	ted in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5			•	
(69)m= 34.3	6 34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36		(69)
Pumps and	fans gains	(Table 5	5a)				•			•	•	•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)	•	•				•	•	
(71)m= -90.8	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84		(71)
Water heati	ng gains (1	able 5)								!	!	•	
(72)m= 80.8	6 78.22	73.39	67.03	62.7	56.84	52.37	58.7	61.34	67.89	75.21	78.83		(72)
Total intern	al gains =				(66)	m + (67)m	ı + (68)m +	+ (69)m + ((70)m + (7	1)m + (72))m	•	
(73)m= 358.4	14 355.88	342.88	322.28	301.45	281.27	268.49	274.73	285.55	306.34	330.16	348.1		(73)
6. Solar ga	ins:												
Solar gains a	re calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to co	nvert to th	e applicat	ole orientat	tion.		
Orientation:	Access F Table 6d		Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	Ta	FF able 6c		Gains (W)	

N		1		1		1		ı		1		٦
Northeast _{0.9x}	0.77	X	0.9	X	11.28	X	0.63	X	0.7] =	3.1	(75)
Northeast _{0.9x}	0.77	X	0.9	Х	22.97	X	0.63	X	0.7	=	6.32	(75)
Northeast _{0.9x}	0.77	X	0.9	X	41.38	X	0.63	X	0.7] =	11.38	(75)
Northeast _{0.9x}	0.77	X	0.9	X	67.96	X	0.63	X	0.7	=	18.69	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.35	X	0.63	X	0.7	=	25.12	(75)
Northeast _{0.9x}	0.77	X	0.9	X	97.38	X	0.63	X	0.7	=	26.79	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.1	X	0.63	X	0.7	=	25.06	(75)
Northeast _{0.9x}	0.77	X	0.9	X	72.63	X	0.63	X	0.7	=	19.98	(75)
Northeast _{0.9x}	0.77	X	0.9	X	50.42	X	0.63	X	0.7	=	13.87	(75)
Northeast _{0.9x}	0.77	X	0.9	X	28.07	X	0.63	X	0.7	=	7.72	(75)
Northeast _{0.9x}	0.77	X	0.9	x	14.2	X	0.63	X	0.7] =	3.9	(75)
Northeast _{0.9x}	0.77	X	0.9	x	9.21	X	0.63	X	0.7	=	2.53	(75)
Southeast _{0.9x}	0.77	X	5.79	X	36.79	X	0.63	X	0.7	=	65.11	(77)
Southeast _{0.9x}	0.77	X	5.79	X	62.67	X	0.63	X	0.7	=	110.9	(77)
Southeast 0.9x	0.77	X	5.79	x	85.75	x	0.63	x	0.7	=	151.74	(77)
Southeast 0.9x	0.77	X	5.79	x	106.25	X	0.63	X	0.7	=	188.01	(77)
Southeast _{0.9x}	0.77	X	5.79	x	119.01	X	0.63	X	0.7] =	210.59	(77)
Southeast _{0.9x}	0.77	X	5.79	x	118.15	X	0.63	X	0.7] =	209.07	(77)
Southeast _{0.9x}	0.77	X	5.79	x	113.91	x	0.63	x	0.7] =	201.56	(77)
Southeast _{0.9x}	0.77	X	5.79	x	104.39	x	0.63	x	0.7] =	184.72	(77)
Southeast _{0.9x}	0.77	X	5.79	x	92.85	X	0.63	X	0.7] =	164.3	(77)
Southeast 0.9x	0.77	x	5.79	x	69.27	x	0.63	x	0.7] =	122.57	(77)
Southeast _{0.9x}	0.77	X	5.79	x	44.07	x	0.63	x	0.7] =	77.98	(77)
Southeast _{0.9x}	0.77	X	5.79	x	31.49	x	0.63	x	0.7] =	55.72	(77)
Northwest _{0.9x}	0.77	X	1.37	x	11.28	x	0.63	x	0.7] =	23.62	(81)
Northwest _{0.9x}	0.77	X	2.19	x	11.28	x	0.63	x	0.7] =	7.55	(81)
Northwest _{0.9x}	0.77	X	1.37	x	22.97	x	0.63	x	0.7] =	48.08	(81)
Northwest _{0.9x}	0.77	x	2.19	x	22.97	x	0.63	x	0.7] =	15.37	(81)
Northwest _{0.9x}	0.77	x	1.37	x	41.38	x	0.63	x	0.7] =	86.62	(81)
Northwest 0.9x	0.77	x	2.19	x	41.38	x	0.63	x	0.7	j =	27.69	(81)
Northwest _{0.9x}	0.77	x	1.37	x	67.96	x	0.63	x	0.7	j =	142.26	(81)
Northwest _{0.9x}	0.77	x	2.19	x	67.96	x	0.63	x	0.7	j =	45.48	(81)
Northwest 0.9x	0.77	x	1.37	x	91.35	x	0.63	x	0.7	j =	191.23	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.35	x	0.63	x	0.7	j =	61.14	(81)
Northwest _{0.9x}	0.77	X	1.37	x	97.38	x	0.63	x	0.7	j =	203.87	(81)
Northwest _{0.9x}	0.77	X	2.19	x	97.38	x	0.63	x	0.7	j =	65.18	(81)
Northwest _{0.9x}	0.77	x	1.37	x	91.1	x	0.63	x	0.7	j =	190.72	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.1	x	0.63	x	0.7	i =	60.97	(81)
Northwest 0.9x	0.77	X	1.37	x	72.63	X	0.63	x	0.7] =	152.04	(81)
Northwest 0.9x	0.77	X	2.19	x	72.63	X	0.63	x	0.7] =	48.61	(81)
Northwest 0.9x	0.77	X	1.37	×	50.42	X	0.63	X	0.7] =	105.55	(81)
L		1		ı								

Northwest 0.9x	0.77	x	2.1	9	x	50.42] x		0.63	x	0.7	=	33.75	(81)
Northwest 0.9x	0.77	x	1.3	37	x	28.07] x [0.63	x [0.7	=	58.76	(81)
Northwest 0.9x	0.77	X	2.1	9	x	28.07] x [0.63	x	0.7	=	18.79	(81)
Northwest 0.9x	0.77	x	1.3	57	x	14.2] x [0.63	x	0.7	=	29.72	(81)
Northwest 0.9x	0.77	х	2.1	9	x	14.2] x [0.63	x	0.7	=	9.5	(81)
Northwest 0.9x	0.77	x	1.3	7	x	9.21	x		0.63	_ x [0.7	=	19.29	(81)
Northwest 0.9x	0.77	x	2.1	9	x	9.21	i × i		0.63	_ x [0.7	=	6.17	(81)
•														
Solar gains in	watts, ca	alculated	for eacl	n month			(83)m	= Su	m(74)m .	(82)m				
(83)m= 99.38	180.67	277.44	394.45	488.08	504.9	478.31	405.3	34	317.47	207.83	121.11	83.71		(83)
Total gains –	internal a	and solar	(84)m =	(73)m ·	+ (83)n	n , watts						_		
(84)m= 457.82	536.55	620.32	716.73	789.53	786.17	746.8	680.0	80	603.02	514.17	451.27	431.81		(84)
7. Mean inte	rnal temp	perature	(heating	season)									
Temperature	•		`		,	from Ta	ble 9,	Th1	(°C)				21	(85)
Utilisation fa	ctor for g	ains for l	iving are	ea, h1,m	(see T	able 9a)			, ,					
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	ıg	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.99	0.96	0.89	0.76	0.6	0.67	- +	0.88	0.98	0.99	1		(86)
Mean interna	al tompor	aturo in	living or	Do T1 /fc	llow et	one 3 to	7 in T	abla	00)		1			
(87)m= 19.24	19.42	19.74	20.18	20.59	20.86	20.96	20.9	-	20.71	20.19	19.64	19.21		(87)
	ļ	<u> </u>			<u> </u>	<u> </u>				20.10	10.01	10.21		(- /
Temperature	T					`	1		` ′	40.00	10.00	I 40.00	[(00)
(88)m= 19.62	19.62	19.62	19.63	19.63	19.64	19.64	19.6	55	19.64	19.63	19.63	19.63		(88)
Utilisation fac	ctor for g	ains for ı	est of d	welling,	h2,m (s	see Table	9a)						ı	
(89)m= 1	0.99	0.98	0.94	0.84	0.65	0.44	0.5	1	0.81	0.96	0.99	1		(89)
Mean_interna	al temper	ature in	the rest	of dwelli	ng T2	(follow ste	eps 3	to 7	in Tabl	e 9c)				
(90)m= 17.32	17.59	18.06	18.69	19.24	19.55	19.63	19.6	32	19.41	18.71	17.91	17.29		(90)
									f	LA = Livir	ng area ÷ (4) =	0.39	(91)
Mean interna	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1 -	– fL/	۹) × T2					
(92)m= 18.06	18.3	18.71	19.27	19.76	20.06	20.14	20.1	-	19.91	19.28	18.58	18.03		(92)
Apply adjust	ment to the	he mean	internal	temper	ature fr	om Table	4e, v	wher	re appro	priate	•			
(93)m= 18.06	18.3	18.71	19.27	19.76	20.06	20.14	20.1	3	19.91	19.28	18.58	18.03		(93)
8. Space hea	ating requ	uirement					•							
Set Ti to the					ed at s	tep 11 of	Table	e 9b	, so tha	t Ti,m=(76)m an	d re-calc	culate	
the utilisation	1					1		_	_	_			1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	ıg	Sep	Oct	Nov	Dec		
Utilisation fac	ctor for ga			0.85	0.68	0.5	0.5	, T	0.82	0.06	1 0 00	1 4		(94)
` '		0.98	0.94		0.00	0.5	0.57	<u>′ </u>	0.02	0.96	0.99	1		(94)
Useful gains (95)m= 455.11	·	605.01	671.39	668.13	536.66	376.97	387.8	82 T	497.22	493.5	446.49	429.76		(95)
Monthly ave					<u> </u>	1 37 3.37	1 337.0	<u> </u>	101.22	1.00.0	1 . +0.40	1 .20.70		()
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	₄ T	14.1	10.6	7.1	4.2		(96)
Heat loss rat	l				l		<u> </u>				<u> </u>	<u> </u>		
	1515.74	1378.31		899.33	603.85	-``	411.9	́ т	645.2	969.16	1285.96	1555.14		(97)
Space heatir	ng require	ement fo	r each m	nonth, k	Nh/mo	nth = 0.02	24 x [((97)r	m – (95)m] x (4	1)m		I	
(98)m= 822.45	Ť	575.34	351.15	172.02	0	0	0	Ť	0	353.89	604.42	837.28		
											•		1	

					Tota	l per vear	(kWh/year	r) = Sum(9	18) _{1 59 12} = [4378.61	(98)
Space heating requirement in	k\Mh/m²	lvear				po. jou.	(,)	<i>,</i> - Ca(0		61.64	(99)
·		-				VIID)			L	01.04	
9a. Energy requirements – Indi Space heating:	viduai ne	eating sy	/stems i	ncluaing	micro-C	HP)					
Fraction of space heat from se	econdary	/supple	mentary	system					Γ	0	(201)
Fraction of space heat from m	ain syste	em(s)	·	•	(202) = 1 -	- (201) =			F	1	(202)
Fraction of total heating from r	nain sys	tem 1			(204) = (2	02) × [1 –	(203)] =		F	1	(204)
Efficiency of main space heati	ng syste	m 1							F	93.4	(206)
Efficiency of secondary/supple	ementary	/ heating	g system	ո, %					[0	(208)
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	∟ ear
Space heating requirement (c	alculated	l above)									
822.45 662.06 575.34	351.15	172.02	0	0	0	0	353.89	604.42	837.28		
(211) m = {[(98)m x (204)] } x 1	00 ÷ (20	6)									(211)
880.57 708.85 615.99	375.96	184.17	0	0	0	0	378.9	647.13	896.44		_
					Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	2=	4688.02	(211)
Space heating fuel (secondary	•	month									
$= \{[(98)\text{m x } (201)] \} \text{ x } 100 \div (206)$ $(215)\text{m} = 0 \qquad 0 \qquad 0$	8) 0	0	0	0	0	0	0	0	0		
(213)111- 0 0			0				ar) =Sum(2			0	(215)
Water heating Output from water heater (calculated) 193.18 168.75 175.57	ulated ab	ove) 150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		_
Efficiency of water heater										80.3	(216)
(217)m= 88.29 88.15 87.82	87.04	85.38	80.3	80.3	80.3	80.3	86.95	87.92	88.36		(217)
Fuel for water heating, kWh/mc (219)m = (64)m x 100 ÷ (217)											
(219)m= 218.81 191.44 199.93	178.92	176.58	165.37	158.43	176.62	178.57	187.79	198.23	213.51		
					Tota	I = Sum(2	19a) ₁₁₂ =			2244.2	(219)
Annual totals							k'	Wh/year	, 	kWh/yea	r ¬
Space heating fuel used, main	system [*]	1							Ĺ	4688.02	╛
Water heating fuel used										2244.2	
Electricity for pumps, fans and	electric k	keep-hot	t								
central heating pump:									30		(230c
boiler with a fan-assisted flue									45		(230e
Total electricity for the above, k	:Wh/year	-			sum	of (230a).	(230g) =			75	(231)
Electricity for lighting									Ţ	314.48	(232)
Total delivered energy for all us	ses (211))(221)	+ (231)	+ (232).	(237b)	=			Ţ	7321.7	(338)
12a. CO2 emissions – Individu	ual heatii	ng <u>syst</u> e	ems inclu	udi <u>ng mi</u>	cro <u>-CH</u> E)			L		

Energy kWh/year **Emissions**

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.216	=	1012.61	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	484.75	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1497.36	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	163.22	(268)
Total CO2, kg/year	sum	of (265)(271) =		1699.5	(272)

TER = 23.92 (273)

Sasessor Name: Chris Hocknell Stroma Number: STRO016363			l lser I)etails: _						
Address: 1. Overall dwelling dimensions: Area(m*)		_	<u> </u>	Strom	-					
## Coveral works Substitution Su	Software Name.	-	Property					VEISIC	л. т.о.э.эт	
Strough Stro	Address :		roporty	, taa1000	. r lat 10					
Ground floor Solidar	1. Overall dwelling dime	ensions:								
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)	0 15				1			٦	· ` `	<u>^</u>
Dwelling volume				50.44	(1a) x		2.7	(2a) =	136.19	(3a)
2. Ventilation rate: main heating heati	Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	50.44	(4)					
Number of chimneys	Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	136.19	(5)
Number of chimneys Number of open flues 0	2. Ventilation rate:									
Number of open flues			ry 	other	_	total			m³ per hou	ır
Number of intermittent fans	Number of chimneys	0 + 0] + [0] = [0	X 4	40 =	0	(6a)
Number of passive vents	Number of open flues	0 + 0	+	0] = [0	x 2	20 =	0	(6b)
Number of flueless gas fires	Number of intermittent fa	ins				2	X ·	10 =	20	(7a)
Air changes per hour	Number of passive vents	3			Ī	0	x -	10 =	0	(7b)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20	Number of flueless gas f	ires			Ī	0	X 4	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)								Air ch	nanges per ho	our
Number of storeys in the dwelling (ns) Additional infiltration (19)-1)x0.1 = 0 (10) (10)		•						÷ (5) =	0.15	(8)
Additional infiltration			ed to (17),	otherwise (continue fr	om (9) to	(16)		0	(9)
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	•	ne awaiing (na)					[(9)	-1]x0.1 =		_
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)	Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	ry constr	ruction	. ,			=
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 Window infiltration 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 If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20) 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			o the grea	ter wall are	a (after					
If no draught lobby, enter 0.05, else enter 0			.1 (seal	ed), else	enter 0				0	(12)
Percentage of windows and doors draught stripped	•		(/,						=
Infiltration rate Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.34 (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	Percentage of window	s and doors draught stripped							0	(14)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] =	Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
If based on air permeability value, then $(18) = [(17) \div 20] \div (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ 0.85 (20) Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ Monthly average wind speed from Table 7 $(22) = 5.1 + 5 + 4.9 + 4.4 + 4.3 + 3.8 + 3.8 + 3.8 + 3.7 + 4 + 4.3 + 4.5 + 4.7$ Wind Factor $(22a) = (22) = 4$									0	(16)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85 (20)$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.34 (21)$ 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 $(22a)m = (22)m \div 4$	•	·	•	•	•	etre of e	envelope	area	5	╡``
Number of sides sheltered	•	•				is being u	sed		0.4	(18)
Shelter factor $ (20) = 1 - [0.075 \times (19)] = 0.85 $			ne or a de	gree an pe	ппеаышу	is being u	seu		2	(19)
Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec				(20) = 1 -	[0.075 x (19)] =				→ ' '
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 3.7 4 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate incorpora	ting shelter factor		(21) = (18) x (20) =				0.34	(21)
Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.7 4 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate modified f	for monthly wind speed								
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.7 4 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4	Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind Factor (22a)m = (22)m ÷ 4	Monthly average wind sp	peed from Table 7		•	•				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 = (2	2)m ÷ 4								
		' , , , , , , , , , , , , , , , , , , ,	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltr	ation rate	(allowi	ng for sl	nelter an	ıd wind s	speed) =	(21a) x	(22a)m					
0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4]	
Calculate effect		•	rate for t	he appli	cable ca	se	•	•	•	•	•		(00-1)
If exhaust air h			endix N (2	3h) = (23;	a) x Fmv (6	equation (I	N5)) othe	rwise (23h	n) = (23a)			0	(23a)
If balanced with									, (200)			0	(23b) (23c)
a) If balance		-	-	_					2h)m + (23h) x [1 – (23c)		(230)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If balance	ed mechar	nical ve	ntilation	without	heat red	covery (N	л ЛV) (24k	o)m = (22	2b)m + (23b)	1	ı	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If whole h	ouse extr			•	•				5 x (23h	,	•	•	
(24c)m = 0	0.5 * 1	0	0	0	0	0	0	0	0	0	0	1	(24c)
d) If natural		•										J	,
,	n = 1, the			•	•				0.5]			_	
(24d)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(24d)
Effective air	change ra	ate - er	nter (24a) or (24I	o) or (24	c) or (24	d) in bo	x (25)	-		-		
(25)m= 0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58		(25)
3. Heat losse	s and hea	at loss p	paramet	er:									
ELEMENT	Gross area (i		Openin m	Ξ	Net Ar A ,r		U-val W/m2		A X U (W/I		k-value kJ/m²·		A X k kJ/K
Doors					1.99	х	1	=	1.99				(26)
Windows Type	e 1				1.37	x1	/[1/(1.4)+	0.04] =	1.82				(27)
Windows Type	e 2				4.65	x1	/[1/(1.4)+	0.04] =	6.16				(27)
Windows Type	e 3				1.54	x1	/[1/(1.4)+	0.04] =	2.04				(27)
Walls Type1	55.8		8.93		46.87	7 X	0.18	= İ	8.44			\neg	(29)
Walls Type2	22.49	,	1.99		20.5	x	0.18	- = i	3.69			\exists \Box	(29)
Roof	50.44	<u> </u>	0		50.44	1 X	0.13	- = i	6.56	T i		7 F	(30)
Total area of e	elements,	m²			128.7	3							(31)
Party wall					9.64	X	0	=	0				(32)
Party floor					50.44	<u> </u>						7 F	(32a)
* for windows and ** include the area						ated using	ı formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragrapl	1 3.2	
Fabric heat los	ss, W/K =	S (A x	U)				(26)(30) + (32) =				32.51	(33)
Heat capacity	Cm = S(A	Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	17007.00	(34)
Thermal mass	paramete	er (TMF	P = Cm +	- TFA) ir	n kJ/m²K	•		Indica	itive Value	: Medium		250	(35)
For design assess can be used inste				construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L x	κY) cal	culated	using Ap	pendix l	K						20.48	(36)
if details of therma		re not kn	own (36) =	= 0.05 x (3	11)			(22)	(0.0)				
Total fabric he		ا داددا	l	_					(36) =	05): (5)		52.99	(37)
Ventilation hea			· ·		1, ,,,,	1,.1		- 	= 0.33 × (<u> </u>	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	J	

	<u> </u>	i	i	i	i	i	ı		î	i	i	1	
(38)m= 26		26.31	25.56	25.43	24.78	24.78	24.66	25.03	25.43	25.71	26		(38)
	fer coefficie	1			T				= (37) + (37)			1	
(39)m= 79	.62 79.46	79.3	78.56	78.42	77.77	77.77	77.65	78.02	78.42	78.7	78.99	70.50	(39)
Heat loss p	parameter (HLP), W	/m²K						= (39)m ÷	Sum(39) ₁ .	12 /12=	78.56	(39)
(40)m= 1.5	58 1.58	1.57	1.56	1.55	1.54	1.54	1.54	1.55	1.55	1.56	1.57		_
Number of	days in mo	nth (Tah	(د1 ما					•	Average =	Sum(40) ₁	12 /12=	1.56	(40)
	an Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
	1 28	31	30	31	30	31	31	30	31	30	31		(41)
. ,		<u> </u>											
1 Water	hooting one	rav roau	iromont:								kWh/ye	oor:	
4. Water	heating ene	rgy requ	irement.								KVVII/ye	al.	
	occupancy,									1	.7		(42)
	13.9, N = 1 13.9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (ΓFA -13.	.9)		•	
	erage hot w	ater usad	ge in litre	es per da	av Vd.av	erage =	(25 x N)	+ 36		74	1.65		(43)
Reduce the a	nnual average	hot water	usage by	5% if the a	lwelling is	designed t			se target o			l	(- /
not more that	t 125 litres per	person per	r day (all w	ater use, I	not and co	ld)			ı			1	
	an Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usa	age in litres pe	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)		ı	ı		1	
(44)m= 82	.11 79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11		_
Energy conte	nt of hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x D)Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		895.77	(44)
(45)m= 121	1.77 106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		
									Total = Su	m(45) ₁₁₂ =	=	1174.5	(45)
If instantaneo	ous water heat	ing at point	of use (no	hot water	r storage),	enter 0 in	boxes (46,) to (61)	_	_			
(46)m= 18	ı	16.48	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(46)
Water stor	_	مانام داد مانا		-lan an \A	MAILIDO	-4	ماطانين				_	1	(4-)
Ü	olume (litres	,	0 ,			Ü		ame ves	sei		0		(47)
	ity heating a if no stored			_			, ,	ars) ante	ar 'O' in <i>(</i>	<i>1</i> 7)			
Water stor		not wate	zi (ulio ii	ioiuues i	nstantai	ieous cc	IIIDI DON	crs) crit	51 0 111 (71)			
	ıfacturer's d	eclared l	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperatu	ire factor fro	m Table	2b								0		(49)
Energy los	t from wate	r storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
•	ıfacturer's d		-										, ,
	storage loss			e 2 (kW	h/litre/da	ıy)					0		(51)
	ity heating s ctor from Ta		on 4.3								_	1	(50)
	re factor from		2h								0		(52) (53)
				201			(47) v (E4)	\ \ (EQ) \ \ (E2) -]	
	t from wate or (54) in (_	;, KVV11/Y6	zai			(47) x (51)) X (32) X (JJ) =	-	0		(54) (55)
` '	age loss ca	•	for each	month			((56)m = (55) × <i>(</i> 41)	m		U	I	(55)
	`					1			ı			1	(EG)
()	0 0 ntains dedicate	0 ed solar sto	0 rage (57)	0 m = (56)m	0 x [(50) = (0 H11)1 ÷ (5	0 0) else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 om Append] lix H	(56)
				1		1			1			1	/ >
(57)m= () I 0	0	0	0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) fro	om Table 3				0		(58)
Primary circuit loss calculated		9)m = (58) ÷ 36	5 × (41)m				
(modified by factor from Tab	le H5 if there is sol	lar water heatin	ng and a cylind	er thermostat)			
(59)m= 0 0 0	0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each	month (61)m = (60	0) ÷ 365 × (41)	m				
(61)m= 41.84 36.42 38.8	, , , , , , , , , , , , , , , , , , , 	33.13 34.24	35.76 36.08	38.8 39.02	41.84		(61)
Total heat required for water h	eating calculated fo	or each month	(62)m = 0.85 ×	(45)m + (46)m +	 · (57)m +	(59)m + (61)m	
(62)m= 163.61 142.92 148.7		112.46 107.75	120.12 121.44	`````	159.77		(62)
Solar DHW input calculated using App		!		I I I I I I I I I I I I I I I I I I I	er heating)		
(add additional lines if FGHRS							
(63)m= 0 0 0	0 0	0 0	0 0	0 0	0		(63)
Output from water heater	<u> </u>	II	<u> </u>				
(64)m= 163.61 142.92 148.7	131.89 127.69 1	112.46 107.75	120.12 121.44	138.29 147.62	159.77		
(0.7)				water heater (annual)	1	1622.26	(64)
Heat gains from water heating	kWh/month 0.25 ′	′ [0 85 x (45)m			'		1,
(65)m= 50.95 44.52 46.24		34.66 33	36.99 37.4	42.78 45.86	49.67		(65)
` '		!!			ļ		(00)
include (57)m in calculation	. ,	inder is in the d	iweiling or not	water is from con	imunity n	eaung	
5. Internal gains (see Table 5	•						
Metabolic gains (Table 5), Wat				1		1	
Jan Feb Mar	Apr May	Jun Jul	Aug Sep		Dec		(00)
(66)m= 85.15 85.15 85.15	85.15 85.15 8	85.15 85.15	85.15 85.15	85.15 85.15	85.15	I	(66)
Lighting gains (calculated in A	· · · · ·	n L9 or L9a), al	so see Table 5	5		•	
(67)m= 13.55 12.03 9.79	7.41 5.54	4.68 5.05	6.57 8.81	11.19 13.06	13.92	I	(67)
Appliances gains (calculated in	n Appendix L, equa	ntion L13 or L13	3a), also see T	able 5			
(68)m= 148.38 149.92 146.04	137.78 127.35 1	117.55 111	109.46 113.34	121.6 132.03	141.83		(68)
Cooking gains (calculated in A	ppendix L, equatio	n L15 or L15a)	, also see Tabl	e 5			
(69)m= 31.52 31.52 31.52	31.52 31.52 3	31.52 31.52	31.52 31.52	31.52 31.52	31.52		(69)
Pumps and fans gains (Table s	5a)			-			
(70)m= 3 3 3	3 3	3 3	3 3	3 3	3		(70)
Losses e.g. evaporation (nega	tive values) (Table	5)	•		•		
(71)m= -68.12 -68.12 -68.12	 	-68.12 -68.12	-68.12 -68.12	-68.12 -68.12	-68.12		(71)
Water heating gains (Table 5)	I I		·	I I			
(72)m= 68.48 66.24 62.15	56.77 53.1	48.14 44.36	49.72 51.95	57.5 63.7	66.76		(72)
Total internal gains =		!		+ (70)m + (71)m + (72			
(73)m= 281.95 279.74 269.52	253.5 237.54 2	221.91 211.96	217.29 225.65		274.06		(73)
6. Solar gains:	200.0 201.04 2	21.01	217.23 220.00	241.04 200.04	274.00		(1-)
Solar gains are calculated using sola	ır flux from Table 6a and	d associated equat	tions to convert to	the applicable orienta	tion.		
Orientation: Access Factor	Area	Flux	g_	FF		Gains	
Table 6d	m²	Table 6a	Table 6			(W)	
Northeast _{0.9x} 0.77 x	4.65 ×	11.28	x 0.63	x 0.7		16.03	(75)
Northeast 0.9x 0.77 x		11.28	x 0.63	x 0.7	 	5.31	(75)
0.77 A	1.07	11.20	0.00			0.01	1,, 0,

Jan		Mar	Apr Ma	Ť	Jun	Jul	Αι	ug Sep	Oct	Nov	Dec		
Utilisation fac	•	•		_			, פיטו	(0)					
7. Mean inter Temperature	· · · · · · · · · · · · · · · · · · ·				area f	rom Tah	nle 0	Th1 (°C)				21	(85)
					.00.01	713.00	L	330.79	552.32	7 324.1	317.00	<u></u>	(=+)
(84)m= 334.1		Solar 19.61	$\frac{(84)\text{m} = (73)\text{m}}{471.03} = 510$	`	63)III ,	479.68	442	.1 398.79	352.94	1 324.1	317.86]	(84)
(83)m= 52.15 Total gains – ii		50.09 solar	$\begin{array}{c c} 217.53 & 272.4 \\ \hline (84)m = (73)a \end{array}$		83.16	267.73	224	81 173.14	111.1	63.76	43.8]	(83)
Solar gains in			-		02 42 1			= Sum(74)m .		00.70	40.0	1	(02)
_		_		_			•		_				_
Southwest _{0.9x}	0.77	X	1.37	X	3	1.49	j	0.63	X	0.7	=	26.37	(79)
Southwest _{0.9x}	0.77	X	1.37	×		4.07	j i	0.63	X	0.7	╡ =	36.9	(79)
Southwest _{0.9x}	0.77	X	1.37	X	6	9.27	j	0.63	×	0.7	= =	58	(79)
Southwest _{0.9x}	0.77	X	1.37	X		2.85		0.63	X	0.7	_ =	77.75	(79)
Southwest _{0.9x}	0.77	→ x	1.37] x		4.39	, 	0.63	×	0.7	╡ -	87.41	(79)
Southwest _{0.9x}	0.77	X	1.37]	_	3.91	, 	0.63	X	0.7	= =	95.39	(79)
Southwest _{0.9x}	0.77	^ x	1.37	」 ^ x		8.15] 	0.63	$\frac{1}{x}$	0.7	╡ -	98.94	(79)
Southwest _{0.9x}	0.77	 	1.37	」 ^] x		9.01]]	0.63	-	0.7	╡ -	99.66	(79)
Southwest _{0.9x}	0.77	-	1.37	」 ^] x		6.25]]	0.63	-	0.7	╡ -	88.97	$= \frac{(79)}{(79)}$
Southwest _{0.9x}	0.77		1.37	」 ^] _×		2.67 5.75]]	0.63	_	0.7	╡ -	52.48 71.81	= (79)
Southwest _{0.9x}	0.77	」 × □ ×	1.37	」 ×] x		6.79 2.67]]	0.63	x x	0.7		30.81	(79)
Southwest _{0.9x}	0.77	」 ×	1.54	」× □ ↓		.21	X	0.63	■ ×	0.7	┥ -	4.34	(79)
Northeast 0.9x	0.77	X ۲	4.65	」× ┐、	_	.21	X I v	0.63	X y	0.7	┥ -	13.09	(75)
Northeast 0.9x	0.77	」 ×	1.54	」× T ↓		4.2	X	0.63	_ X	0.7	=	6.68	(75)
Northeast 0.9x	0.77	→ × → ×	4.65	」× □ ↓	-	4.2	X	0.63	■ ×	0.7	_	20.18	(75)
Northeast 0.9x	0.77	」 ×	1.54	」× ┐、		3.07	X l v	0.63	→ × → ×	0.7	=	13.21	(75)
Northeast 0.9x	0.77	」 ×	4.65	」× ┐、		3.07	X	0.63	X → V	0.7	=	39.89	(75)
Northeast _{0.9x}	0.77	」 ×	1.54] X]		0.42	X	0.63	X	0.7	 	23.73	= (75)
Northeast 0.9x	0.77	X	4.65	X		0.42	X	0.63	X	0.7	_ =	71.65	(75)
Northeast 0.9x	0.77	X	1.54	X		2.63	X	0.63	X	0.7	_ =	34.18	(75)
Northeast 0.9x	0.77	X	4.65	X	_	2.63	X	0.63	×	0.7	_ =	103.21	(75)
Northeast 0.9x	0.77	X	1.54	X	g	1.1	X	0.63	X	0.7	_ =	42.88	(75)
Northeast 0.9x	0.77	X	4.65	X	9	1.1	X	0.63	X	0.7	=	129.46	(75)
Northeast 0.9x	0.77	X	1.54	X	9	7.38	X	0.63	X	0.7	=	45.83	(75)
Northeast _{0.9x}	0.77	X	4.65	X	9	7.38	X	0.63	X	0.7	=	138.39	(75)
Northeast _{0.9x}	0.77	X	1.54	X	9	1.35	X	0.63	X	0.7	=	42.99	(75)
Northeast 0.9x	0.77	X	4.65	X	9	1.35	X	0.63	X	0.7	=	129.81	(75)
Northeast 0.9x	0.77	X	1.54	X	6	7.96	X	0.63	X	0.7	=	31.98	(75)
Northeast 0.9x	0.77	X	4.65	X	6	7.96	x	0.63	X	0.7	=	96.57	(75)
Northeast 0.9x	0.77	X	1.54	X	4	1.38	X	0.63	X	0.7	=	19.47	(75)
Northeast 0.9x	0.77	X	4.65	X	4	1.38	x	0.63	X	0.7	=	58.8	(75)
Northeast 0.9x	0.77	×	1.54	X	2	2.97	X	0.63	x	0.7	=	10.81	(75)
Northeast _{0.9x}	0.77	X	4.65	X		2.97	X	0.63	X	0.7	=	32.64	(75)

(86)m=	1	0.99	0.99	0.97	0.91	0.79	0.65	0.71	0.9	0.98	0.99	1		(86)
Mean	internal	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Table	e 9c)				•	
(87)m=	19.28	19.43	19.73	20.14	20.54	20.83	20.95	20.92	20.69	20.19	19.66	19.25		(87)
Temp	erature	durina h	eating p	eriods ir	rest of	dwellina	from Ta	ble 9. Ti	h2 (°C)	•	•			
(88)m=	19.63	19.63	19.63	19.64	19.65	19.66	19.66	19.66	19.65	19.65	19.64	19.64		(88)
l Itilie:	ation fac	tor for a	ains for	rest of d	welling	n2 m (se	e Tahle	0a)	Į.	l		ļ.	l	
(89)m=	1	0.99	0.98	0.95	0.87	0.69	0.48	0.54	0.83	0.97	0.99	1		(89)
	intornal	Ltompor	aturo in	the rest	of dwolli	na T2 /f	ollow etc	nc 3 to .	I 7 in Tabl	lo ()o)				
(90)m=	17.38	17.61	18.04	18.64	19.19	19.54	19.64	19.63	19.39	18.71	17.95	17.35		(90)
(00)	17.00	11.01	10.01	10.01	10.10	10.01	10.01	10.00			g area ÷ (4		0.54	(91)
			, ,,			\ 6		. /4 6	A) TO		•	<i>'</i>	0.01	
(92)m=		18.6	ature (fc	r the wh	19.93	ling) = fl 20.24	LA × 11	+ (1 – fL 20.33	A) × 12	19.51	18.88	18.38		(92)
				internal					<u> </u>		10.00	10.30		(02)
(93)m=	18.41	18.6	18.96	19.46	19.93	20.24	20.35	20.33	20.1	19.51	18.88	18.38		(93)
	ace hea	ting requ	uirement											
					e obtain	ed at ste	ep 11 of	Table 9l	b, so tha	ıt Ti,m=(76)m an	d re-calc	culate	
the ut	ilisation	factor fo	or gains	using Ta	ble 9a								•	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			ains, hm	1	2.22	0 = 4						I .	Ī	(04)
(94)m=		0.99	0.98	0.95	0.88	0.74	0.57	0.63	0.86	0.97	0.99	1		(94)
(95)m=	332.11	371.93	, VV = (94 411.25	4)m x (84 448.16	449.18	373.97	274.58	279.89	342.21	341.01	320.82	316.3		(95)
			l	perature			214.00	210.00	042.21	041.01	020.02	010.0		(00)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
	loss rate	for mea	ı an intern	ıal tempe	erature,	 Lm , W =	 =[(39)m :	x [(93)m	– (96)m	l]				
	1123.77		988.01	829.45	645.1	438.93	291.58	305.3	467.95	698.98	927.35	1120.47		(97)
Space	e heatin	g require	ement fo	r each m	nonth, k\	Wh/mont	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	588.99	481.78	429.11	274.53	145.77	0	0	0	0	266.33	436.7	598.3		
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	3221.5	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								63.87	(99)
9a. En	ergy red	uiremer	nts – Indi	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:												
Fracti	ion of sp	ace hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	ace hea	t from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fract	ion of to	tal heatii	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/ye	⊒ :ar
Space				alculate					<u> </u>		· · · · · ·		1	
	588.99	481.78	429.11	274.53	145.77	0	0	0	0	266.33	436.7	598.3		
(211)m	n = {[(98)m x (20	4)] } x 1	00 ÷ (20	16)					-			•	(211)
-	630.61	515.83	459.43	293.93	156.07	0	0	0	0	285.15	467.56	640.58		
								Tota	ıl (kWh/yea	ar) =Sum(2	211),15,1012	=	3449.14	(211)
												'		

215)m= 0 0 0 0 0 0	0 0	0 0	0	0 0	\neg	
215)m= 0 0 0 0 0		Total (kWh/y		=	0	(215
Water heating					L	_
Output from water heater (calculated above)			1 1		==1	
163.61	12.46 107.75	120.12 121.44	138.29 14	7.62 159		(216
· · · · · · · · · · · · · · · · · · ·	30.3 80.3	80.3 80.3	86.67 87	7.62 88.0	80.3	ار 217)
Fuel for water heating, kWh/month	30.0	00.0	1 00.01			(
(219)m = (64)m x 100 ÷ (217)m	<u> </u>	<u> </u>				
219)m= 185.94 162.65 169.82 151.85 149.55 14	40.06 134.18	149.58 151.24		8.48 181		٦
Annual totals		Total = Sum		hoor	1904.31 kWh/year	(219
Space heating fuel used, main system 1			kWh/	yeai	3449.14	7
Nater heating fuel used					1904.31	┪
Electricity for pumps, fans and electric keep-hot						_
central heating pump:				30		(230
boiler with a fan-assisted flue				45		(230
Fotal electricity for the above, kWh/year		sum of (230a	ı)(230g) =		75	(231
Electricity for lighting		•	, (0,		239.24](232
, ,	(221) ± (222)	(227h) -				╡
Total delivered energy for all uses (211)(221) +	. , , ,	` '			5667.7	(338
12a. CO2 emissions – Individual heating systems	s including mi	cro-CHP				
	Energy kWh/year		Emission kg CO2/k		Emissions kg CO2/yea	
Space heating (main system 1)	(211) x		0.216	=	745.02	(261
Space heating (secondary)	(215) x		0.519	=	0	(263
. 37	(219) x		0.216	_ =	411.33	(264
Vater heating						_ 7,00
	(261) + (262) -	+ (263) + (264) =			1156.35	(26
Vater heating Space and water heating	(261) + (262) - (231) x	+ (263) + (264) =	0.519	=	1156.35 38.93	_
Vater heating		+ (263) + (264) =	0.519	= = =](26)](26)](26)

TER =

(273)

26.16

Energy Assessment The Bird in Hand, Kilburn

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Be Lean - DER from the Be Lean scenario DER SAP worksheet

Appendix B 33

		Heer Detailer					
		User Details:					
Assessor Name:	Chris Hocknell	Stroma	_			016363	
Software Name:	Stroma FSAP 2012	Softwar			Versio	n: 1.0.5.51	
		operty Address: F	House-	H01-LEAN			
Address: 1. Overall dwelling dime	West End Lane, LONDON, N	IVV6 4NX					
1. Overall dwelling diffle	HISIOHS.	Area(m²)		Av. Height	(m)	Volume(m³	:\ :\
Basement			la) x	2.1	(111) (2a) = [120.54) (3a)
Ground floor		53.06	1b) x	2.85	(2b) =	151.22	(3b)
First floor			lc) x	3.08	(2c) =	163.42	(3c)
Second floor			' 1d) x	2.26	(2d) =	98.92	(3d)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1n)				\` ′ [` ′
Dwelling volume		`)+(3c)+(3d)+(3e	e)+(3n) =	534.11	(5)
						004.11	
2. Ventilation rate:	main secondary	other		total		m³ per hou	r
Number of chimneys	heating heating 0	+ 0	= [0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0	= [0	x 20 =	0	(6b)
Number of intermittent fa				0	x 10 =	0	(7a)
Number of passive vents				0	x 10 =	0	(7b)
Number of flueless gas fi				0	x 40 =	0	(7c)
J					l l		(, -/
					Air ch	anges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+(7a)$	a)+(7b)+(7c) =		0	÷ (5) =	0	(8)
	een carried out or is intended, proceed	to (17), otherwise co	ntinue fr	om (9) to (16)	·		_
Number of storeys in the	ne dwelling (ns)					0	(9)
Additional infiltration					[(9)-1]x0.1 =	0	(10)
	.25 for steel or timber frame or	•		uction	l	0	(11)
if both types of wall are pri deducting areas of openin	resent, use the value corresponding to a	the greater wall area	(after				
	loor, enter 0.2 (unsealed) or 0.1	l (sealed), else e	nter 0		Ī	0	(12)
If no draught lobby, en	,	(l I	0	(13)
•	s and doors draught stripped				I I	0	(14)
Window infiltration		0.25 - [0.2 x	: (14) ÷ 1	00] =	<u>[</u>	0	(15)
Infiltration rate		(8) + (10) +	(11) + (1	2) + (13) + (15)) = [0	(16)
	q50, expressed in cubic metres				ļ	 15	(17)
,	ity value, then (18) = [(17) ÷ 20]+(8)				Iopo urou 	0.75	(18)
•	s if a pressurisation test has been done			is being used	l	0.70	(10)
Number of sides sheltere				3	ſ	2	(19)
Shelter factor		(20) = 1 - [0	.075 x (1	9)] =	ł	0.85	(20)
Infiltration rate incorporat	ing shelter factor	$(21) = (18) \times$	(20) =		[0.64	(21)
Infiltration rate modified for	or monthly wind speed						_

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Jan

Feb

Monthly average	ge wind	speed fr	om Tabl	e 7									
(22)m= 5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\)O -)	(00)			•	•	•	•	•	•	•	•	
Wind Factor (2 (22a)m= 1.27	22a)m = 1.25	(22)m ÷	1.1	1.08	0.95	0.95	0.92	1 1	1.08	1.12	1.18]	
(224)111- 1.27	1.23	1.25	1.1	1.00	0.93	0.93	0.92		1.00	1.12	1.10		
Adjusted infiltra		- ` 				i 	`	` ´		1	1	1	
0.81 Calculate effect	0.8	0.78	0.7 rate for t	0.69 he appli	0.61 cable ca	0.61	0.59	0.64	0.69	0.72	0.75		
If mechanica		•	ato for t	пс арри	oubic ou	00						0.5	(23a)
If exhaust air he	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	o) = (23a)			0.5	(23b)
If balanced with	n heat rec	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23c)
a) If balance	d mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	_
(24a)m= 0.93	0.91	0.89	0.81	0.8	0.72	0.72	0.7	0.75	0.8	0.83	0.86		(24a)
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	ЛV) (24b	o)m = (2	2b)m + (23b)		-	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h				•	•								
if (22b)m	1	r` ´	· ` `	ŕ	ŕ	`	r ` ` 	ŕ	`	i 		1	(0.4 -)
(24c)m= 0	0	0		0	0	0	0	0	0	0	0		(24c)
d) If natural i if (22b)m				•	•				0.51				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)		•	1	1	
(25)m= 0.93	0.91	0.89	0.81	0.8	0.72	0.72	0.7	0.75	0.8	0.83	0.86		(25)
3. Heat losses	s and he	eat loss i	paramete	er:									
ELEMENT	Gro		Openin		Net Ar	ea	U-val	ue	AXU		k-value	e A.	X k
	area	(m²)	· m		A ,r	m²	W/m2	2K	(W/	K)	kJ/m²·l	K kJ	/K
Doors Type 1					3.67	X	1.6	=	5.872				(26)
Doors Type 2					2.85	X	1.6	=	4.56				(26)
Doors Type 3					2.35	X	1	=	2.35				(26)
Windows Type	1				2.22	х1	/[1/(1.6)+	0.04] =	3.34				(27)
Windows Type	2				1.13	х1	/[1/(1.6)+	0.04] =	1.7				(27)
Windows Type	3				0.61	х1	/[1/(1.6)+	0.04] =	0.92				(27)
Windows Type	e 4				2.25	х1	/[1/(1.6)+	0.04] =	3.38				(27)
Windows Type	5				1.77	x1	/[1/(1.6)+	0.04] =	2.66				(27)
Windows Type	6				1.31	x1	/[1/(1.6)+	0.04] =	1.97				(27)
Windows Type	e 7				0.68	x1	/[1/(1.6)+	0.04] =	1.02				(27)
Windows Type	. 0				2.69	x1	/[1/(1.6)+	0.04] =	4.05				(27)
	0												
Windows Type					1.03	x1	/[1/(1.6)+	0.04] =	1.55				(27)
Windows Type Windows Type	9						/[1/(1.6)+ /[1/(1.6)+		1.55 4.36				(27) (27)

Floor 7	ype 1					57.4	X	0.25	= [14.35				(28)
Floor 7	ype 2					53.06	x	0.25	= [13.265				(28)
Walls	Гуре1	81.4	.3	0		81.43	3 X	0.55	= [44.79				(29)
Walls	Гуре2	15.3	1	6.41		8.9	x	0.15	= [1.34				(29)
Walls	Гуре3	24.3	3	0		24.3	x	0.15	<u> </u>	3.65	-			(29)
Walls	Гуре4	101.4	44	33.5	7	67.87	7 X	0.55	<u> </u>	37.33	-			(29)
Roof ⁻	Гуре1	62.7	4	3.34		59.4	x	0.18	<u> </u>	10.69	-			(30)
Roof ⁻	Гуре2	10.9	16	0		10.96	<u>x</u>	0.18	<u> </u>	1.97			7	(30)
Total a	rea of e	lements	, m²			406.6	4							(31)
Party v	vall					58.5	x	0	= [0				(32)
			ows, use e sides of in				ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				191.96	(33)
Heat c	apacity	Cm = S(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	39052.95	(34)
Therm	al mass	parame	ter (TMF	P = Cm +	÷ TFA) ir	ı kJ/m²K			Indica	tive Value	Medium		250	(35)
	•		ere the de tailed calcu		constructi	ion are not	t known pr	ecisely the	indicative	e values of	TMP in Ta	able 1f		_
Therm	al bridge	es : S (L	x Y) cal	culated i	using Ap	pendix ł	<						61	(36)
			are not kn	own (36) =	= 0.05 x (3	1)								_
	abric he									(36) =	,,		252.95	(37)
Ventila			alculated		i		l			= 0.33 × (1	
(38)m=	Jan 163.22	Feb 160.41	Mar 157.6	Apr 143.56	May 140.75	Jun 126.71	Jul 126.71	Aug 123.9	Sep 132.32	Oct 140.75	Nov 146.37	Dec 151.99		(38)
,				140.00	140.75	120.71	120.71	120.0				101.00		(00)
(39)m=	416.18	oefficier	410.56	396.51	393.7	379.66	379.66	376.85	(39)m 385.28	393.7	38)m 399.32	404.94]	
(00)111-	410.10	+10.07	410.00	000.01	000.7	070.00	073.00	070.00		Average =			395.81	(39)
Heat lo	ss para	meter (H	HLP), W	m²K						= (39)m ÷				`
(40)m=	2.01	1.99	1.98	1.91	1.9	1.83	1.83	1.82	1.86	1.9	1.93	1.95		_
Numbe	er of day	e in moi	nth (Tab	(12 ما						Average =	Sum(40) ₁	12 /12=	1.91	(40)
Numbe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
` ,													I	
4. Wa	iter heat	ting ener	gy requi	rement:								kWh/ye	ear:	
Accum	and occu	inancy I	NI.									0.4	1	(40)
if TF				[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13.		.01		(42)
Annua	l averag	e hot wa						(25 x N) to achieve		se target o		5.72		(43)
		_				not and co	-			3 0.				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from 7	Table 1c x	(43)						
(44)m=	116.29	112.06	107.84	103.61	99.38	95.15	95.15	99.38	103.61	107.84	112.06	116.29		_
										Total = Su	m(44) ₁₁₂ =	=	1268.65	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) 172.46 150.83 155.65 130.2 112.36 104.11 119.47 120.9 140.9 153.8 167.02 (45)m =Total = $Sum(45)_{1...12}$ = 1663.4 (45)If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 25.87 22.63 23.35 20.35 (46)19.53 16.85 15.62 18.14 21.13 23.07 25.05 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): (48)Temperature factor from Table 2b 0 (49)Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)0 b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)If community heating see section 4.3 Volume factor from Table 2a 0 (52)Temperature factor from Table 2b 0 (53)Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ (54)0 Enter (50) or (54) in (55) (55)0 Water storage loss calculated for each month $((56)m = (55) \times (41)m$ (56)m =0 (56)If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H (57)(57)m =(58)Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = $(58) \div 365 \times (41)$ m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)(59)m =0 Combi loss calculated for each month (61)m = (60) \div 365 × (41)m 50.96 50.96 50.64 46.92 48.49 50.64 49.32 50.96 49.32 50.96 (61)(61)m=Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m 170.11 223.42 196.86 206.61 185.01 152.6 170.22 (62)180.85 159.28 191.86 203.12 217.98 (62)m=Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)(63)m=0 0 0 0 0 0 0 Output from water heater (64)m=223.42 196.86 206.61 185.01 180.85 159.28 152.6 170.11 170.22 191.86 203.12 217.98 (64)Output from water heater (annual)_{1...12} 2257.9 Heat gains from water heating, kWh/month 0.25 \(^{1}\) [0.85 \times (45)m + (61)m] + 0.8 \(^{1}\) [(46)m + (57)m + (59)m] 64.49 52.39 (65)(65)m =70.08 57.45 55.95 49.09 46.74 52.53 59.59 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 Aug Jan Feb Mar Apr May Jun Jul Sep Oct Nov Dec

(66)m=	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equati	on L9 o	r L9a), a	lso see	Table 5					
(67)m=	33.69	29.92	24.34	18.42	13.77	11.63	12.56	16.33	21.92	27.83	32.48	34.63		(67)
Applia	nces gai	ns (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Tal	ole 5				
(68)m=	377.92	381.84	371.96	350.92	324.37	299.41	282.73	278.81	288.69	309.73	336.29	361.25		(68)
Cookin	Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06		(69)
Pumps	Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46		(71)
Water	heating	gains (T	able 5)		_									
(72)m=	94.2	91.75	86.68	79.79	75.21	68.18	62.82	70.41	72.96	80.09	88.15	91.76		(72)
Total i	nternal	gains =				(66)	m + (67)m	+ (68)m +	- (69)m + (70)m + (7	1)m + (72)	m	•	
(73)m=	576.98	574.69	554.15	520.31	484.51	450.38	429.29	436.72	454.74	488.82	528.09	558.81		(73)
0.0.1														

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

	ess Factor le 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast _{0.9x}	0.77	x	0.68	x	11.28	x	0.55	x	0.8	=	7.02	(75)
Northeast _{0.9x}	0.77	x [0.68	x	22.97	x	0.55	x	0.8	=	14.29	(75)
Northeast _{0.9x}	0.77	x [0.68	x	41.38	x	0.55	x	0.8	=	25.74	(75)
Northeast _{0.9x}	0.77	x [0.68	x	67.96	x	0.55	x	0.8	=	42.27	(75)
Northeast _{0.9x}	0.77	x [0.68	x	91.35	x	0.55	x	0.8	=	56.82	(75)
Northeast _{0.9x}	0.77	×	0.68	x	97.38	x	0.55	X	0.8	=	60.58	(75)
Northeast _{0.9x}	0.77	x [0.68	x	91.1	x	0.55	x	0.8	=	56.67	(75)
Northeast _{0.9x}	0.77	x [0.68	x	72.63	x	0.55	x	0.8	=	45.18	(75)
Northeast _{0.9x}	0.77	×	0.68	x	50.42	x	0.55	x	0.8	=	31.36	(75)
Northeast _{0.9x}	0.77	x [0.68	x	28.07	x	0.55	x	0.8	=	17.46	(75)
Northeast _{0.9x}	0.77	x [0.68	x	14.2	x	0.55	x	0.8	=	8.83	(75)
Northeast _{0.9x}	0.77	× [0.68	x	9.21	x	0.55	x	0.8	=	5.73	(75)
Southeast _{0.9x}	0.77	x [2.69	x	36.79	x	0.55	x	0.8	=	60.36	(77)
Southeast _{0.9x}	0.77	x [1.03	x	36.79	x	0.55	x	0.8	=	11.56	(77)
Southeast 0.9x	0.77	x [2.69	x	62.67	x	0.55	x	0.8	=	102.81	(77)
Southeast _{0.9x}	0.77	x [1.03	x	62.67	x	0.55	x	0.8	=	19.68	(77)
Southeast _{0.9x}	0.77	x [2.69	x	85.75	x	0.55	x	0.8	=	140.67	(77)
Southeast _{0.9x}	0.77	x	1.03	x	85.75	x	0.55	x	0.8	=	26.93	(77)
Southeast _{0.9x}	0.77	x [2.69	x	106.25	x	0.55	x	0.8	=	174.3	(77)
Southeast _{0.9x}	0.77	x [1.03	x	106.25	x	0.55	x	0.8	=	33.37	(77)
Southeast _{0.9x}	0.77	x	2.69	X	119.01	x	0.55	x	0.8	=	195.23	(77)

		,		1		1		ı		,		_
Southeast 0.9x	0.77	X	1.03	X	119.01	X	0.55	X	0.8] =	37.38	(77)
Southeast _{0.9x}	0.77	X	2.69	X	118.15	X	0.55	X	0.8	=	193.82	(77)
Southeast _{0.9x}	0.77	X	1.03	X	118.15	X	0.55	X	0.8	=	37.11	(77)
Southeast _{0.9x}	0.77	X	2.69	X	113.91	X	0.55	X	0.8	=	186.86	(77)
Southeast _{0.9x}	0.77	X	1.03	X	113.91	X	0.55	X	0.8	=	35.78	(77)
Southeast _{0.9x}	0.77	X	2.69	X	104.39	X	0.55	X	0.8	=	171.25	(77)
Southeast 0.9x	0.77	X	1.03	X	104.39	X	0.55	X	0.8	=	32.79	(77)
Southeast _{0.9x}	0.77	X	2.69	X	92.85	X	0.55	X	0.8	=	152.32	(77)
Southeast _{0.9x}	0.77	X	1.03	X	92.85	X	0.55	X	0.8	=	29.16	(77)
Southeast 0.9x	0.77	X	2.69	X	69.27	X	0.55	X	0.8	=	113.63	(77)
Southeast _{0.9x}	0.77	X	1.03	x	69.27	x	0.55	x	0.8] =	21.75	(77)
Southeast _{0.9x}	0.77	X	2.69	x	44.07	X	0.55	x	0.8] =	72.3	(77)
Southeast _{0.9x}	0.77	X	1.03	x	44.07	X	0.55	x	0.8] =	13.84	(77)
Southeast _{0.9x}	0.77	X	2.69	x	31.49	X	0.55	x	0.8] =	51.65	(77)
Southeast _{0.9x}	0.77	X	1.03	x	31.49	X	0.55	x	0.8	=	9.89	(77)
Southwest _{0.9x}	0.77	X	2.22	х	36.79		0.55	x	0.8] =	49.81	(79)
Southwest _{0.9x}	0.77	X	1.13	x	36.79		0.55	x	0.8] =	25.36	(79)
Southwest _{0.9x}	0.77	X	0.61	x	36.79		0.55	x	0.8] =	6.84	(79)
Southwest _{0.9x}	0.77	X	2.22	x	62.67		0.55	x	0.8	=	84.85	(79)
Southwest _{0.9x}	0.77	X	1.13	x	62.67		0.55	x	0.8] =	43.19	(79)
Southwest _{0.9x}	0.77	X	0.61	x	62.67		0.55	x	0.8	=	11.66	(79)
Southwest _{0.9x}	0.77	X	2.22	x	85.75		0.55	х	0.8] =	116.1	(79)
Southwest _{0.9x}	0.77	X	1.13	x	85.75		0.55	x	0.8] =	59.09	(79)
Southwest _{0.9x}	0.77	X	0.61	x	85.75		0.55	x	0.8] =	15.95	(79)
Southwest _{0.9x}	0.77	X	2.22	x	106.25		0.55	x	0.8	=	143.85	(79)
Southwest _{0.9x}	0.77	X	1.13	x	106.25		0.55	x	0.8] =	73.22	(79)
Southwest _{0.9x}	0.77	X	0.61	x	106.25		0.55	x	0.8] =	19.76	(79)
Southwest _{0.9x}	0.77	X	2.22	x	119.01	Ì	0.55	x	0.8] =	161.12	(79)
Southwest _{0.9x}	0.77	X	1.13	x	119.01	ĺ	0.55	x	0.8	Ī =	82.01	(79)
Southwest _{0.9x}	0.77	X	0.61	x	119.01	ĺ	0.55	x	0.8	j =	22.14	(79)
Southwest _{0.9x}	0.77	X	2.22	x	118.15	j	0.55	x	0.8	j =	159.96	(79)
Southwest _{0.9x}	0.77	x	1.13	х	118.15	j	0.55	x	0.8	j =	81.42	(79)
Southwest _{0.9x}	0.77	x	0.61	x	118.15	j	0.55	x	0.8	j =	21.98	(79)
Southwest _{0.9x}	0.77	x	2.22	х	113.91	j	0.55	x	0.8	j =	154.22	(79)
Southwest _{0.9x}	0.77	x	1.13	х	113.91	j	0.55	x	0.8	j =	78.5	(79)
Southwest _{0.9x}	0.77	j×	0.61	x	113.91	j	0.55	x	0.8	j =	21.19	(79)
Southwest _{0.9x}	0.77	X	2.22	x	104.39	į	0.55	x	0.8	j =	141.33	(79)
Southwest _{0.9x}	0.77	x	1.13	x	104.39	ĺ	0.55	x	0.8	j =	71.94	(79)
Southwest _{0.9x}	0.77	j×	0.61	x	104.39	j	0.55	x	0.8	j =	19.42	(79)
Southwest _{0.9x}	0.77	X	2.22	x	92.85	j	0.55	x	0.8	j =	125.71	(79)
Southwest _{0.9x}	0.77	x	1.13	x	92.85	ĺ	0.55	x	0.8	j =	63.99	(79)
_		_		•		•		1		•		_

		,		1		1 1		1		1		_
Southwest _{0.9x}	0.77	X	0.61	Х	92.85		0.55	X	0.8] =	17.27	(79)
Southwest _{0.9x}	0.77	X	2.22	X	69.27		0.55	X	0.8	=	93.78	(79)
Southwest _{0.9x}	0.77	X	1.13	X	69.27	_	0.55	X	0.8	=	47.73	(79)
Southwest _{0.9x}	0.77	X	0.61	X	69.27		0.55	X	0.8	=	12.88	(79)
Southwest _{0.9x}	0.77	X	2.22	X	44.07		0.55	X	0.8	=	59.66	(79)
Southwest _{0.9x}	0.77	X	1.13	X	44.07		0.55	X	0.8	=	30.37	(79)
Southwest _{0.9x}	0.77	X	0.61	X	44.07		0.55	X	0.8	=	8.2	(79)
Southwest _{0.9x}	0.77	X	2.22	X	31.49		0.55	X	0.8	=	42.63	(79)
Southwest _{0.9x}	0.77	X	1.13	X	31.49]	0.55	X	0.8	=	21.7	(79)
Southwest _{0.9x}	0.77	X	0.61	X	31.49]	0.55	X	0.8	=	5.86	(79)
Northwest 0.9x	0.77	X	2.25	x	11.28	x	0.55	x	0.8	=	23.22	(81)
Northwest 0.9x	0.77	X	1.77	x	11.28	X	0.55	x	0.8] =	6.09	(81)
Northwest 0.9x	0.77	X	1.31	x	11.28	X	0.55	X	0.8	=	13.52	(81)
Northwest 0.9x	0.77	X	2.9	x	11.28	X	0.55	x	0.8] =	9.98	(81)
Northwest 0.9x	0.77	X	2.25	x	22.97	X	0.55	x	0.8	=	47.27	(81)
Northwest _{0.9x}	0.77	X	1.77	x	22.97	x	0.55	x	0.8] =	12.4	(81)
Northwest _{0.9x}	0.77	X	1.31	x	22.97	x	0.55	x	0.8] =	27.52	(81)
Northwest _{0.9x}	0.77	X	2.9	x	22.97	x	0.55	x	0.8] =	20.31	(81)
Northwest _{0.9x}	0.77	X	2.25	x	41.38	x	0.55	x	0.8] =	85.17	(81)
Northwest _{0.9x}	0.77	X	1.77	x	41.38	x	0.55	x	0.8] =	22.33	(81)
Northwest _{0.9x}	0.77	X	1.31	x	41.38	x	0.55	x	0.8	Ī =	49.59	(81)
Northwest 0.9x	0.77	X	2.9	x	41.38	x	0.55	x	0.8	j =	36.59	(81)
Northwest _{0.9x}	0.77	x	2.25	x	67.96	X	0.55	x	0.8	j =	139.87	(81)
Northwest _{0.9x}	0.77	x	1.77	x	67.96	x	0.55	x	0.8	j =	36.68	(81)
Northwest _{0.9x}	0.77	X	1.31	x	67.96	x	0.55	x	0.8	j =	81.43	(81)
Northwest 0.9x	0.77	x	2.9	x	67.96	X	0.55	x	0.8	j =	60.09	(81)
Northwest _{0.9x}	0.77	x	2.25	x	91.35	x	0.55	x	0.8	j =	188.01	(81)
Northwest 0.9x	0.77	x	1.77	х	91.35	x	0.55	x	0.8	j =	49.3	(81)
Northwest 0.9x	0.77	x	1.31	х	91.35	X	0.55	x	0.8	j =	109.46	(81)
Northwest 0.9x	0.77	j×	2.9	x	91.35	x	0.55	x	0.8	j =	80.77	(81)
Northwest _{0.9x}	0.77	j×	2.25	x	97.38	x	0.55	x	0.8	j =	200.44	(81)
Northwest _{0.9x}	0.77	X	1.77	x	97.38	x	0.55	x	0.8	j =	52.56	(81)
Northwest _{0.9x}	0.77	X	1.31	x	97.38	x	0.55	x	0.8	j =	116.7	(81)
Northwest _{0.9x}	0.77	X	2.9	x	97.38	X	0.55	x	0.8	j =	86.11	(81)
Northwest _{0.9x}	0.77	X	2.25	x	91.1	x	0.55	x	0.8	i =	187.51	(81)
Northwest _{0.9x}	0.77	X	1.77	x	91.1	X	0.55	x	0.8	j =	49.17	(81)
Northwest _{0.9x}	0.77	X	1.31	x	91.1	X	0.55	x	0.8	j =	109.17	(81)
Northwest _{0.9x}	0.77	X	2.9	x	91.1	X	0.55	x	0.8	j =	80.56	(81)
Northwest 0.9x	0.77	X	2.25	x	72.63	X	0.55	x	0.8] =	149.48	(81)
Northwest 0.9x	0.77	X	1.77	x	72.63	X	0.55	x	0.8] =	39.2	(81)
Northwest 0.9x	0.77	X	1.31	×	72.63	X	0.55	X	0.8] =	87.03	(81)
L				•				ı				_

Northwest _{0.9x}					. —		٦		– 1 1			24.00	7(04)
Northwest 0.9x	0.77	X	2.9	_	_	72.63	X	0.55	× [0.8	╡ -	64.22	(81)
<u>L</u>	0.77	X	2.25	_		50.42	X	0.55	×	0.8	╡ -	103.78	(81)
Northwest 0.9x	0.77	X	1.77	=		50.42	X	0.55	× [0.8	_ =	27.21	(81)
Northwest _{0.9x}	0.77	X	1.31		X	50.42	X	0.55	×	0.8	=	60.42	(81)
Northwest 0.9x	0.77	X	2.9		x	50.42	X	0.55	X	0.8	_ =	44.59	(81)
Northwest 0.9x	0.77	X	2.25		x	28.07	X	0.55	x	8.0	=	57.77	(81)
Northwest 0.9x	0.77	X	1.77		x	28.07	X	0.55	X	8.0	=	15.15	(81)
Northwest 0.9x	0.77	X	1.31		x	28.07	X	0.55	X	8.0	=	33.63	(81)
Northwest _{0.9x}	0.77	X	2.9		x	28.07	X	0.55	X	0.8	=	24.82	(81)
Northwest 0.9x	0.77	X	2.25		x	14.2	X	0.55	Х	8.0	=	29.22	(81)
Northwest _{0.9x}	0.77	X	1.77		x	14.2	X	0.55	х	8.0	=	7.66	(81)
Northwest _{0.9x}	0.77	X	1.31		x	14.2	X	0.55	X	0.8	=	17.01	(81)
Northwest 0.9x	0.77	X	2.9		x	14.2	X	0.55	x	0.8	=	12.55	(81)
Northwest _{0.9x}	0.77	X	2.25		x	9.21	X	0.55	x	0.8	=	18.96	(81)
Northwest _{0.9x}	0.77	X	1.77		x	9.21	X	0.55	х	0.8	=	4.97	(81)
Northwest _{0.9x}	0.77	X	1.31		x	9.21	X	0.55	х	0.8	=	11.04	(81)
Northwest _{0.9x}	0.77	X	2.9		x	9.21	X	0.55	х	0.8	=	8.15	(81)
Rooflights 0.9x	1	X	1.11		x (37.03	X	0.55	x	0.8	=	48.92	(82)
Rooflights 0.9x	1	X	1.11		x = -	70.28	X	0.55	x	0.8	=	92.85	(82)
Rooflights 0.9x	1	X	1.11		x 1	11.87	X	0.55	x	0.8	=	147.79	(82)
Rooflights 0.9x	1	X	1.11		x 1	59.33	X	0.55	x	0.8	=	210.48	(82)
Rooflights _{0.9x}	1	x	1.11		x	193.3	j×	0.55	×	0.8	=	255.37	(82)
Rooflights _{0.9x}	1	x	1.11		x 1	97.35	X	0.55	x	0.8	=	260.71	(82)
Rooflights _{0.9x}	1	x	1.11	Ti.	x 1	88.08	X	0.55	x	0.8	_ =	248.47	(82)
Rooflights _{0.9x}	1	X	1.11		x 1	62.62	i x	0.55	x	0.8	╡ =	214.83	(82)
Rooflights _{0.9x}	1	X	1.11		x 1	28.66	X	0.55	x	0.8	= =	169.98	(82)
Rooflights 0.9x	1	X	1.11			32.24	X	0.55	×	0.8	-	108.65	(82)
Rooflights 0.9x	1	X	1.11	_	=	I5.75] x	0.55	_ x	0.8	_ =	60.44	(82)
Rooflights 0.9x	1	X	1.11	=	x :	30.74	X	0.55	= x	0.8	_ =	40.61	(82)
L	-						_						` ′
Solar gains in	watts, ca	alculated	for each n	nonth			(83)m	n = Sum(74)m	(82)m				
(83)m= 262.68	476.83	725.95	1015.33 12		1271.38	1208.08	-		547.26	320.09	221.2		(83)
Total gains – i	nternal a	nd solar	(84)m = (7	73)m +	- (83)m	, watts		! 					
(84)m= 839.66	1051.52	1280.1	1535.63 17	722.13	1721.76	1637.36	1473	3.38 1280.52	1036.0	9 848.18	780.01		(84)
7. Mean inter	nal temp	erature	(heating se	eason`		•			•		•		
Temperature			`	<i></i>		from Tal	ble 9.	Th1 (°C)				21	(85)
Utilisation fac	•	•			_			, ,					
Jan	Feb	Mar		May	Jun	Jul	Α	ug Sep	Oct	Nov	Dec		
(86)m= 1	1	1		0.96	0.89	0.79	0.8		0.99	1	1		(86)
Mean interna	l temper	atura in l	living area	T1 (fo	llow etc	ne 3 to .	7 in T	ahle Oc)	1		1	J	
(87)m= 18.61	18.8	19.16		20.2	20.64	20.85	20		19.78	19.13	18.62]	(87)
. ,	<u> </u>	ļ				<u> </u>		L	1	<u> </u>		l	, ,
Temperature (88)m= 19.33	19.34	19.35		19.4	19.45	19.45	19.		19.4	19.38	19.36]	(88)
(00)111- 19.33	13.54	13.00	10.09	10.4	19.40	19.40	19.	13.43	13.4	1 19.00	19.00	J	(00)

Utilisa	tion fac	tor for a	ains for ı	rest of d	wellina. I	h2.m (se	ee Table	9a)						
(89)m=	1	1	0.99	0.98	0.93	0.8	0.6	0.68	0.92	0.99	1	1		(89)
Mean	internal	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	ps 3 to 7	7 in Tabl	le 9c)				
(90)m=	16.22	16.51	17.04	17.84	18.57	19.18	19.39	19.37	18.91	17.98	17.02	16.26		(90)
L									f	fLA = Livin	g area ÷ (4	1) =	0.17	(91)
Mean	internal	l temper	ature (fo	r the wh	ole dwel	lina) = fl	I A × T1	+ (1 – fl	A) × T2					_
(92)m=	16.63	16.9	17.4	18.16	18.85	19.43	19.64	19.61	19.17	18.29	17.39	16.67		(92)
Apply	adjustn	nent to t	he mean	internal	tempera	ature fro	m Table	4e, whe	re appro	priate				
(93)m=	16.48	16.75	17.25	18.01	18.7	19.28	19.49	19.46	19.02	18.14	17.24	16.52		(93)
8. Spa	ice hea	ting requ	uirement											
			ernal ter or gains	•		ed at ste	ep 11 of	Table 9b	o, so tha	it Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
L Utilisa			ains, hm		iviay	Ouri	l oui	7 tug	ОСР	000	1101			
(94)m=	1	1	0.99	0.97	0.91	0.79	0.61	0.68	0.9	0.98	1	1		(94)
Useful	I gains,	hmGm ,	, W = (94	↓ 1)m x (84	 4)m		l			l				
(95)m=	837.82	1046.54	1265.44	1487.2	1575.55	1362.22	991.51	996.94	1153.11	1017.79	844.89	778.75		(95)
Month	ly 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				<u> </u>							
(97)m=	5068.65	4898.76	4414.61	3612.72	2755.27	1776.56	1096.73	1153.54	1896.54	2966.67	4047.2	4987.02		(97)
· -			ement fo											
(98)m=	3147.73	2588.69	2342.98	1530.37	877.71	0	0	0	0		2305.66			_
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	17374.08	(98)
Space	heating	g require	ement in	kWh/m²	/year								83.82	(99)
9a. Ene	ergy req	luiremer	nts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	HP)					
•	heatin	_										ı		_
			t from se			mentary	-					ļ	0	(201)
Fraction	on of sp	ace hea	it from m	ain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fraction	on of to	tal heatii	ng from	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficie	ncy of r	main spa	ace heat	ing syste	em 1								90.3	(206)
Efficie	ncy of s	seconda	ry/supple	ementar	y heating	g system	ո, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	heating	g require	ement (c	alculate	d above)									
L	3147.73	2588.69	2342.98	1530.37	877.71	0	0	0	0	1449.97	2305.66	3130.96		
(211)m	= {[(98])m x (20	4)] } x 1	00 ÷ (20	6)		_			_				(211)
	3485.86	2866.77	2594.66	1694.76	972	0	0	0	0		2553.34			_
								Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	19240.4	(211)
-		• •	econdar	• •	month							•		
· · · · · ·			00 ÷ (20		-					1				
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		7
								ıota	ı (KVVN/yea	ar) =Sum(2	(15) _{15,1012}	=	0	(215)

Water heating														
Output from water heater (calculated above) 223.42 196.86 206.61 185.01 180.85 1	59.28 152.6	170.11	170.22	191.86	203.12	217.98								
Efficiency of water heater	_						81	(216)						
(217)m= 89.62 89.57 89.47 89.2 88.56	81 81	81	81	89.1	89.47	89.63		(217)						
Fuel for water heating, kWh/month														
$(219)m = (64)m \times 100 \div (217)m$ (219)m = 249.3 219.78 230.93 207.42 204.2 19	96.64 188.4	210.02	210.14	215.32	227.03	243.2								
	_	Tota	ıl = Sum(2	19a) ₁₁₂ =		l	2602.36	(219)						
Annual totals				k	Wh/yeaı	r	kWh/year	- -						
Space heating fuel used, main system 1							19240.4	<u> </u>						
Water heating fuel used							2602.36							
Electricity for pumps, fans and electric keep-hot														
mechanical ventilation - balanced, extract or positive input from outside 716.77 (230a)														
central heating pump: 30 (230														
Total electricity for the above, kWh/year														
Electricity for lighting							595.01	(232)						
Total delivered energy for all uses (211)(221) +	(231) + (232)	(237b)	=				23184.54	(338)						
12a. CO2 emissions – Individual heating system	s including m	icro-CHF												
	Energy kWh/year			Emiss kg CO	i on fac 2/kWh	tor	Emissions kg CO2/yea	ır						
Space heating (main system 1)	(211) x			0.2	16	=	4155.93	(261)						
Space heating (secondary)	(215) x			0.5	19	=	0	(263)						
Water heating	(219) x			0.2	16	=	562.11	(264)						
Space and water heating	(261) + (262)	+ (263) + ((264) =				4718.04	(265)						
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	387.57	(267)						
Electricity for lighting	(232) x			0.5	19	=	308.81	(268)						
Total CO2, kg/year sum of (265)(271) = 5414.42 (273)														
Dwelling CO2 Emission Rate			(272)	÷ (4) =			26.12	(273)						

El rating (section 14)

(274)

		User D	etails:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	<u> </u>	Strom Softwa	_				016363 on: 1.0.5.51	
	F	Property	Address	Flat-G0)1-LEAN				
Address :									
Overall dwelling dime	ensions:	Δ	a (2 \		Av. Ha	: a.la4/a.\		Valuma/m²	
Ground floor			a(m²) 31.64	(1a) x		ight(m) 2.7	(2a) =	Volume(m ³	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1			(4)]()	220.40	(==,
	a) (15) (16) (16) (16) (1(1	'''	01.04)+(3c)+(3c	l)+(3e)+	(3n) =		7 .5
Dwelling volume				(38) (35) ((() () () ()	1) ((00)	.(011) –	220.43	(5)
2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	ır
Number of chimneys	heating heating beauting heating	П + Г	0	7 = [0	x 4	40 =	0	(6a)
Number of open flues	0 + 0	_	0]	0	x	20 =	0	(6b)
Number of intermittent fa							10 =		╡゛
Number of passive vents				L	0		10 =	0	(7a)
·				Ļ	0		40 =	0	(7b)
Number of flueless gas fi	iles			L	0	^	+0 -	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a)+(7b)+((7c) =	Г	0		÷ (5) =	0	(8)
	peen carried out or is intended, procee	ed to (17), o	otherwise o	ontinue fr	om (9) to ((16)			<u>-</u>
Number of storeys in the Additional infiltration	he dwelling (ns)					[(0)	-1]x0.1 =	0	(9) (10)
	.25 for steel or timber frame o	r 0.35 fo	r masoni	v constr	uction	[(9)]	-1]XU.1 -	0	(10)
if both types of wall are p	resent, use the value corresponding t			•					` ′
deducting areas of openii	ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or () 1 (seale	ed) else	enter 0				0	(12)
If no draught lobby, en	,	(oodii	, c.cc	onto: o				0	(13)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)					0	(16)
•	q50, expressed in cubic metrolity value, then $(18) = [(17) \div 20] +$	•	•	•	etre of e	envelope	area	3	(17)
•	es if a pressurisation test has been do				is being u	sed		0.15	(18)
Number of sides sheltere		·	,	·				2	(19)
Shelter factor			(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporate	•		(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified f	 	11		0	0-4	Non	D	1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp (22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7]	
()	1 4.0 0.0	1 0.0	L		I +.0	I5	J 7.7	I	
Wind Factor (22a)m = (2					ı	1	1	1	
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	1	
Calculate effec		-	rate for t	he appli	cable ca	se	!	!	!	<u>I</u>			
If mechanica								. (00)	\ (00 \)			0.5	(2
If exhaust air h									o) = (23a)			0.5	(2
If balanced with												77.35	(2
a) If balance						, 	- 	´ `	, 	 	' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ') ÷ 100] ¬	(2)
24a)m= 0.28	<u> </u>	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
b) If balance				i	1		- ^ ``	ŕ	- 			1	(0
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h	ouse extra n < 0.5 × (2			•	•				.5 × (23b)		_	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural if (22b)n	ventilation n = 1, then								0.5]			_	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change rat	te - er	nter (24a) or (24l	b) or (24	c) or (24	d) in bo	x (25)				_	
25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
3. Heat losse	s and heat	loss	paramet	er:									
LEMENT	Gross area (m	1²)	Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I	≺)	k-valu kJ/m²·		A X k kJ/K
oors					1.99	X	1	=	1.99				(2
/indows Type	: 1				1.37	_x 1	/[1/(1.4)+	0.04] =	1.82				(2
√indows Type	2				4.34	x1	/[1/(1.4)+	0.04] =	5.75				(2
√indows Type	3				5.76	_x 1	/[1/(1.4)+	0.04] =	7.64				(2
√indows Type	2 4				1.65	x1	/[1/(1.4)+	0.04] =	2.19				(2
loor					81.64	4 x	0.13	=	10.6132	<u>=</u> 2 [(2
Valls Type1	79.62		16.1	4	63.48	3 x	0.15	=	9.52	=		= =	(2
Valls Type2	53.08	=	1.99		51.09	x	0.15		7.66	F i		=	(2
Roof Type1	4.85			=	4.85	x	0.13		0.63	F i		=	(3
Roof Type2	1.55		0	=	1.55	=	0.13		0.2	-		= 	`(3
otal area of e		 1 ²			220.7	=	0.10		U. <u>L</u>				(3
arty ceiling	,				75.24	_				Г			(3
for windows and	roof windows	s. use e	effective wi	ndow U-v			n formula 1	/[(1/U-valı	ue)+0.041 a	L Is aiven in	paragrani		(
include the area							,		.,	3	7-1-3-1		
abric heat los	ss, W/K = S	6 (A x	U)				(26)(30) + (32) =				52.02	(3
	Cm = S(A)	xk)						((28).	(30) + (32	2) + (32a).	(32e) =	30206.1	(3
eat capacity	naramatar	r (TMF	⊃ = Cm +	+ TFA) iı	n kJ/m²K			Indica	ative Value	Medium		250	(3
	parameter	`											
eat capacity hermal mass or design assess an be used inste	sments where	the de		construct	tion are no	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		

Total fabric heat loss					(33) +	(36) =		[73.53	(37)
Ventilation heat loss calculated monthly	y				(38)m	= 0.33 × (25)m x (5)	L		
Jan Feb Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 20.06 19.83 19.6 18.44	18.21	17.05	17.05	16.82	17.51	18.21	18.67	19.14		(38)
Heat transfer coefficient, W/K					(39)m	= (37) + (37)	38)m			
(39)m= 93.59 93.36 93.13 91.97	91.74	90.58	90.58	90.35	91.04	91.74	92.2	92.67		
Heat loss parameter (HLP), W/m²K						Average = = (39)m ÷	Sum(39) _{1.}	12 /12=	91.91	(39)
(40)m= 1.15 1.14 1.14 1.13	1.12	1.11	1.11	1.11	1.12	1.12	1.13	1.14		
Number of days in month (Table 1a)			•		,	Average =	Sum(40) _{1.}	12 /12=	1.13	(40)
Jan Feb Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31 28 31 30	31	30	31	31	30	31	30	31		(41)
4. Water heating energy requirement:								kWh/ye	ear:	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp	(<u>-</u> 0 0003	40 v (TF	-Δ -13 0)2)1 + 0 ()013 x (1	Γ F Δ - 13		49		(42)
if TFA £ 13.9, N = 1	(-0.0000	л х (11	A-10.0	/2/] . 0.0) X 010 X	1174-10.	.5)			
Annual average hot water usage in litre	•	•	_	,				.41		(43)
Reduce the annual average hot water usage by not more that 125 litres per person per day (all w		-	-	o acnieve	a water us	e target o	ī			
Jan Feb Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month		-	l .		Оер	Oct	1407	Dec		
(44)m= 102.76 99.02 95.28 91.55	87.81	84.07	84.07	87.81	91.55	95.28	99.02	102.76		
						Γotal = Su	m(44) ₁₁₂ =	:	1120.97	(44)
Energy content of hot water used - calculated mo	onthly = 4.1	190 x Vd,n	n x nm x D	OTm / 3600	kWh/mon	th (see Ta	ables 1b, 1	c, 1d)		
(45)m= 152.38 133.28 137.53 119.9	115.05	99.28	92	105.57	106.83	124.5	135.9	147.58		
If instantaneous water heating at point of use (no	hot water	: etorage)	enter () in	haves (46		Γotal = Su	m(45) ₁₁₂ =	. [1469.77	(45)
										(40)
(46)m= 22.86 19.99 20.63 17.99 Water storage loss:	17.26	14.89	13.8	15.83	16.02	18.67	20.38	22.14		(46)
Storage volume (litres) including any so	olar or W	/WHRS	storage	within sa	me ves	sel		0		(47)
If community heating and no tank in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no stored hot water (this in	ıcludes iı	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage loss:		4.144								
a) If manufacturer's declared loss factor	or is knov	wn (kWh	n/day):					0		(48)
Temperature factor from Table 2b								0		(49)
Energy lost from water storage, kWh/yeb) If manufacturer's declared cylinder l		or is not		(48) x (49)	=			0		(50)
Hot water storage loss factor from Table								0		(51)
If community heating see section 4.3	·		• •							
Volume factor from Table 2a								0		(52)
Temperature factor from Table 2b								0		(53)
Energy lost from water storage, kWh/ye	ear			(47) x (51)	x (52) x (53) =	-	0		(54)
Enter (50) or (54) in (55)								0		(55)

· · · · ·	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)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	v circuit	loss (an	nual) fro	m Table	- 3					-		0		(58)
	-	•	•			59)m = ((58) ÷ 36	65 × (41)	m					
(mod	dified by	factor fi	rom Tab	le H5 if t	here is s	solar wat	er heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41)m						
(61)m=	50.96	45.58	48.56	45.15	44.75	41.46	42.84	44.75	45.15	48.56	48.83	50.96		(61)
Total h	eat requ	uired for	water he	eating ca	alculated	l for eacl	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	203.34	178.85	186.08	165.05	159.79	140.74	134.84	150.31	151.97	173.05	184.73	198.53		(62)
Solar DH	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 ad	dditiona	l lines if	FGHRS	and/or V	wwhrs	applies	, see Ap	pendix (3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from w	ater hea	ter			•	•	•		•		•		
(64)m=	203.34	178.85	186.08	165.05	159.79	140.74	134.84	150.31	151.97	173.05	184.73	198.53		
!								Outp	out from w	ater heate	r (annual)₁	12	2027.3	(64)
Heat g	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 ;	د [(46)m	+ (57)m	+ (59)m	1	_
(65)m=	63.41	55.71	57.87	51.15	49.44	43.37	<u> </u>	`		-``	<u> </u>	<u> </u>	•	(0-)
				01.10	43.44	45.57	41.3	46.29	46.81	53.53	57.39	61.81		(65)
inclu	de (57)	m in cald	!			<u> </u>	!	ļ	ļ	<u> </u>	ļ		eating	(65)
			culation o	of (65)m	only if c	<u> </u>	!	ļ	ļ	<u> </u>	ļ	61.81 munity h	eating	(65)
5. Int	ernal ga	ains (see	culation of Table 5	of (65)m and 5a	only if c	<u> </u>	!	ļ	ļ	<u> </u>	ļ		eating	(65)
5. Int	ernal ga	ains (see	culation of Table 5	of (65)m and 5a	only if o	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	eating	(65)
5. Int	ernal ga	ains (see	culation of Table 5 (5), Wat	of (65)m and 5a ts Apr	only if c	ylinder is	!	dwelling	or hot w	<u> </u>	ļ	munity h	eating	(65)
5. Int Metabo (66)m=	ernal ga olic gain Jan 124.66	s (Table Feb 124.66	ETable 5 5), Wat Mar 124.66	of (65)m 5 and 5a ts Apr 124.66	only if o	Jun 124.66	Jul 124.66	Aug 124.66	or hot w	ater is fr	om com	munity h	eating	
5. Int Metabo (66)m= Lightin	ernal ga olic gain Jan 124.66 g gains	s (Table Feb 124.66 (calcular	Expression of the control of the con	of (65)m and 5a ts Apr 124.66 ppendix	only if constant of the consta	Jun 124.66	Jul 124.66 r L9a), a	Aug 124.66	Sep 124.66 Table 5	Oct	Nov	Dec	eating	(66)
5. Int Metabo (66)m= Lightin (67)m=	ernal gan Dlic gain Jan 124.66 g gains	rins (see s (Table Feb 124.66 (calculated)	Table 5 5), Wat Mar 124.66 ted in Ap	of (65)m and 5a ts Apr 124.66 ppendix 10.86	only if constant of the consta	Jun 124.66 ion L9 o	Jul 124.66 r L9a), a	Aug 124.66 Iso see	Sep 124.66 Table 5	Oct 124.66	om com	munity h	eating	
5. Int Metabo (66)m= Lighting (67)m= Appliar	ernal gain Jan 124.66 g gains 19.86 nces ga	reb 124.66 (calcular 17.64 ins (calcular 17.64)	Evaluation of Table 5 (a) Wat Mar 124.66 (b) ted in Ap 14.35 (b) ulated in	of (65)m and 5a ts Apr 124.66 ppendix 10.86	May 124.66 L, equat 8.12 dix L, eq	Jun 124.66 ion L9 o 6.85 uation L	Jul 124.66 r L9a), a 7.41 13 or L1	Aug 124.66 Iso see 9.63 3a), also	Sep 124.66 Table 5 12.92 see Ta	Oct 124.66 16.41 ble 5	Nov 124.66	Dec 124.66	eating	(66) (67)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m=	ernal gain Jan 124.66 g gains 19.86 nces ga	resident (see Feb 124.66 (calcular 17.64 ins (calcular 225.15	Table 5 25), Wat Mar 124.66 ted in Ap 14.35 ulated in 219.32	of (65)m 5 and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91	May 124.66 L, equat 8.12 dix L, eq 191.26	Jun 124.66 ion L9 o 6.85 uation L	Jul 124.66 r L9a), a 7.41 13 or L1	Aug 124.66 Iso see 9.63 3a), also	Sep 124.66 Table 5 12.92 see Ta	Oct 124.66 16.41 ble 5 182.63	Nov	Dec	eating	(66)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin	ernal gan Jan 124.66 g gains 19.86 nces ga 222.83	resins (see Feb 124.66 (calcular 17.64 ins (calcular 225.15 (calcular 17.64 calcu	Example 5 to 219.32 teed in April 219.32	of (65)m and 5a ts Apr 124.66 ppendix 10.86 Append 206.91 ppendix	May 124.66 L, equat 8.12 dix L, eq 191.26 L, equat	Jun 124.66 ion L9 o 6.85 uation L 176.54	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a	Aug 124.66 Iso see 9.63 3a), also 164.39	Sep 124.66 Table 5 12.92 see Ta 170.22	Oct 124.66 16.41 ble 5 182.63	Nov 124.66 19.15	Dec 124.66 20.41	eating	(66) (67)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m=	ernal gain Jan 124.66 g gains 19.86 nces ga 222.83 g gains 35.47	reb 124.66 (calcular 17.64 ins (calcular 225.15 (calcular 35.47	ted in Apulated in	of (65)m ts Apr 124.66 ppendix 10.86 Append 206.91 ppendix 35.47	May 124.66 L, equat 8.12 dix L, eq 191.26	Jun 124.66 ion L9 o 6.85 uation L	Jul 124.66 r L9a), a 7.41 13 or L1	Aug 124.66 Iso see 9.63 3a), also	Sep 124.66 Table 5 12.92 see Ta	Oct 124.66 16.41 ble 5 182.63	Nov 124.66	Dec 124.66	eating	(66) (67)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps	ernal gain Jan 124.66 g gains 19.86 nces ga 222.83 g gains 35.47 and fai	s (Table Feb 124.66 (calcula 17.64 ins (calc 225.15 (calcula 35.47	Table 5 25), Wat Mar 124.66 ted in Ap 14.35 ulated in 219.32 tted in A 35.47 (Table 5	of (65)m s and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47	May 124.66 L, equat 8.12 dix L, eq 191.26 L, equat 35.47	Jun 124.66 ion L9 o 6.85 uation L 176.54 tion L15 35.47	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39), also se 35.47	Sep 124.66 Table 5 12.92 see Ta 170.22 ee Table 35.47	Oct 124.66 16.41 ble 5 182.63 5 35.47	Nov 124.66 19.15 198.28	Dec 124.66 20.41 213 35.47	eating	(66) (67) (68)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cooking (69)m= Pumps (70)m=	ernal gar Jan 124.66 g gains 19.86 nces ga 222.83 ng gains 35.47 and far	res (Table Feb 124.66 (calcula 17.64 ins (calcula 35.47 ins gains 3	ted in Apulated in	of (65)m and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47	May 124.66 L, equat 8.12 dix L, eq 191.26 L, equat 35.47	Jun 124.66 ion L9 o 6.85 uation L 176.54 tion L15 35.47	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a	Aug 124.66 Iso see 9.63 3a), also 164.39	Sep 124.66 Table 5 12.92 see Ta 170.22	Oct 124.66 16.41 ble 5 182.63	Nov 124.66 19.15	Dec 124.66 20.41	eating	(66) (67)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses	ernal gain Jan 124.66 g gains 19.86 nces ga 222.83 g gains 35.47 a and fai	raporatio	ted in Apulated in	of (65)m ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47 5a) 3	only if construction only if c	Jun 124.66 ion L9 of 6.85 uation L 176.54 tion L15 35.47	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39), also se 35.47	Sep 124.66 Table 5 12.92 see Ta 170.22 ee Table 35.47	Oct 124.66 16.41 ble 5 182.63 5 35.47	Nov 124.66 19.15 198.28 35.47	Dec 124.66 20.41 213 35.47	eating	(66) (67) (68) (69)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m=	ernal gar Jan 124.66 g gains 19.86 nces ga 222.83 g gains 35.47 and fai 3 s e.g. ev	s (Table Feb 124.66 (calcula 17.64 ins (calc 225.15 (calcula 35.47 ns gains 3 raporatio -99.73	ted in Ap 14.35 ulated in Ap 15.47 (Table 5 3 on (negative)	of (65)m and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47	May 124.66 L, equat 8.12 dix L, eq 191.26 L, equat 35.47	Jun 124.66 ion L9 o 6.85 uation L 176.54 tion L15 35.47	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39), also se 35.47	Sep 124.66 Table 5 12.92 see Ta 170.22 ee Table 35.47	Oct 124.66 16.41 ble 5 182.63 5 35.47	Nov 124.66 19.15 198.28	Dec 124.66 20.41 213 35.47	eating	(66) (67) (68)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m= Water	ernal gar Jan 124.66 g gains 19.86 nces ga 222.83 ng gains 35.47 and fai 3 s e.g. ev -99.73 heating	raporatio -99.73 gains (see	ted in Ap 14.35 ulated in Ap 35.47 (Table 5 3 on (negating 1-99.73	of (65)m s and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47 5a) 3 tive valu -99.73	May 124.66 L, equat 8.12 dix L, eq 191.26 L, equat 35.47 3 es) (Tab	Jun 124.66 ion L9 of 6.85 uation L 176.54 tion L15 35.47 3 ole 5) -99.73	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39), also se 35.47	Sep 124.66 Table 5 12.92 See Ta 170.22 ee Table 35.47 3	Oct 124.66 16.41 ble 5 182.63 5 35.47	Nov 124.66 19.15 198.28 35.47 3	Dec 124.66 20.41 213 35.47 3	eating	(66) (67) (68) (69) (70)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	ernal gar Jan 124.66 g gains 19.86 nces ga 222.83 g gains 35.47 and fai 3 e.g. ev -99.73 heating	raporation series (See See See See See See See See See Se	culation of Table 5 25), Wat Mar 124.66 ted in Ap 14.35 ulated in 219.32 ted in Ap 35.47 (Table 5 3 on (negation of 14.35) 77.78	of (65)m ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47 5a) 3	only if construction only if c	Jun 124.66 ion L9 of 6.85 uation L 176.54 tion L15 35.47 3 ble 5) -99.73	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39), also se 35.47	Sep 124.66 Table 5 12.92 see Ta 170.22 ee Table 35.47 3	Oct 124.66 16.41 ble 5 182.63 5 35.47 3 -99.73	Nov 124.66 19.15 198.28 35.47 3	Dec 124.66 20.41 35.47 3 83.08	eating	(66) (67) (68) (69)
5. Int Metabo (66)m= Lighting (67)m= Appliar (68)m= Cookin (69)m= Pumps (70)m= Losses (71)m= Water (72)m=	ernal gar Jan 124.66 g gains 19.86 nces ga 222.83 g gains 35.47 and fai 3 e.g. ev -99.73 heating	raporatio -99.73 gains (see	culation of Table 5 25), Wat Mar 124.66 ted in Ap 14.35 ulated in 219.32 ted in Ap 35.47 (Table 5 3 on (negation of 14.35) 77.78	of (65)m s and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47 5a) 3 tive valu -99.73	May 124.66 L, equat 8.12 dix L, eq 191.26 L, equat 35.47 3 es) (Tab	Jun 124.66 ion L9 of 6.85 uation L 176.54 tion L15 35.47 3 ble 5) -99.73	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39), also se 35.47	Sep 124.66 Table 5 12.92 see Ta 170.22 ee Table 35.47 3	Oct 124.66 16.41 ble 5 182.63 5 35.47	Nov 124.66 19.15 198.28 35.47 3	Dec 124.66 20.41 35.47 3 83.08	eating	(66) (67) (68) (69) (70)

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	X	1.65	x	11.28	x	0.55	x	0.8] =	11.35	(75)
Northeast 0.9x	0.77	x	1.65	x	22.97	x	0.55	x	0.8	=	23.11	(75)
Northeast 0.9x	0.77	x	1.65	x	41.38	x	0.55	x	0.8	=	41.64	(75)
Northeast _{0.9x}	0.77	x	1.65	x	67.96	x	0.55	x	0.8	=	68.38	(75)
Northeast 0.9x	0.77	x	1.65	x	91.35	x	0.55	x	0.8	=	91.92	(75)
Northeast 0.9x	0.77	x	1.65	x	97.38	x	0.55	x	0.8	=	97.99	(75)
Northeast 0.9x	0.77	x	1.65	x	91.1	x	0.55	x	0.8	=	91.67	(75)
Northeast 0.9x	0.77	X	1.65	x	72.63	x	0.55	X	0.8	=	73.08	(75)
Northeast _{0.9x}	0.77	x	1.65	x	50.42	x	0.55	x	0.8	=	50.74	(75)
Northeast 0.9x	0.77	x	1.65	x	28.07	x	0.55	x	0.8	=	28.24	(75)
Northeast 0.9x	0.77	X	1.65	x	14.2	X	0.55	X	0.8	=	14.29	(75)
Northeast _{0.9x}	0.77	x	1.65	x	9.21	x	0.55	x	0.8	=	9.27	(75)
Southeast 0.9x	0.77	x	5.76	x	36.79	x	0.55	X	0.8	=	64.62	(77)
Southeast 0.9x	0.77	x	5.76	x	62.67	x	0.55	x	0.8	=	110.08	(77)
Southeast 0.9x	0.77	x	5.76	x	85.75	x	0.55	x	0.8	=	150.61	(77)
Southeast 0.9x	0.77	X	5.76	x	106.25	x	0.55	X	0.8	=	186.61	(77)
Southeast 0.9x	0.77	X	5.76	x	119.01	x	0.55	X	0.8	=	209.02	(77)
Southeast 0.9x	0.77	x	5.76	x	118.15	x	0.55	x	0.8	=	207.51	(77)
Southeast 0.9x	0.77	X	5.76	x	113.91	x	0.55	X	0.8	=	200.06	(77)
Southeast 0.9x	0.77	X	5.76	x	104.39	x	0.55	X	0.8	=	183.35	(77)
Southeast 0.9x	0.77	X	5.76	x	92.85	x	0.55	X	0.8	=	163.08	(77)
Southeast 0.9x	0.77	x	5.76	x	69.27	x	0.55	X	0.8	=	121.66	(77)
Southeast 0.9x	0.77	x	5.76	x	44.07	x	0.55	x	0.8	=	77.4	(77)
Southeast 0.9x	0.77	x	5.76	x	31.49	x	0.55	x	0.8	=	55.3	(77)
Southwest _{0.9x}	0.77	x	1.37	x	36.79]	0.55	x	0.8	=	30.74	(79)
Southwest _{0.9x}	0.77	X	4.34	x	36.79]	0.55	X	0.8	=	48.69	(79)
Southwest _{0.9x}	0.77	x	1.37	x	62.67]	0.55	x	0.8	=	52.36	(79)
Southwest _{0.9x}	0.77	X	4.34	x	62.67]	0.55	X	0.8	=	82.94	(79)
Southwest _{0.9x}	0.77	X	1.37	x	85.75]	0.55	X	0.8	=	71.64	(79)
Southwest _{0.9x}	0.77	X	4.34	x	85.75]	0.55	X	0.8	=	113.48	(79)
Southwest _{0.9x}	0.77	x	1.37	x	106.25]	0.55	x	0.8	=	88.77	(79)
Southwest _{0.9x}	0.77	x	4.34	x	106.25]	0.55	x	0.8	=	140.61	(79)
Southwest _{0.9x}	0.77	x	1.37	x	119.01]	0.55	X	0.8	=	99.43	(79)
Southwest _{0.9x}	0.77	x	4.34	x	119.01]	0.55	X	0.8	=	157.49	(79)
Southwest _{0.9x}	0.77	X	1.37	x	118.15]	0.55	X	0.8	=	98.71	(79)
Southwest _{0.9x}	0.77	X	4.34	x	118.15]	0.55	x	0.8] =	156.35	(79)
Southwest _{0.9x}	0.77	X	1.37	x	113.91]	0.55	x	0.8] =	95.17	(79)
Southwest _{0.9x}	0.77	X	4.34	x	113.91]	0.55	x	0.8] =	150.74	(79)
Southwest _{0.9x}	0.77	X	1.37	x	104.39]	0.55	x	0.8] =	87.22	(79)

Southwe	st _{0.9x} 0.7	7 ×	4.3	34	X	10	04.39			0.55	X	0.8	=	138.15	(79)
Southwe	st _{0.9x} 0.7	7 x	1.3	37	X	9	2.85			0.55	X	0.8	=	77.58	(79)
Southwe	st _{0.9x} 0.7	7 ×	4.3	34	X	9	2.85			0.55	x	0.8	=	122.88	(79)
Southwe	st _{0.9x} 0.7	7 X	1.3	37	x	6	9.27			0.55	x	0.8	=	57.87	(79)
Southwe	st _{0.9x} 0.7	7 ×	4.3	34	x	6	9.27]		0.55	X	0.8	=	91.67	(79)
Southwe	st _{0.9x} 0.7	7 ×	1.3	37	x	4	4.07]		0.55	x	0.8	=	36.82	(79)
Southwe	st <mark>0.9x</mark> 0.7	7 ×	4.3	34	x	4	4.07]		0.55	x [0.8	=	58.32	(79)
Southwe	st _{0.9x} 0.7	7 x	1.3	37	x	3	1.49			0.55	x [0.8	=	26.31	(79)
Southwe	st _{0.9x} 0.7	7 ×	4.3	34	x	3	1.49			0.55	x	0.8	=	41.67	(79)
Solar ga	ains in watts, o	calculated	for eac	h month				(83)m	ı = Sı	um(74)m .	(82)m			_	
(83)m=	155.41 268.49	377.37	484.37	557.86	56	60.57	537.64	481	.79	414.27	299.44	186.83	132.55	5	(83)
Total ga	ins – internal	and sola	r (84)m =	= (73)m	+ (8	33)m	, watts						_	_	
(84)m=	546.73 657.57	752.22	836.59	887.09	8	67.6	830.66	781.	.42	725.82	633.82	547.38	512.44	ļ	(84)
7. Mea	n internal tem	perature	(heating	season)										
	rature during	•	,			area 1	from Tab	ole 9,	, Th′	1 (°C)				21	(85)
•	ion factor for	•			-					,					
	Jan Feb	Mar	Apr	May	È	Jun	Jul	Aı	ug	Sep	Oct	Nov	Dec	:	
(86)m=	1 0.99	0.98	0.93	0.82	(0.64	0.47	0.5	52	0.77	0.95	0.99	1	7	(86)
L Mean i	nternal tempe	rature in	living ar	ea T1 (fo	مااد	w ste	ns 3 to 7	7 in T	ahle	a 9c)					
_	19.83 20.02	20.29	20.61	20.85	_	0.97	20.99	20.9	$\overline{}$	20.92	20.6	20.15	19.79	\neg	(87)
` ′ ∟	L	1	<u> </u>	<u> </u>			l	<u> </u>							, ,
· -	rature during 19.96 19.97	19.97	19.98	19.98	_	9.99	19.99	20	$\overline{}$	12 (°C) 19.99	19.98	19.98	19.97	٦	(88)
(88)m=	19.90	19.97	19.96	19.90	'	9.99	19.99		<u> </u>	19.99	19.90	19.96	19.97		(00)
	ion factor for			· · ·	_		i	<u> </u>						_	
(89)m=	1 0.99	0.97	0.91	0.77	(0.55	0.37	0.4	11	0.69	0.93	0.99	1		(89)
Mean i	nternal tempe	rature in	the rest	of dwell	ing	T2 (f	ollow ste	ps 3	to 7	' in Tabl	e 9c)			_	
(90)m=	18.41 18.69	19.08	19.54	19.85	1	9.97	19.99	19.9	99	19.93	19.53	18.88	18.37		(90)
										f	LA = Livi	ng area ÷ (4	4) =	0.34	(91)
Mean i	nternal tempe	rature (fo	or the wh	ole dwe	llin	g) = fl	LA × T1	+ (1	– fL	A) × T2					
	18.89 19.14	19.49	19.9	20.18	1	20.31	20.33	20.		20.26	19.89	19.31	18.85	7	(92)
Apply a	adjustment to	the mear	interna	l temper	atu	re fro	m Table	4e,	whe	re appro	priate				
(93)m=	18.74 18.99	19.34	19.75	20.03	2	0.16	20.18	20.	18	20.11	19.74	19.16	18.7		(93)
8. Spa	ce heating red	quiremen	t												
	to the mean ir				ned	at ste	ep 11 of	Tabl	e 9b	, so tha	t Ti,m=	(76)m an	d re-ca	lculate	
the utili	isation factor		T -		_							T	Ι	_	
1.1617 41	Jan Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec	<u>: </u>	
	ion factor for 0.99 0.98	gains, nn 0.96	0.9	0.77	Γ,	0.57	0.39		12	0.7	0.93	0.99		7	(94)
(94)m=			l			J.37	0.39	0.4	13	0.7	0.93	0.99	1		(54)
	gains, hmGm 543.3 647.48	<u> </u>	753.29	681.99	1 40	90.39	322.61	338	68	509.22	588.73	539.79	510.06		(95)
	y average ext		<u> </u>		1		022.01	000	.00	000.22	000.70	000.70	010.00		(55)
(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	٦	(96)
	oss rate for me		<u> </u>									1		_	` '
	1351.14 1315.1			764.6	_	03.51	324.13	341	_	547.42	838.23	1111.9	1343.3	3	(97)
` ′ ∟	I	1	<u> </u>				<u> </u>		!			1		_	•

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m		
(98)m= 601.03 448.66 351.01 176.1 61.46 0 0 0 185.63 411.93 619.93		
Total per year (kWh/year) = Sum(98) _{15,912} = 20	855.74	(98)
Space heating requirement in kWh/m²/year	34.98	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		1
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) × [1 – (203)] =	1	(204)
	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	r
Space heating requirement (calculated above) 601.03 448.66 351.01 176.1 61.46 0 0 0 185.63 411.93 619.93		
		(211)
(211)m = {[(98)m x (204)] } x 100 ÷ (206) 665.59 496.86 388.72 195.01 68.06 0 0 0 205.57 456.17 686.52		(211)
	162.51	(211)
Space heating fuel (secondary), kWh/month		1
$= \{[(98)m \times (201)]\} \times 100 \div (208)$		
(215)m= 0 0 0 0 0 0 0 0 0 0 0		1
Total (kWh/year) =Sum(215) _{15,1012} =	0	(215)
Water heating Output from water heater (calculated above)		
203.34 178.85 186.08 165.05 159.79 140.74 134.84 150.31 151.97 173.05 184.73 198.53		
Efficiency of water heater	81	(216)
(217)m= 87.75 87.44 86.85 85.55 83.39 81 81 81 81 85.56 87.2 87.85		(217)
Fuel for water heating, kWh/month		
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 231.72 204.55 214.27 192.93 191.63 173.75 166.47 185.57 187.62 202.26 211.84 225.98 $		
Total = Sum(219a) ₁₁₂ = 2	388.6	(219)
Annual totals kWh/year k	Wh/year	-
Space heating fuel used, main system 1	162.51]
Water heating fuel used	388.6	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside 295.81		(230a)
central heating pump:		(230c)
Total electricity for the above, kWh/year sum of (230a)(230g) =	25.81	(231)
Electricity for lighting	350.77	(232)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =	227.69	(338)
12a. CO2 emissions – Individual heating systems including micro-CHP		•

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	683.1 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	515.94 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1199.04 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	169.1 (267)
Electricity for lighting	(232) x	0.519	182.05 (268)
Total CO2, kg/year	sum	of (265)(271) =	1550.19 (272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	18.99 (273)
El rating (section 14)			84 (274)

		l lsor-F	Details:						
Assessor Name:	Chris Hocknell	<u> </u>		a Num	ber:		STRO	016363	
Software Name:	Stroma FSAP 2012			are Ve			Versio	n: 1.0.5.51	
	F	Property	Address	: Flat-10	1-LEAN				
Address: 1. Overall dwelling dime	anaiona:								
1. Overall dwelling diffle	ensions.	Are	a(m²)		Av. He	ight(m)		Volume(m ³	3)
Ground floor				(1a) x		2.63	(2a) =	208.59	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) :	79.31	(4)			_		
Dwelling volume				I (3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	208.59	(5)
2. Ventilation rate:									`
2. Ventuation rate.	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys		¬ + [0	7 = [0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	-	0	ī - r	0	x	20 =	0	(6b)
Number of intermittent fa	ns				0	x ·	10 =	0	(7a)
Number of passive vents					0	x ·	10 =	0	(7b)
Number of flueless gas fi	res			Ē	0	X 4	40 =	0	(7c)
				<u>L</u>				_	
				_			Air ch	nanges per ho	our —
	ys, flues and fans = (6a)+(6b)+(een carried out or is intended, proced			continue fr	0		÷ (5) =	0	(8)
Number of storeys in the		iu io (11),	ourerwise (continue n	om (9) to	(10)		0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o			•	ruction			0	(11)
if both types of wall are pl deducting areas of openii	resent, use the value corresponding t ngs); if equal user 0.35	o the grea	ter wall are	a (atter					
•	floor, enter 0.2 (unsealed) or 0).1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
-	s and doors draught stripped		0.25 - [0.2) v (4.4) · .4	1001 -			0	(14)
Window infiltration Infiltration rate			-	+ (11) + (-	+ (15) =		0	(15)
	q50, expressed in cubic metr	e ner h					area	0	(16)
•	ity value, then (18) = [(17) ÷ 20]+	•	•	•	ielie oi e	rivelope	aica	0.15	(17)
·	es if a pressurisation test has been do				is being u	sed		0.10	()
Number of sides sheltered	ed							2	(19)
Shelter factor				[0.075 x (*	19)] =			0.85	(20)
Infiltration rate incorporat	•		(21) = (18	s) x (20) =				0.13	(21)
Infiltration rate modified f	 	1	Δ		0-4	Nave	D	1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp (22)m= 5.1 5	peed from Table 7 4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	1	
(22)m= 5.1 5	7.0 7.7 4.3 3.0	3.0	J 3.1	<u> </u>	4.3	4.3	4.1	J	
Wind Factor (22a)m = (2	2)m ÷ 4	,		,				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		

0.16	(2 (2 (2 (2 (2
If mechanical ventilation: If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.35 a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m= 0.28	(2 (2 (2
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.35 a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100] (24a)m = 0.28	(2
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100] (24a)m = 0.28	(2
(24a)m=	(2
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m = 0	(2
(24b)m= 0 0 0 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 $(22b)m < 0.5 \times (23b)$, then $(24c) = (23b)$; otherwise $(24c) = (22b)m + 0.5 \times (23b)$ (24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) (24c)m=	(2
(24c)m= 0 0 0 0 0 0 0 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)m ² x 0.5] (24d)m= 0 0 0 0 0 0 0 0 0 0 0 Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	(2
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m ² x 0.5] (24d)m=	
(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	(2
	(2
3. Heat losses and heat loss parameter: ELEMENT Gross Openings Net Area U-value A X U k-value A X	(le
ELEMENT Gross Openings Net Area U-value A X U k-value A X area (m²) m² A ,m² W/m2K (W/K) kJ/m²·K kJ/l	
Doors 1.99 x 1 = 1.99	(2
Windows Type 1 $1.37 x^{1/[1/(1.4) + 0.04]} = 1.82$	(2
Windows Type 2 0.9 $x^{1/[1/(1.4)+0.04]} = 1.19$	(2
Windows Type 3 5.81 $x^{1/[1/(1.4)+0.04]} = 7.7$	(2
Windows Type 4 $4.37 x^{1/[1/(1.4) + 0.04]} = 5.79$	(2
Windows Type 5 4.16 $x^{1/[1/(1.4) + 0.04]} = 5.52$	(2
Rooflights $3.06414 \times 1/[1/(1.4) + 0.04] = 4.289796$	(2
Floor 55.4 x 0.13 = 7.202	(2
Walls Type1 70.84 17.98 52.86 x 0.15 = 7.93] (2
Walls Type2 27.91 1.99 25.92 x 0.15 = 3.89] (2
Roof Type1 5.84 3.06 2.78 x 0.13 = 0.36	_] ₍₃
Roof Type2 0.17 0 0.17 x 0.13 = 0.02](3
Fotal area of elements, m ²	┛` (3
Party wall 17.81 x 0 = 0	\ _(3
Party floor 23.91	(3
Party ceiling 70.27	(3
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	٧,٥
Fabric heat loss, W/K = S (A x U) (26)(30) + (32) = 49.29	7(3
40.20](3](3
40.20	╡

an be u							_							
	Ū	`	,		using Ap	•	K						24.58	(36
	of therma abric hea	0 0	are not kn	own (36) =	= 0.05 x (3	1)			(33) +	(36) =			72.07	(37
			alculated	l monthly	. /						25)m x (5)	1	73.87	(5/
Cittic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
88)m=	18.99	18.77	18.55	17.45	17.23	16.13	16.13	15.91	16.57	17.23	17.67	18.11		(38
,	ansfer c	oefficier	nt W/K				!	<u> </u>	(39)m	= (37) + (3	38\m	<u> </u>	l	
89)m=	92.86	92.64	92.42	91.32	91.1	90	90	89.78	90.44	91.1	91.54	91.98		
,							<u> </u>	<u> </u>		Average =	Sum(39) _{1.}	/12=	91.27	(39
leat lo	ss para	meter (F	ILP), W/	m²K					(40)m	= (39)m ÷	(4)			_
l0)m=	1.17	1.17	1.17	1.15	1.15	1.13	1.13	1.13	1.14	1.15	1.15	1.16		_
lumbe	er of day	s in mor	nth (Tabl	le 1a)					,	Average =	Sum(40) _{1.}	12 /12=	1.15	(40
iaiiibc	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
,							<u> </u>	<u> </u>				<u> </u>	l	
1 Wa	iter heat	ing ener	gy requi	rement:								kWh/y	ear:	
1. 110	nor noar	ing ono	gyroqui	romont.								ice viii, y	Jan.	
	ed occu			[1 ovn	/ 0 0002)40 v /TI	= A 12 O)2)1 ± 0 (1012 v /	ΓΕΛ 12		45		(4
if TL						149 X I I F	- A - I 3 9		11 1 . A X I	I F A - 1.5				
	A > 13.9 A £ 13.9		+ 1.76 X	[i - exp	(-0.000	, 10 X (11	71 10.0	<i>)</i> 2)] · O.() X 010 X (3)			
if TF nnua	A £ 13.9 I averag	9, N = 1 e hot wa	ater usaç	ge in litre	s per da	ay Vd,av	erage =	(25 x N)	+ 36		92	2.38		(4
if TF Innua Jeduce	A £ 13.9 I averag the annua	9, N = 1 e hot wa l average	ater usag	ge in litre	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed	(25 x N)	+ 36		92	2.38		(4
if TF nnua educe	A £ 13.9 I averag the annua e that 125	e hot wa e hot wa la average litres per p	ater usag hot water person per	ge in litre usage by day (all w	es per da 5% if the d rater use, f	ay Vd,av lwelling is not and co	erage = designed i ld)	(25 x N) to achieve	+ 36 a water us	se target o	92]	(4
if TF Innua educe ot more	A £ 13.9 I averag the annua e that 125 Jan	O, N = 1 e hot wa l average litres per p	ater usag hot water person per Mar	ge in litre usage by day (all w	es per da 5% if the d	ay Vd,av welling is not and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36		92	.38 Dec]	(4
if TF nnua educe ot more	A £ 13.9 I averag the annua that 125 Jan ar usage ir	e hot wa al average litres per p Feb	ater usag hot water person per Mar day for ea	ge in litre usage by day (all w Apr ach month	es per da 5% if the d rater use, l May Vd,m = fac	ay Vd,av welling is not and co Jun ctor from	erage = designed in the latest term Jul Table 1c x	(25 x N) to achieve Aug (43)	+ 36 a water us Sep	e target o	92 Nov	Dec]	(4
if TF nnua educe ot more	A £ 13.9 I averag the annua e that 125 Jan	O, N = 1 e hot wa l average litres per p	ater usag hot water person per Mar	ge in litre usage by day (all w	es per da 5% if the d vater use, I	ay Vd,av welling is not and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us Sep 90.53	Oct	92 Nov 97.92	Dec 101.62	1108.55	·
if TF nnua educe ot more ot wate 4)m=	A £ 13.9 I averag the annua e that 125 Jan er usage ir	P, N = 1 e hot want average litres per p Feb n litres per 97.92	hot water person per Mar day for ea	ge in litre usage by day (all w Apr ach month 90.53	es per da 5% if the d rater use, l May Vd,m = fac	ay Vd,av welling is not and co Jun ctor from 1	erage = designed id) Jul Table 1c x 83.14	(25 x N) to achieve Aug (43) 86.84	+ 36 a water us Sep	Oct 94.23 Fotal = Su	92 Nov 97.92 m(44) ₁₁₂ =	Dec 101.62	1108.55	·
if TF nnua educe of more of wate 4)m=	A £ 13.9 I averag the annua e that 125 Jan er usage ir	P, N = 1 e hot want average litres per p Feb n litres per 97.92	hot water person per Mar day for ea	ge in litre usage by day (all w Apr ach month 90.53	es per da 5% if the d vater use, I May Vd,m = fal 86.84	ay Vd,av welling is not and co Jun ctor from 1	erage = designed id) Jul Table 1c x 83.14	(25 x N) to achieve Aug (43) 86.84	+ 36 a water us Sep	Oct 94.23 Fotal = Su	92 Nov 97.92 m(44) ₁₁₂ =	Dec 101.62	1108.55	·
if TF nnua educe of more of wate 4)m= nergy of	A £ 13.9 I average the annual enthat 125 Jan er usage in 101.62 content of 150.69	P, N = 1 e hot wa el average litres per Feb n litres per 97.92 hot water	Mar 94.23 used - calc	ge in litre usage by day (all w Apr ach month 90.53 culated mo	es per da 5% if the da 5% if th	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r	erage = designed id) Jul Table 1c x 83.14 m x nm x E 90.98	(25 x N) to achieve Aug (43) 86.84 07m / 3600	+ 36 a water us Sep 90.53 b kWh/mon 105.64	Oct 94.23 Fotal = Su th (see Ta	92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1	Dec 101.62 = c, 1d) 145.94	1108.55	(4
if TF Innua educe of more of wate 4)m= nergy of 5)m=	A £ 13.9 I average the annual of that 125 Jan er usage in 101.62 content of 150.69	P, N = 1 e hot wa el average litres per Feb n litres per 97.92 hot water	Mar 94.23 used - calc	ge in litre usage by day (all w Apr ach month 90.53 culated mo	es per da 5% if the d vater use, I May Vd,m = fal 86.84	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r	erage = designed id) Jul Table 1c x 83.14 m x nm x E 90.98	(25 x N) to achieve Aug (43) 86.84 07m / 3600	+ 36 a water us Sep 90.53 b kWh/mon 105.64	Oct 94.23 Fotal = Su th (see Ta	92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39 m(45) ₁₁₂ =	Dec 101.62 = c, 1d) 145.94		(4
if TF nnua educe ot more ot wate 4)m= nergy of 5)m= instant 6)m=	A £ 13.9 I average the annual enthat 125 Jan er usage in 101.62 content of 150.69 raneous w 22.6	P, N = 1 e hot wa el average litres per Feb n litres per 97.92 hot water 131.8 ater heatin	Mar 94.23 used - calc	ge in litre usage by day (all w Apr ach month 90.53 culated mo	es per da 5% if the da 5% if th	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r	erage = designed in designed i	(25 x N) to achieve Aug (43) 86.84 07m / 3600	+ 36 a water us Sep 90.53 b kWh/mon 105.64	Oct 94.23 Fotal = Su th (see Ta	92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39	Dec 101.62 = c, 1d) 145.94		(4
if TF nnua educe ot more ot wate 4)m= nergy (5)m= instant 6)m= /ater	A £ 13.9 I average the annual enthat 125 Jan 101.62 content of 150.69 eneous w 22.6 storage	P, N = 1 e hot wa el average litres per p Feb n litres per 97.92 hot water 131.8 ater heatin 19.77 loss:	Mar day for ea 94.23 used - calc 136 ng at point 20.4	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no	es per da 5% if the di sater use, l' May Vd,m = fai	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18	erage = designed in did) Jul Table 1c x 83.14 m x nm x E 90.98 enter 0 in 13.65	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66	+ 36 a water us Sep 90.53	94.23 Total = Su th (see Ta 123.12 Total = Su 18.47	92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39 m(45) ₁₁₂ =	Dec 101.62 = c, 1d) 145.94 = 21.89		(4)
if TF nnua educe of more of wate 4)m= nergy of 5)m= instant 6)m= /ater torag	A £ 13.9 I average the annual enthat 125 Jan 101.62 content of 150.69 etaneous w 22.6 storage e volum	P, N = 1 e hot wa el average litres per Feb n litres per 97.92 hot water 131.8 ater heatin 19.77 loss: e (litres)	Mar Mar 94.23 used - calc 136 ng at point 20.4	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no	es per da 5% if the d rater use, I May Vd,m = far 86.84 onthly = 4. 113.77 o hot water 17.07	ay Vd,av welling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage),	erage = designed id) Jul Table 1c x 83.14 m x nm x E 90.98 enter 0 in 13.65 storage	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa	+ 36 a water us Sep 90.53	94.23 Total = Su th (see Ta 123.12 Total = Su 18.47	92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39 m(45) ₁₁₂ =	Dec 101.62 = c, 1d) 145.94		(4)
if TF nnua educe of more of wate 4)m= nergy of 5)m= instant 6)m= /ater torag comr	A £ 13.9 I average the annual enthat 125 Jan 101.62 content of 150.69 taneous w 22.6 storage enthat volume annuity h	P, N = 1 e hot wa el average litres per p Feb n litres per 97.92 hot water 131.8 ater heatin 19.77 loss: e (litres) eating a	Mar Mar 94.23 used - calc 136 ng at point 20.4 includin	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no	es per da 5% if the di sater use, l' May Vd,m = fai	ay Vd,av welling is not and co Jun ctor from 1 83.14 190 x Vd,r 98.18 storage), 14.73	erage = designed id) Jul Table 1c x 83.14 m x nm x E 90.98 enter 0 in 13.65 storage) litres in	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa (47)	+ 36 a water us Sep 90.53 b kWh/mon 105.64 c to (61) 15.85 ame vess	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	92 Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ =	Dec 101.62 = c, 1d) 145.94 = 21.89		(4)
if TF nnua educe of more of wate 4)m= nergy of 5)m= instant 6)m= /ater torag commitherw /ater	A £ 13.9 I average the annual enthal 125 Jan 101.62 content of 150.69 staneous w 22.6 storage e volum munity he wise if no storage	P, N = 1 e hot wa el average litres per p Feb n litres per 97.92 hot water 131.8 ater heatin 19.77 loss: e (litres) eating a p stored loss:	Mar Mar 94.23 used - calc 136 ng at point 20.4 includin nd no ta hot water	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so nk in dw er (this in	es per da 5% if the d rater use, I May Vd,m = far 86.84 2011 2011 2011 2012 2013 2014 2015 2015 2016	ay Vd,av welling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar	erage = designed in designed i	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa (47)	+ 36 a water us Sep 90.53 b kWh/mon 105.64 c to (61) 15.85 ame vess	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	92 Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ =	Dec 101.62 = c, 1d) 145.94 = 21.89		(4)
if TF Innua educe of more of wate (4)m= instant (6)m= Vater torag comr Otherw Vater a) If m	A £ 13.9 I average the annual enthal 125 Jan 101.62 content of 150.69 aneous w 22.6 storage e volume munity he vise if no storage tanufactions.	e hot was all average litres per per per per per per per per per per	Mar Mar 94.23 used - calc 136 ng at point 20.4 including the including the talk that water and the calc an	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ank in dw er (this in	es per da 5% if the d rater use, f May Vd,m = fac 86.84 113.77 hot water 17.07 plar or W relling, e	ay Vd,av welling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar	erage = designed in designed i	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa (47)	+ 36 a water us Sep 90.53 b kWh/mon 105.64 c to (61) 15.85 ame vess	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	92 Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 = c, 1d) 145.94 = 21.89		(4)
if TF Innua	A £ 13.9 I average the annual enthat 125 Jan 101.62 content of 150.69 taneous w 22.6 storage enunity he vise if no storage tanufactive rature factors.	P, N = 1 e hot was al average litres per p Feb n litres per 97.92 hot water 131.8 ater heatin 19.77 loss: e (litres) eating a o stored loss: urer's de	ater usage hot water person per Mar 94.23 used - calce 136 including at point 136 including and no tale hot water 136 eclared lem Table	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ank in dw er (this in oss facto 2b	es per da 5% if the d sater use, f May Vd,m = fac 86.84 113.77 hot water 17.07 clar or W velling, e acludes i	ay Vd,av welling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar	erage = designed in designed i	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa (47)	+ 36 a water us Sep 90.53 b kWh/mon 105.64 c to (61) 15.85 ame vess	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	92 Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 = c, 1d) 145.94 = 21.89		(4)
if TF Innua Innua Innua Interpret In	A £ 13.9 I average the annual of that 125 Jan 101.62 content of 150.69 aneous w 22.6 storage e volum munity h vise if no storage e anufaction of the content of the cont	e hot was all average litres per per per per per per per per per per	Mar day for ear 94.23 used - calc 136 ng at point 20.4 including the including the total water and the total water as storage	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ank in dw er (this in oss facto 2b , kWh/ye	es per da 5% if the d ater use, I May Vd,m = fac 86.84 anthly = 4. 113.77 b hot water 17.07 clar or W velling, e acludes i or is knowear	ay Vd,av lwelling is not and co Jun etor from 7 83.14 190 x Vd,r 98.18 r storage), 14.73 /WHRS nter 110 nstantar	erage = designed in designed i	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa (47)	+ 36 a water us Sep 90.53 105.64 105.64 15.85 ame vess ers) ente	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 c, 1d) 145.94 21.89 0		(4 (4 (4 (4 (4
if TF Innua	A £ 13.9 I average the annual enter that 125 Jan 101.62 content of 150.69 taneous w 22.6 storage e volume munity he vise if no storage annufaction of ann	P, N = 1 e hot wa el average litres per p Feb n litres per 97.92 hot water 131.8 ater heatin 19.77 loss: e (litres) eating a p stored loss: urer's de actor fro m water urer's de	Mar Mar Mar Mar Mar Mar Mar Mar Mar Mar	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ank in dw er (this in oss facto 2b , kWh/ye cylinder l	es per da 5% if the d rater use, I May Vd,m = far 86.84 113.77 hot water 17.07 clar or W relling, e ncludes i or is knows	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar wn (kWh	erage = designed in designed i	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa (47) ombi boil	+ 36 a water us Sep 90.53 105.64 105.64 15.85 ame vess ers) ente	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	92 Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 c, 1d) 145.94 21.89 0 0 0		(4 (4 (4 (4 (4 (5
if TF Innua	A £ 13.9 I average the annual entate 125 Jan 101.62 content of 150.69 caneous w 22.6 storage e volum munity he wise if no storage in anufaction anufact	P, N = 1 e hot wa el average litres per p Feb n litres per 97.92 hot water 131.8 ater heatin 19.77 loss: e (litres) eating a p stored loss: urer's de actor fro m water urer's de age loss	Mar Mar Mar Mar Mar Mar Mar Mar Mar Mar	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ink in dw er (this in oss facto 2b , kWh/ye cylinder l com Tabl	es per da 5% if the d ater use, I May Vd,m = fac 86.84 anthly = 4. 113.77 b hot water 17.07 clar or W velling, e acludes i or is knowear	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar wn (kWh	erage = designed in designed i	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa (47) ombi boil	+ 36 a water us Sep 90.53 105.64 105.64 15.85 ame vess ers) ente	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	92 Nov 97.92 m(44) ₁₁₂ = sbles 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 = c, 1d) 145.94 = 21.89 0		(4 (4 (4 (4 (5 (5 (5 (4 (4 (4 (5 (5 (4 (4 (4 (4 (4 (4 (4 (4 (4 (4 (4 (4 (4
if TF Innua	A £ 13.9 I average the annual entate 125 Jan 101.62 content of 150.69 caneous w 22.6 storage e volum munity he wise if no storage in anufaction of the content of the canufaction of	e hot was a verage litres per per per per per per per per per per	mater usage hot water person per Mar 94.23 used - calconder 136 mg at point 20.4 including and no tale hot water eclared less storage eclared of factor free sections.	ge in litre usage by day (all w Apr ach month 90.53 culated mo 118.57 of use (no 17.79 ag any so ink in dw er (this in oss facto 2b , kWh/ye cylinder l com Tabl	es per da 5% if the d rater use, I May Vd,m = far 86.84 113.77 hot water 17.07 clar or W relling, e ncludes i or is knows	ay Vd,av lwelling is not and co Jun ctor from 7 83.14 190 x Vd,r 98.18 storage), 14.73 /WHRS nter 110 nstantar wn (kWh	erage = designed in designed i	(25 x N) to achieve Aug (43) 86.84 07m / 3600 104.4 boxes (46) 15.66 within sa (47) ombi boil	+ 36 a water us Sep 90.53 105.64 105.64 15.85 ame vess ers) ente	Oct 94.23 Fotal = Sur 123.12 Fotal = Sur 18.47	92 Nov 97.92 m(44) ₁₁₂ = ables 1b, 1 134.39 m(45) ₁₁₂ = 20.16	Dec 101.62 c, 1d) 145.94 21.89 0 0 0		(4: (4: (4: (4: (4: (5: (5: (5:

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0		(54)
Enter (50) or (54) in (55) Water storage loss calculated for each month	$((56)m = (55) \times (41)m$		0		(55)
	· · · · · · · · · · · · · · · · · · ·			1	(56)
(56)m =		0 0 m where (H11) i			(30)
(57)m =	- 	0 0		Ī	(57)
	1 1		0		(58)
Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷	÷ 365 × (41)m		0		(00)
(modified by factor from Table H5 if there is solar water he	` '	r thermostat)			
(59)m= 0 0 0 0 0 0 0		0 0	1		(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × ((41)m				
(61)m= 50.96 45.07 48.02 44.65 44.25 41 42.3	<u> </u>	48.02 48.2	29 50.96		(61)
Total heat required for water heating calculated for each more	nth (62)m = 0.85 × ((45)m + (46)r	m + (57)m +	(59)m + (61)m	
(62)m= 201.65 176.87 184.02 163.22 158.02 139.18 133.3		171.13 182		1	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative qua	antity) (enter '0' if no sola	r contribution to	water heating)	l	
(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= 201.65 176.87 184.02 163.22 158.02 139.18 133.	.34 148.65 150.29	171.13 182	.68 196.9		
	Output from wa	ater heater (ann	ual) ₁₁₂	2005.95	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45	5)m + (61)m] + 0.8 >	([(46)m + (57	7)m + (59)m]	
(65)m= 62.85 55.09 57.23 50.59 48.89 42.89 40.8	84 45.77 46.29	52.94 56.	76 61.26		(65)
include (57)m in calculation of (65)m only if cylinder is in the	he dwelling or hot w	ater is from c	community b	·	
5. Internal gains (see Table 5 and 5a):			John Humby 11	eating	
o. Internal game (see Table o and oa).			Community in	eating	
			Johnnanity II	eating	
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju	ıl Aug Sep		ov Dec	eating	
Metabolic gains (Table 5), Watts			ov Dec		(66)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju	48 122.48 122.48	Oct N	ov Dec		(66)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48 122.48 122.48), also see Table 5	Oct N	ov Dec .48 122.48		(66) (67)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48 122.48 122.48), also see Table 5 5 9.42 12.64	Oct N 122.48 122 16.05 18.	ov Dec .48 122.48		
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48	Oct N 122.48 122 16.05 18.	ov Dec .48 122.48 74 19.97		
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48 122.48 122.48), also see Table 5 9.42 12.64 L13a), also see Ta 166.52	Oct N 122.48 122 16.05 18. ble 5 178.66 193	ov Dec .48 122.48 74 19.97		(67)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48	Oct N 122.48 122 16.05 18. ble 5 178.66 193	ov Dec .48 122.48 74 19.97 .98 208.37		(67)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	48	Oct N 122.48 122 16.05 18. ble 5 178.66 193 5	ov Dec .48 122.48 74 19.97 .98 208.37		(67) (68)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	.48 122.48	Oct N 122.48 122 16.05 18. ble 5 178.66 193 5	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25		(67) (68)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	48	Oct N 122.48 122 16.05 18. ble 5 178.66 193 5 35.25 35.	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25		(67) (68) (69)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Ju (66)m= 122.48 1	48	Oct N 122.48 122 16.05 18. ble 5 178.66 193 5 35.25 35.	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3		(67) (68) (69)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	48	Oct No. 122.48 122 16.05 18. 125 178.66 193 5 35.25 35.3 3 3	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3		(67) (68) (69) (70)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	122.48 122	Oct No. 122.48 122 16.05 18. 125 178.66 193 5 35.25 35.3 3 3	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3 .99 -97.99		(67) (68) (69) (70)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	48	Oct No. 122.48 122 16.05 18. 125 16.05 193 5 178.66 193 5 35.25 35. 35. 35. 35. 35. 35. 35. 35. 35. 35	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3 .99 -97.99 83 82.35		(67) (68) (69) (70) (71)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jun (66)m= 122.48	122.48 122	Oct No. 122.48 122 16.05 18. 125 16.05 193 5 178.66 193 5 35.25 35. 35. 35. 35. 35. 35. 35. 35. 35. 35	ov Dec .48 122.48 74 19.97 .98 208.37 25 35.25 3 3 .99 -97.99 83 82.35 (72)m		(67) (68) (69) (70) (71)

Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast _{0.9x}	0.77	X	0.9	x	11.28	x	0.55	x	0.8	=	3.1	(75)
Northeast 0.9x	0.77	x	0.9	x	22.97	x	0.55	x	0.8	=	6.3	(75)
Northeast 0.9x	0.77	x	0.9	x	41.38	x	0.55	x	0.8	=	11.36	(75)
Northeast _{0.9x}	0.77	x	0.9	x	67.96	x	0.55	x	0.8	=	18.65	(75)
Northeast 0.9x	0.77	x	0.9	x	91.35	x	0.55	x	0.8	=	25.07	(75)
Northeast 0.9x	0.77	x	0.9	x	97.38	x	0.55	x	0.8	=	26.73	(75)
Northeast _{0.9x}	0.77	x	0.9	x	91.1	x	0.55	X	0.8	=	25	(75)
Northeast 0.9x	0.77	X	0.9	X	72.63	x	0.55	X	0.8	=	19.93	(75)
Northeast _{0.9x}	0.77	x	0.9	x	50.42	x	0.55	x	0.8	=	13.84	(75)
Northeast 0.9x	0.77	x	0.9	x	28.07	x	0.55	x	0.8	=	7.7	(75)
Northeast 0.9x	0.77	X	0.9	X	14.2	X	0.55	X	0.8	=	3.9	(75)
Northeast _{0.9x}	0.77	x	0.9	x	9.21	x	0.55	x	0.8	=	2.53	(75)
Southeast 0.9x	0.77	x	5.81	x	36.79	x	0.55	x	0.8	=	65.18	(77)
Southeast 0.9x	0.77	x	5.81	x	62.67	x	0.55	x	0.8	=	111.03	(77)
Southeast 0.9x	0.77	x	5.81	x	85.75	x	0.55	x	0.8] =	151.92	(77)
Southeast 0.9x	0.77	x	5.81	X	106.25	x	0.55	X	0.8] =	188.23	(77)
Southeast 0.9x	0.77	x	5.81	X	119.01	x	0.55	X	0.8	=	210.84	(77)
Southeast 0.9x	0.77	x	5.81	x	118.15	x	0.55	x	0.8	=	209.31	(77)
Southeast 0.9x	0.77	x	5.81	X	113.91	x	0.55	X	0.8] =	201.8	(77)
Southeast 0.9x	0.77	x	5.81	х	104.39	x	0.55	X	0.8	=	184.94	(77)
Southeast 0.9x	0.77	x	5.81	x	92.85	x	0.55	x	0.8	=	164.5	(77)
Southeast 0.9x	0.77	x	5.81	X	69.27	x	0.55	X	0.8] =	122.71	(77)
Southeast 0.9x	0.77	x	5.81	x	44.07	x	0.55	X	0.8] =	78.07	(77)
Southeast 0.9x	0.77	x	5.81	x	31.49	x	0.55	X	0.8] =	55.78	(77)
Southwest _{0.9x}	0.77	x	4.16	x	36.79]	0.55	X	0.8	=	46.67	(79)
Southwest _{0.9x}	0.77	x	4.16	x	62.67]	0.55	x	0.8	=	79.5	(79)
Southwest _{0.9x}	0.77	x	4.16	x	85.75]	0.55	X	0.8	=	108.77	(79)
Southwest _{0.9x}	0.77	x	4.16	x	106.25]	0.55	x	0.8	=	134.78	(79)
Southwest _{0.9x}	0.77	X	4.16	x	119.01]	0.55	X	0.8	=	150.96	(79)
Southwest _{0.9x}	0.77	x	4.16	x	118.15]	0.55	x	0.8	=	149.87	(79)
Southwest _{0.9x}	0.77	x	4.16	x	113.91]	0.55	x	0.8	=	144.49	(79)
Southwest _{0.9x}	0.77	x	4.16	x	104.39]	0.55	x	0.8	=	132.42	(79)
Southwest _{0.9x}	0.77	x	4.16	x	92.85]	0.55	X	0.8	=	117.78	(79)
Southwest _{0.9x}	0.77	x	4.16	x	69.27]	0.55	X	0.8	=	87.86	(79)
Southwest _{0.9x}	0.77	x	4.16	x	44.07]	0.55	X	0.8] =	55.9	(79)
Southwest _{0.9x}	0.77	X	4.16	x	31.49]	0.55	x	0.8] =	39.94	(79)
Northwest 0.9x	0.77	X	1.37	x	11.28	x	0.55	x	0.8] =	9.43	(81)
Northwest 0.9x	0.77	X	4.37	x	11.28	x	0.55	x	0.8	=	15.03	(81)
Northwest 0.9x	0.77	X	1.37	x	22.97	x	0.55	x	0.8	j =	19.19	(81)

Northwest _{0.9x}		٦	4.07	٦.,	00.07	1 1	0.55	¬ "г		-	22.2	7(04)
Northwest 0.9x	0.77	X	4.37] X	22.97	X	0.55]	0.8	=	30.6	(81)
<u> </u>	0.77	X	1.37	」 ^X	41.38	X	0.55]	0.8	_ =	34.57	(81)
Northwest 0.9x	0.77	X	4.37	」 [×]	41.38	X	0.55]	0.8	=	55.14	(81)
Northwest 0.9x	0.77	X	1.37	」 ^X	67.96	X	0.55	_ X	0.8	=	56.78	(81)
Northwest _{0.9x}	0.77	X	4.37	X	67.96	X	0.55	_ X	0.8	_ =	90.55	(81)
Northwest 0.9x	0.77	X	1.37	X	91.35	X	0.55]	0.8	_ =	76.32	(81)
Northwest 0.9x	0.77	X	4.37	X	91.35	X	0.55	_ X	0.8	_ =	121.72	(81)
Northwest 0.9x	0.77	X	1.37	X	97.38	X	0.55	_ X _	0.8	_ =	81.36	(81)
Northwest _{0.9x}	0.77	X	4.37	X	97.38	X	0.55	x	0.8	=	129.76	(81)
Northwest 0.9x	0.77	X	1.37	X	91.1	X	0.55	x	0.8	=	76.11	(81)
Northwest _{0.9x}	0.77	X	4.37	X	91.1	X	0.55	_ x _	0.8	=	121.39	(81)
Northwest _{0.9x}	0.77	X	1.37	X	72.63	X	0.55	X	0.8	=	60.68	(81)
Northwest _{0.9x}	0.77	X	4.37	X	72.63	X	0.55	X	0.8	=	96.78	(81)
Northwest _{0.9x}	0.77	X	1.37	X	50.42	X	0.55	X	0.8	=	42.13	(81)
Northwest _{0.9x}	0.77	X	4.37	X	50.42	X	0.55	x [0.8	=	67.19	(81)
Northwest _{0.9x}	0.77	X	1.37	X	28.07	X	0.55	x [0.8	=	23.45	(81)
Northwest 0.9x	0.77	X	4.37	X	28.07	X	0.55	x	0.8	=	37.4	(81)
Northwest _{0.9x}	0.77	X	1.37	X	14.2	X	0.55	x	0.8	=	11.86	(81)
Northwest _{0.9x}	0.77	X	4.37	X	14.2	X	0.55	x	0.8	=	18.92	(81)
Northwest _{0.9x}	0.77	X	1.37	X	9.21	X	0.55	x	0.8	=	7.7	(81)
Northwest _{0.9x}	0.77	X	4.37	X	9.21	X	0.55	x	0.8	=	12.28	(81)
Rooflights 0.9x	1	X	3.06	X	18.07	x	0.55	x	0.8	=	21.93	(82)
Rooflights 0.9x	1	X	3.06	x	37.96	X	0.55	T x [0.8	=	46.06	(82)
Rooflights 0.9x	1	X	3.06	×	71.02	X	0.55	x	0.8	=	86.18	(82)
Rooflights 0.9x	1	X	3.06	X	119.98	x	0.55	x	0.8	=	145.58	(82)
Rooflights 0.9x	1	X	3.06	x	163.58	X	0.55	- x	0.8	=	198.49	(82)
Rooflights 0.9x	1	X	3.06	x	175.24	X	0.55	Īx「	0.8	-	212.64	(82)
Rooflights 0.9x	1	X	3.06	Īx	163.61	x	0.55	x	0.8	-	198.52	(82)
Rooflights 0.9x	1	X	3.06	j x	129.11	x	0.55	×	0.8	=	156.67	(82)
Rooflights 0.9x	1	X	3.06	i x	87.66	X	0.55] x [0.8	=	106.37	(82)
Rooflights 0.9x	1	X	3.06	j x	47.1	X	0.55	i x i	0.8	=	57.15	(82)
Rooflights 0.9x	1	X	3.06	x	22.95	X	0.55	x	0.8	= =	27.85	(82)
Rooflights 0.9x	1	X	3.06] x	14.62	X	0.55]	0.8	= =	17.74	(82)
_	<u> </u>	J	0.00	_		J I						` ′
Solar gains in w	atts. calcul	ated	for each mor	nth		(83)m	= Sum(74)m	.(82)m				
ĭ .		7.93	634.57 783.3		09.67 767.32	651	- 1 	336.28	196.5	135.97		(83)
Total gains – int	ternal and	solar	(84)m = (73)	m + (33)m , watts						1	
(84)m= 545.98	674.93 816	6.19	980.62 1106	.9 1	111.4 1055.29	945	92 817.99	664.89	550.79	509.41		(84)
7. Mean intern	al tempera	ture (heating seas	o <u>n)</u>								
Temperature d	•	,			area from Tal	ole 9.	Th1 (°C)				21	(85)
Utilisation factor	•	•		_		-,	(-)					 ` ′
Jan		/lar	Apr Ma	Ť	Jun Jul	Aı	ıg Sep	Oct	Nov	Dec		
				· I	I .		~ ' '				ī	

(86)m=	1	0.99	0.96	0.88	0.71	0.51	0.37	0.43	0.71	0.94	0.99	1		(86)
Mean	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Table	e 9c)					
(87)m=	19.81	20.03	20.35	20.71	20.92	20.99	21	21	20.94	20.62	20.14	19.77		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, Ti	 h2 (°C)					
(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95		(88)
Utilisa	ition fac	tor for g	ains for i	rest of d	welling, l	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.95	0.85	0.65	0.43	0.29	0.34	0.62	0.92	0.99	1		(89)
Mean	internal	temper	ature in	the rest	of dwelli	na T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)			l	
(90)m=	18.37	18.69	19.14	19.65	19.89	19.97	19.97	19.97	19.93	19.54	18.86	18.32		(90)
L									f	fLA = Livin	g area ÷ (4	4) =	0.35	(91)
Mean	internal	temper	ature (fo	r the wh	ole dwel	llina) = fl	A × T1	+ (1 – fL	A) × T2			!		_
(92)m=	18.87	19.15	19.56	20.02	20.25	20.32	20.33	20.33	20.28	19.91	19.3	18.82		(92)
Apply	adjustn	nent to the	ne mear	internal	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	18.72	19	19.41	19.87	20.1	20.17	20.18	20.18	20.13	19.76	19.15	18.67		(93)
8. Spa	ace hea	ting requ	uirement											
				•		ed at ste	ep 11 of	Table 9b	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
tne uti		Feb	or gains Mar	using Ta		Jun	Jul	Λιια	Son	Oct	Nov	Dec		
] L Itilisa	Jan Ition fac		ains, hm	Apr	May	Jun	Jui	Aug	Sep	Oct	INOV	Dec		
(94)m=	0.99	0.98	0.95	0.84	0.65	0.45	0.3	0.36	0.64	0.91	0.98	0.99		(94)
L	I I gains,	hmGm .	W = (94	1)m x (84	1)m						<u> </u>			
(95)m=	542.17	662.38	772.66	826.18	723.94	496.4	321.39	337.94	519.83	607.22	542.17	506.8		(95)
Month	ıly avera	age exte	rnal tem	perature	from Ta	able 8							l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
r			an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m-	– (96)m]	ı		ı	
` ′ L	1339.04		1193.2	1001.35	765.31	501.26	321.93	339.12	545.4	834.94		1331.37		(97)
. г				r each m					``	′ 	ı ´	010.10		
(98)m=	592.87	432.66	312.88	126.13	30.78	0	0	0	0	169.42	404.05	613.48		7(00)
								lota	i per year	(kwn/year	r) = Sum(9	8)15,912 =	2682.26	(98)
Space	e heating	g require	ement in	kWh/m²	/year								33.82	(99)
9a. Ene	ergy req	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatin	•			مامسىم/،									7(204)
	•			econdary		mentary	•	(202) - 4	(204) -				0	(201)
	•			nain syst	` ,			(202) = 1 -		(222)			1	(202)
			_	main sys				(204) = (20	02) × [1 –	(203)] =			1	(204)
	•	•		ing syste									90.3	(206)
Efficie	ency of s	econda	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				alculate									l	
	592.87	432.66	312.88	126.13	30.78	0	0	0	0	169.42	404.05	613.48		
(211)m	i			00 ÷ (20				· ·	1	i		i	l	(211)
	656.56	479.13	346.49	139.67	34.08	0	0	0 Tata	0	187.62	447.45	679.38		_
								lota	ı (kvvn/yea	ar) =Sum(2	211) _{15,1012}	Ē	2970.39	(211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)								
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0 0	0	0	0	0	0		
, ,	ļ .	Total (<u>l</u> (kWh/yea	r) =Sum(2	215) _{15,101}	_	0	(215)
Water heating								_
Output from water heater (calculated above)	00.40 400.04	T 440.05 T	450.00	474.40	100.00	400.0		
201.65 176.87 184.02 163.22 158.02 1 Efficiency of water heater	39.18 133.34	148.65	150.29	171.13	182.68	196.9	81	(216)
(217)m= 87.74 87.39 86.62 84.81 82.38	81 81	81	81	85.37	87.18	87.85	01	(217)
Fuel for water heating, kWh/month								, ,
(219) m = (64) m x $100 \div (217)$ m			- 1			1		
(219)m= 229.82 202.39 212.45 192.46 191.82 1	71.82 164.62	<u> </u>	185.54	200.45	209.54	224.13	2000 50	٦،٠٠٠
Annual totals		rotai -	= Sum(21		Nh/voo		2368.56 kWh/year	(219)
Space heating fuel used, main system 1				K.	Nh/yeaı		2970.39	7
Water heating fuel used							2368.56	Ī
Electricity for pumps, fans and electric keep-hot								_
mechanical ventilation - balanced, extract or pos	itive input fror	n outside				241.75		(230a)
central heating pump:						30		(230c)
Total electricity for the above, kWh/year		sum o	f (230a)	.(230g) =			271.75	(231)
Electricity for lighting							343.21	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232).	(237b) =	:				5953.92	(338)
12a. CO2 emissions – Individual heating system	s including mi	cro-CHP						
	Energy kWh/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x			0.2	16	=	641.6	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.2	16	=	511.61	(264)
Space and water heating	(261) + (262)	+ (263) + (26	64) =				1153.21	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	141.04	(267)
Electricity for lighting	(232) x			0.5	19	=	178.13	(268)
Total CO2, kg/year			sum of	(265)(2	271) =		1472.38	(272)
Dwelling CO2 Emission Rate			(272) ÷	- (4) =			18.56	(273)
El rating (section 14)							84	(274)

		l lser I	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	<u> </u>	Strom Softwa	_				0016363 on: 1.0.5.51	
	į	Property	Address	Flat-10	2-LEAN				
Address :									
Overall dwelling dimer	nsions:	A	- (2)		A I I .	! !- 4 <i>(</i>)		V - l /	
Ground floor			a(m²) 50.44	(1a) x		ight(m) 2.7	(2a) =	Volume(m³	(3a)
	ı)+(1b)+(1c)+(1d)+(1e)+(1							130.19	
•)'(1b)'(1c)'(1d)'(1e)'(1	'''	50.44	(4)	\+(20\+(26	d)+(3e)+	(2p) -		_
Dwelling volume				(3a)+(3b)+(30)+(30	л)+(Se)+	(311) =	136.19	(5)
2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	r
Number of chimneys	heating heating	, 	0	7 = 6	0	x	40 =	0	(6a)
Number of open flues		_	0]			20 =		╡``
Number of intermittent far		_ L	0	┙┢	0		10 =	0	(6b)
	15			Ļ	0		10 =	0	(7a)
Number of passive vents				Ļ	0			0	(7b)
Number of flueless gas fir	es				0	X 4	40 =	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimney	rs, flues and fans = (6a)+(6b)+(7a)+(7b)+	(7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has be	een carried out or is intended, procee	ed to (17),	otherwise o	ontinue fr	om (9) to			-	```
Number of storeys in th	e dwelling (ns)							0	(9)
Additional infiltration	25 for steel or timber frame o	r 0 35 fo	r macani	v constr	ruction	[(9)	-1]x0.1 =	0	$=$ $\frac{(10)}{(11)}$
	esent, use the value corresponding t			•	uction			0	(11)
deducting areas of opening	• , ,	\ 1 /aaal	ممال مامم	t O					7
If no draught lobby, ent	oor, enter 0.2 (unsealed) or (er 0.05, else enter 0	ı. ı (seai	ea), eise	enter 0				0	(12)
•	and doors draught stripped							0	(14)
Window infiltration	3 11		0.25 - [0.2	x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic metr		•	•	etre of e	envelope	area	3	(17)
· ·	ty value, then $(18) = [(17) \div 20] +$				i- h-i			0.15	(18)
Number of sides sheltered	: if a pressurisation test has been do d	ne or a de	gree air pe	теаршіу	is being u	sea		2	(19)
Shelter factor	-		(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporati	ng shelter factor		(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified for	or monthly wind speed							1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe		1	1		•			1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
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		

0.16	ation rate				1		r` ´	` ´ 	0.44	0.44	I 0.45	1	
[0.16] Calculate effect	0.16 ctive air c	0.16 change i	0.14 rate for t	0.14 he appli	0.12 cable ca	0.12 ise	0.12	0.13	0.14	0.14	0.15	J	
If mechanica	ıl ventilat	tion:										0.5	(2:
If exhaust air he	at pump u	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (l	N5)) , othe	rwise (23b) = (23a)			0.5	(2:
If balanced with	heat recov	very: effic	iency in %	allowing 1	for in-use f	actor (fron	n Table 4h) =				77.35	(2:
a) If balance		ınical ve	entilation		at recov	ery (MV	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24a)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26]	(24
b) If balance	d mecha	ınical ve	entilation	without	heat red	covery (I	ИV) (24b)m = (22	2b)m + (2	23b)	1	1	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
c) If whole he if (22b)m				•	•				.5 × (23b)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural v				•	•				0.5]			-	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change r	rate - er	nter (24a) or (24l	o) or (24	c) or (24	d) in bo	x (25)	•		•	•	
5)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
3. Heat losses	s and he	at loss r	paramet	er.									
LEMENT	Gros	•	Openin		Net Ar	ea	U-val	ue	AXU		k-value	3	ΑΧk
	area ((m²)	m	1 ²	A ,r	m²	W/m2	!K	(W/ł	<)	kJ/m²·	K	kJ/K
oors					1.99		1	=	1.99				(2
/indows Type	1				1.37	x1	/[1/(1.4)+	0.04] =	1.82				(2
indows Type	2				4.65	x1	/[1/(1.4)+	0.04] =	6.16				(2
indows Type	3				1.54	x1	/[1/(1.4)+	0.04] =	2.04				(2
alls Type1	55.8	;	8.93		46.87	7 X	0.15	=	7.03				(:
alls Type2	22.49	Э	1.99		20.5	X	0.15	=	3.08				(:
otal area of e	lements,	m²			78.29	9							(3
arty wall					9.64	. X	0	=	0				(:
arty floor					50.44	4							(3
arty ceiling					50.44	4							(3
or windows and include the area						lated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	1 3.2	
abric heat los	s, W/K =	: S (A x	U)				(26)(30)) + (32) =				23.93	(:
eat capacity (Cm = S(/	Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	18066.3	(
nermal mass	paramet	er (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(;
r design assess n be used instea				construct	ion are no	t known pi	ecisely the	e indicative	e values of	TMP in Ta	able 1f		
nermal bridge	es : S (L :	x Y) cal	culated (using Ap	pendix l	K						11	(;
details of therma		are not kn	own (36) =	= 0.05 x (3	11)			(00)	(20)				<u> </u>
otal fabric hea	สเ IOSS							(33) +	(36) =			34.94	(;
entilation hea	41	العابيما	J = 41. 1					(00)	= 0.33 × (05) (5)			

(38)m= 12.4	12.25	12.11	11.39	11.25	10.53	10.53	10.39	10.82	11.25	11.54	11.82		(38)
` /			11.39	11.25	10.55	10.55	10.39				11.02		(30)
(39)m= 47.33	47.19	47.05	46.33	46.19	45.47	45.47	45.33	45.76	= (37) + (3 46.19	46.47	46.76		
47.00	47.10	47.00	40.00	40.10	10.47	40.47	40.00			Sum(39) ₁		46.3	(39)
Heat loss para	meter (H	HLP), W	/m²K		_		_		= (39)m ÷				
(40)m= 0.94	0.94	0.93	0.92	0.92	0.9	0.9	0.9	0.91	0.92	0.92	0.93		_
Number of day	e in mo	nth (Tah	(12 ما					•	Average =	Sum(40) ₁	12 /12=	0.92	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
` '		Į			l .		<u> </u>			<u> </u>			
4. Water heat	tina ene	rav reau	irement:								kWh/ye	ear:	
	_		i omoni.									, car.	
Assumed occu if TFA > 13.9			[1 - exn	(- 0 0003	849 v (TF	-Δ -13 Θ)2)1 + 0 (0013 x (Γ F Δ - 13		.7	I	(42)
if TFA £ 13.9		· 1.70 A	. [ι - cxp	(-0.0000	7-3 X (11	A-10.5	<i>)</i> 2)] · O.() X 010 X (1174-10.	.5)			
Annual averag									o toract o		.65		(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													
(44)m= 82.11	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11		
									Total = Su	m(44) ₁₁₂ =	=	895.77	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x D	Tm / 3600	kWh/mor	th (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		_
If instantaneous w	ater heati	na at noint	of use (no	hot water	r storage)	enter 0 in	hoxes (46		Total = Su	m(45) ₁₁₂ =	=	1174.5	(45)
(46)m= 18.27	15.98	16.48	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(46)
Water storage		10.40	14.37	13.79	11.9	11.03	12.03	12.0	14.92	10.29	17.09		(40)
Storage volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	eating a	and no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	ıcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufact		eclared l	oss facto	nr is kno	wn (kW/h	n/day).					0		(48)
Temperature f				51 10 Ki10	**** (1.***)	"day).					0		(49)
Energy lost fro				ear			(48) x (49)) =			0		(50)
b) If manufact		-	-		or is not		(-) (-)				0		(00)
Hot water stora	_			e 2 (kW	h/litre/da	ıy)					0		(51)
If community he Volume factor	•		on 4.3										(50)
Temperature f			2b								0		(52) (53)
Energy lost fro				ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (-	,y				(· · / / (v ·)	, (=) ^ (/	-	0		(55)
Water storage	. , .	•	for each	month			((56)m = (55) × (41)	m				• •
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	L s dedicate	u d solar sto	<u>l</u> rage, (57)ı				0), else (5	<u>I</u> 7)m = (56)	m where (m Append	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				0		(58)
Primary circuit loss calculated for each mor	th (59)m = (58) ÷ 36	65 × (41)m				
(modified by factor from Table H5 if there	is solar water heati	ng and a cylinde	r thermostat)	-		
(59)m= 0 0 0 0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each month (61)r	n = (60) ÷ 365 × (41)m				
(61)m= 41.84 36.42 38.8 36.08 35.	``	35.76 36.08	38.8 39.02	41.84		(61)
Total heat required for water heating calculation	ated for each month	(62)m = 0.85 × ((45)m + (46)m +	(57)m +	(59)m + (61)m	
(62)m= 163.61 142.92 148.7 131.89 127		120.12 121.44	138.29 147.62	159.77		(62)
Solar DHW input calculated using Appendix G or Appe				er heating)		
(add additional lines if FGHRS and/or WWH				g)		
(63)m= 0 0 0 0 0	 	0 0	0 0	0		(63)
Output from water heater		<u> </u>	<u> </u>			
(64)m= 163.61 142.92 148.7 131.89 127	.69 112.46 107.75	120.12 121.44	138.29 147.62	159.77		
(6.)		l	ater heater (annual)		1622.26	(64)
Heat gains from water heating, kWh/month	0 25 ′ [0 85 x (45)m	•	,			1(,,,
(65)m= 50.95 44.52 46.24 40.88 39.		36.99 37.4	42.78 45.86	49.67] 	(65)
` '	_ ! _ ! !	<u> </u>	<u> </u>			(00)
include (57)m in calculation of (65)m only	if cylinder is in the	dwelling or hot w	ater is from com	munity h	eating	
5. Internal gains (see Table 5 and 5a):						
Metabolic gains (Table 5), Watts				1	ı	
	ay Jun Jul	Aug Sep	Oct Nov	Dec		
(66)m= 85.15 85.15 85.15 85.15 85.	15 85.15 85.15	85.15 85.15	85.15 85.15	85.15	J	(66)
Lighting gains (calculated in Appendix L, ed	uation L9 or L9a), a	lso see Table 5				
(67)m= 13.31 11.82 9.61 7.28 5.4	4 4.59 4.96	6.45 8.66	10.99 12.83	13.68		(67)
Appliances gains (calculated in Appendix L	equation L13 or L1	3a), also see Ta	ble 5			
(68)m= 148.38 149.92 146.04 137.78 127	.35 117.55 111	109.46 113.34	121.6 132.03	141.83		(68)
Cooking gains (calculated in Appendix L, ed	quation L15 or L15a), also see Table	5			
(69)m= 31.52 31.52 31.52 31.52 31.	52 31.52 31.52	31.52 31.52	31.52 31.52	31.52		(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= -68.12 -68.12 -68.12 -68.12 -68		-68.12 -68.12	-68.12 -68.12	-68.12		(71)
Water heating gains (Table 5)	I	<u> </u>	<u> </u>	<u> </u>		
(72)m= 68.48 66.24 62.15 56.77 53	.1 48.14 44.36	49.72 51.95	57.5 63.7	66.76		(72)
Total internal gains =	!!	1 + (68)m + (69)m +				, ,
(73)m= 281.71 279.53 269.35 253.37 237		217.17 225.49	241.64 260.1	273.81		(73)
6. Solar gains:	221.03	217.17 223.49	241.04 200.1	273.01		(10)
Solar gains are calculated using solar flux from Table	6a and associated equa	ations to convert to the	ne applicable orienta	tion.		
Orientation: Access Factor Area	Flux	g_	FF		Gains	
Table 6d m ²	Table 6a	9_ Table 6b	Table 6c		(W)	
Northeast 0.9x 0.77 x 4.65	x 11.28	x 0.55	x 0.8		16	(75)
N. (1)	╡ ╞━━━		╡	= -](75)](75)
Nortneast 0.9x 0.77 x 1.54	X 11.28	X 0.55	X 0.8		5.3	1(13)

Utilisation fac	Feb	Mar	Apr	May	Ť	Jun Jul	ΙΑ	ug Sep	Oct	Nov	Dec	1	
Temperature	_	•			_		ble 9	Th1 (°C)				21	(85)
7. Mean inter			`										
(84)m= 333.75	375.24	419.09	470.41	509.28	50	478.99	441	.47 398.24	352.4	323.72	317.51]	(84)
Total gains – ii	nternal a	nd sola	r (84)m =	(73)m	+ (8	33)m , watts		<u>.</u>				_	
(83)m= 52.04	95.71	149.75	217.03	271.84	$\overline{}$	267.12	224		110.8	5 63.62	43.7]	(83)
Solar gains in	watts. ca	lculated	d for each	n month	1		(83)m	ı = Sum(74)m	(82)m				
Southwest _{0.9x}	0.77	Х	1.3	7	x	31.49	J	0.55	X	0.8	=	26.31	(79)
Southwest _{0.9x}	0.77	×		==	X	44.07		0.55	×	0.8	_ =	36.82	(79)
Southwest _{0.9x}	0.77	X			x	69.27	1	0.55	X	0.8	=	57.87	(79)
Southwest _{0.9x}	0.77	х	1.3	7	Х	92.85	_	0.55	х	0.8	=	77.58	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	104.39	Ţ	0.55	X	0.8	=	87.22	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	113.91]	0.55	X	0.8	=	95.17	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	118.15]	0.55	X	0.8	=	98.71	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	119.01]	0.55	X	0.8	=	99.43	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	106.25]	0.55	X	0.8	=	88.77	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	85.75]	0.55	X	0.8	=	71.64	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	62.67]	0.55	X	0.8	=	52.36	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	36.79]	0.55	X	0.8	=	30.74	(79)
Northeast 0.9x	0.77	X	1.5	4	x	9.21	X	0.55	X	0.8	=	4.33	(75)
Northeast _{0.9x}	0.77	X	4.6	5	x	9.21	X	0.55	X	0.8	=	13.06	(75)
Northeast _{0.9x}	0.77	X	1.5	4	x	14.2	X	0.55	X	0.8	=	6.67	(75)
Northeast _{0.9x}	0.77	X	4.6	5	x	14.2	x	0.55	X	0.8	=	20.13	(75)
Northeast _{0.9x}	0.77	X	1.5	4	x	28.07	X	0.55	X	0.8	=	13.18	(75)
Northeast 0.9x	0.77	X	4.6	5	x	28.07	x	0.55	X	0.8	=	39.8	(75)
Northeast 0.9x	0.77	X	1.5	4	x	50.42	x	0.55	×	0.8	=	23.68	(75)
Northeast 0.9x	0.77	X	4.6	5	x [50.42	j×	0.55	x	0.8	=	71.49	(75)
Northeast _{0.9x}	0.77	X	1.5	4	x	72.63	X	0.55	×	0.8	-	34.1	(75)
Northeast _{0.9x}	0.77	×	4.6	5	x	72.63	X	0.55	×	0.8	=	102.98	(75)
Northeast _{0.9x}	0.77	x			x	91.1	X	0.55	×	0.8	= =	42.78	(75)
Northeast 0.9x	0.77	X	4.6		x [91.1] x	0.55	×	0.8	= =	129.17	(75)
Northeast 0.9x	0.77	×			^ L	97.38] x	0.55	×	0.8	=	45.73	(75)
Northeast 0.9x	0.77	×			^ L	97.38]	0.55	= x	0.8	= =	138.08	(75)
Northeast 0.9x	0.77	×			^ L	91.35]	0.55	x	0.8	= =	42.89	(75)
Northeast 0.9x	0.77	^			^ L	91.35] ^] x	0.55	d x	0.8	= =	129.52	(75)
Northeast 0.9x	0.77	X			^ L	67.96]	0.55	×	0.8	=	31.91	(75)
Northeast 0.9x	0.77	×			x [67.96]]	0.55	X	0.8	=	96.35	(75)
Northeast 0.9x	0.77	X	1.5		x [41.38] x	0.55	×	0.8	=	19.43	(75)
Northeast 0.9x	0.77	X			^ L	41.38]	0.55	×	0.8	╡ -	58.67	(75)
Northeast 0.9x	0.77	x	1.5		^ L x [22.97	」 ^] _x	0.55	= x	0.8	= =	10.78	(75)
0.07.	0.77		7.0	J	X	22.97	X	0.55	X	0.8	=	32.56	(75)

(86)m=	1	0.99	0.98	0.92	0.78	0.57	0.42	0.47	0.74	0.95	0.99	1		(86)
Mean	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)				•	
(87)m=	20.11	20.25	20.47	20.75	20.93	20.99	21	21	20.96	20.72	20.37	20.09		(87)
Temp	erature	durina h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9 T	h2 (°C)		•			
(88)m=	20.13	20.14	20.14	20.15	20.15	20.17	20.17	20.17	20.16	20.15	20.15	20.14		(88)
· · · · · · · · · · · · · · · · · · ·		ton fon a	oine fem		برمااام بر	h O ma /a a	. Tabla	0-1						
(89)m=	1	0.99	ains for 1	0.9	0.72	0.5	0.34	0.39	0.67	0.94	0.99	1		(89)
						<u> </u>	<u> </u>	<u> </u>	l	<u> </u>	0.00	<u>'</u>		()
ı						- ` `	r		7 in Tabl		10.00	40.00	1	(00)
(90)m=	18.95	19.15	19.47	19.87	20.09	20.16	20.17	20.17	20.13	19.84	19.33 g area ÷ (4	18.92	0.54	(90)
									·	LA - LIVIII	ig alea + (4	+) -	0.54	(91)
Mean	interna	temper	ature (fo	r the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	A) × T2				ī	
(92)m=	19.58	19.75	20.02	20.35	20.55	20.61	20.62	20.62	20.58	20.32	19.9	19.56		(92)
Apply	adjustn	nent to t	ne mean	interna	temper	ature fro	m Table	4e, whe	ere appro	priate			•	
(93)m=	19.43	19.6	19.87	20.2	20.4	20.46	20.47	20.47	20.43	20.17	19.75	19.41		(93)
8. Spa	ace hea	ting requ	uirement											
				•		ed at ste	ep 11 of	Table 9l	b, so tha	t Ti,m=(76)m an	d re-calc	culate	
the ut			or gains	T T							·		1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ı			ains, hm		0.74	0.50	0.07	0.40	0.7	0.04	I 0.00			(04)
(94)m=	0.99	0.99	0.97	0.9	0.74	0.52	0.37	0.42	0.7	0.94	0.99	1		(94)
			W = (94	<u> </u>		004.05	475.00	400.00	077.45	000 70	040.00	040.44	1	(OE)
(95)m=	331.82	370.72	405.88	423.15	376.98	264.05	175.69	183.96	277.15	329.72	319.66	316.11		(95)
ı	11y avera	age exte	rnal tem	perature 8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	1 4 2		(96)
(96)m=						!	16.6	!	(06)	!	7.1	4.2		(90)
(97)m=	716.33	693.64	628.88	523.56	401.84	266.6	175.93	x [(93)m 184.46	- (96)m	441.87	587.79	711.18		(97)
` ′						<u> </u>	<u> </u>	<u> </u>		<u> </u>		711.10		(01)
(98)m=	286.08	217	165.91	72.3	18.5	0	0.02	0)m – (95 0	83.44	193.05	293.93		
(90)111=	200.00	217	103.91	72.5	10.5								4000.04	(98)
								Tota	ii per year	(KVVII/yeai	r) = Sum(9	O)15,912 -	1330.21	╡
Space	e heating	g require	ement in	kWh/m²	² /year								26.37	(99)
9a. En	ergy req	uiremer	nts – Indi	vidual h	eating s	ystems i	ncluding	micro-C	CHP)					
•	e heatir	•												_
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 heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficie	ency of r	nain spa	ace heat	ing syste	em 1								90.3	(206)
Efficie	ency of s	seconda	ry/supple	ementar	y heating	g systen	ո, %						0	(208)
Ī	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	_l ar
Snace			ement (c				Jui	Aug	Оер	001	1407	Dec	[Kvvii/ye	aı
Opade 	286.08	217	165.91	72.3	18.5	0	0	0	0	83.44	193.05	293.93		
(211)										L	L	I	1	(244)
(211)III 	316.81)m x (20 240.31	4)] } x 1	80.06	20.48	0	0	0	0	92.4	213.79	325.5		(211)
	010.01	۱ ۲۵.۵	100.70	00.00	20.40	L "	L "				211) _{15.1012}		4.470.4	(211)
								1010	(, Cami	- · · /15,1012	2	1473.1	

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)					
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0 0 0	0 0 0	0		
	То	ral (kWh/year) =Sum(215) _{15,10}	=	0	(215)
Water heating					_
Output from water heater (calculated above) 163.61 142.92 148.7 131.89 127.69 1	12.46 107.75 120.12	121.44 138.29 147.62	159.77]	
Efficiency of water heater	II			81	(216)
(217)m= 86.68 86.36 85.65 84.07 82.07	81 81 81	81 84.27 86.02	86.79		(217)
Fuel for water heating, kWh/month					
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 188.76 165.49 173.61 156.89 155.59 1 $	38.84 133.02 148.29	149.93 164.11 171.61	184.09		
	То	ral = Sum(219a) ₁₁₂ =		1930.23	(219)
Annual totals		kWh/yea	r	kWh/year	- 7
Space heating fuel used, main system 1				1473.1	_
Water heating fuel used				1930.23	
Electricity for pumps, fans and electric keep-hot					
mechanical ventilation - balanced, extract or pos	itive input from outsion	de	157.84		(230a)
central heating pump:			30		(230c)
Total electricity for the above, kWh/year	sui	m of (230a)(230g) =		187.84	(231)
Electricity for lighting				234.98	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)(237b) =		3826.15	(338)
12a. CO2 emissions – Individual heating system	s including micro-CH	P			
	Energy kWh/year	Emission fac kg CO2/kWh	ctor	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	=	318.19	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	416.93	(264)
Space and water heating	(261) + (262) + (263) +	(264) =		735.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	97.49	(267)
Electricity for lighting	(232) x	0.519	=	121.95	(268)
Total CO2, kg/year		sum of (265)(271) =		954.56	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.92	(273)
					٦

El rating (section 14)

(274)

		l lser-l	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	<u> </u>	Strom Softwa					0016363 on: 1.0.5.51	
Software Name.	-	Property	Address				VEISIC	л. т.о.э.эт	
Address :		roporty	7 (44) 555	. r lat 20					
1. Overall dwelling dime	ensions:								
0 15			a(m²)	1		ight(m)	٦	Volume(m ³	_
Ground floor			71.04	(1a) x		2.7	(2a) =	191.81	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	71.04	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	191.81	(5)
2. Ventilation rate:									
	main seconda heating heating	ry 	other	_	total			m³ per hou	ır
Number of chimneys	0 + 0] + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ns				0	X ·	10 =	0	(7a)
Number of passive vents	;			Ī	0	x :	10 =	0	(7b)
Number of flueless gas fi	res			Ī	0	x 4	40 =	0	(7c)
				<u>L</u>					
							Air ch	nanges per ho	our
	ys, flues and fans = (6a)+(6b)+([0		÷ (5) =	0	(8)
Number of storeys in t	een carried out or is intended, proced he dwelling (ns)	ed to (17),	otherwise (continue fr	om (9) to	(16)		0	(9)
Additional infiltration	no awoming (no)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	ry consti	ruction			0	(11)
if both types of wall are po deducting areas of openio	resent, use the value corresponding t	o the grea	ter wall are	a (after					
•	floor, enter 0.2 (unsealed) or (.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	. ,	-			0	(15)
Infiltration rate			(8) + (10)					0	(16)
•	q50, expressed in cubic metrity value, then $(18) = [(17) \div 20] +$	•	•	•	etre of e	envelope	area	3	(17)
·	es if a pressurisation test has been do				is being u	sed		0.15	(10)
Number of sides sheltere	ed							2	(19)
Shelter factor			(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•		(21) = (18	s) x (20) =				0.13	(21)
Infiltration rate modified f	 	Jul	Aug	Con	Oct	Nov	Dec	1	
Jan Feb	Mar Apr May Jun	Jui	Aug	Sep	Oct	I NOV	Dec	J	
Monthly average wind sp (22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	1	
, , , , , , , , , , , , , , , , , , , ,	1 1 1 5.0			<u> </u>	L			J	
Wind Factor (22a)m = (2		_						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		

Adjusted infiltra	ation rate	(allowi	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effect		•	ate for t	he appli	cable ca	se						·	
If mechanica			endix N (2	3h) = (23a	a) x Fmv (e	equation (N5)) othe	rwise (23h	n) = (23a)			0.5	(238
If balanced with									, (20a)			0.5	(23k
a) If balance		-	•	_					2h\m + ('	22h) v [:	1 (22a)	77.35	(230
(24a)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	+ 100] 	(24a
b) If balance	LL						<u> </u>	1			0.20		(
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole h													•
,	n < 0.5 × (•	•				.5 × (23b)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
d) If natural	ventilatior	n or wh	ole hous	e positiv	ve input	ventilati	on from	loft				l	
if (22b)n	n = 1, ther	n (24d)	m = (22l	o)m othe	erwise (2	24d)m =	0.5 + [(2	22b)m² x	0.5]			-	
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air	change ra	ate - en	iter (24a) or (24k	o) or (24	c) or (24	d) in bo	x (25)				-	
(25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(25)
3. Heat losse	s and hea	at loss p	paramet	er:									
ELEMENT	Gross area (ı	;	Openin	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	()	k-value kJ/m²·l		A X k kJ/K
Doors	(-	,			1.99		1		1.99	'			(26)
Windows Type	e 1				1.37		/[1/(1.4)+	0.04] =	1.82				(27)
Windows Type					0.9	_	/[1/(1.4)+		1.19				(27)
Windows Type					5.79	〓 .	/[1/(1.4)+		7.68				(27)
Windows Type					2.19	= .	/[1/(1.4)+		2.9	=			(27)
Walls Type1	75.26		15.7	3	59.53	=			8.93	=			(29)
Walls Type2	27.91	_	1.99	=		=	0.15	_		믁 ¦		╡	(29)
Total area of e		 m²	1.98		25.92	=	0.15		3.89				
	iements,	111			103.1	=							(31)
Party floor					10.99	=	0	=	0	<u> </u>		╡	(32)
Party floor					71.04	=				Ĺ		╡	(32a
Party ceiling					71.04			1/8/4/11 1-).0041-				(32)
* for windows and ** include the area						atea using	g tormula 1	1/[(1/U-vail	ie)+0.04] a	s given in	paragrapn	1 3.2	
				,			(26)(30) + (32) =				35.66	(33)
Fabric heat los									(0.0)	2) + (32a)	(32e) =	23186.5	(34)
Fabric heat los		(xk)						((28).	(30) + (32	-) · (OLU).	(-)	20100.0	
	Cm = S(A	•	P = Cm ÷	- TFA) ir	n kJ/m²K	,			(30) + (32 itive Value:		(-)	250	(35)
Fabric heat los Heat capacity	Cm = S(A paramete sments wher	er (TMF	tails of the	•			recisely the	Indica	itive Value:	Medium			==
Fabric heat los Heat capacity Thermal mass For design assess	Cm = S(A paramete sments wher ad of a detail	er (TMF re the der iled calcu	tails of the ılation.	construct	ion are no	t known pi	recisely the	Indica	itive Value:	Medium		250	(35)
Fabric heat los Heat capacity Thermal mass For design assess can be used instead	Cm = S(A paramete sments when ad of a detail es : S (L x	er (TMF re the der iled calcu (Y) calc	tails of the ulation. culated (construct	ion are not opendix I	t known pi	recisely the	Indica	itive Value:	Medium			==

Ventila	ition hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	17.46	17.26	17.05	16.05	15.84	14.84	14.84	14.63	15.24	15.84	16.25	16.65		(38)
Heat tr	ansfer c	oefficier	nt, W/K	•	•	•	•	•	(39)m	= (37) + (38)m	•	'	
(39)m=	65.88	65.68	65.47	64.47	64.26	63.26	63.26	63.05	63.66	64.26	64.67	65.07		
Heat lo	ss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) ₁	12 /12=	64.42	(39)
(40)m=	0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.9	0.9	0.91	0.92		
Numbe	er of day	s in moi	nth (Tab	le 1a)		•			,	Average =	Sum(40) ₁	12 /12=	0.91	(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)
'					•				•				l	
4. Wa	iter heat	ing ene	rgy requi	irement:								kWh/ye	ear:	
Assum	ed occu	ipancy, l	N									.27		(42)
if TF		9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13		.21	l	(42)
Annual	l averag	e hot wa	ater usaç									3.14		(43)
			hot water person per					to achieve	a water us	se target o	f		'	
								Aug	Con	Oct	Nov	Doo		
Hot wate	Jan er usage ir	Feb	Mar day for ea	Apr ach month	May Vd,m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	96.95	93.43	89.9	86.38	82.85	79.32	79.32	82.85	86.38	89.9	93.43	96.95		
(1 1)	00.00	00.10	00.0	00.00	02.00	70.02	70.02	02.00			m(44) ₁₁₂ =		1057.67	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	7 Tm / 3600			ables 1b, 1			
(45)m=	143.78	125.75	129.76	113.13	108.55	93.67	86.8	99.6	100.79	117.47	128.22	139.24		
lf instant	taneous w	ater heati	na at naint	of use (no	hot water	r storage)	enter O in	haves (16		Γotal = Su	m(45) ₁₁₂ =	=	1386.77	(45)
1			ng at point	`				· · · ·	. ,	47.00	1 40 00	00.00		(40)
(46)m= Water	21.57 storage	18.86 loss:	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.89		(46)
	•		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	munity h	eating a	nd no ta	ınk in dw	elling, e	nter 110	litres in	(47)					l	
			hot wate	er (this in	ıcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
	storage					(1.3.4./1	. /						ı	
•			eclared l		or is kno	wn (Kvvr	1/day):					0		(48)
•			m Table					(40) (40)				0		(49)
			storage eclared o	-		or is not		(48) x (49)) =			0		(50)
•			factor fr	-								0		(51)
	-	•	ee secti	on 4.3										
		from Ta		01								0		(52)
•			m Table									0		(53)
			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
	` ,	(54) in (5	•	for oach	month			((56)m = '	55\ ~ (44\)			0		(55)
1			culated 1					((56)m = (-		l	/F0:
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)

If cylinder con	tains dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	om Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circ	cuit loss (ar	nnual) fro	om Table	 ∋ 3	•						0		(58)
Primary circ	•	•			59)m = ((58) ÷ 36	65 × (41)	m				•	
(modified	by factor f	rom Tab	le H5 if t	here is	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	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 49.4	11 43	45.81	42.6	42.22	39.12	40.42	42.22	42.6	45.81	46.07	49.41		(61)
Total heat r	equired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 193	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		(62)
Solar DHW in	out calculated	using App	endix G or	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add addition	nal 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	n water hea	iter											
(64)m= 193.	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		
	•						Outp	out from wa	ater heate	r (annual)₁	12	1915.45	(64)
Heat gains	from water	heating,	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m]	
(65)m= 60.	16 52.56	54.6	48.26	46.65	40.93	38.97	43.67	44.16	50.51	54.15	58.65		(65)
include (57)m in cal	culation o	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Interna	l gains (see	e Table 5	5 and 5a):									
Metabolic g	ains (Table	e 5). Wat	ts	,									
Ja		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.	56 113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56		(66)
Lighting ga	ns (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 17.	8 15.81	12.86	9.74	7.28	6.14	6.64	8.63	11.58	14.71	17.17	18.3		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	•	•	•	
(68)m= 199.	71 201.78	196.56	185.44	171.41	158.22	149.41	147.34	152.56	163.68	177.71	190.9		(68)
Cooking ga	ins (calcula	ated in A	ppendix	L, equat	tion L15	or L15a), also se	ee Table	5	•	•		
(69)m= 34.3	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36		(69)
Pumps and	fans gains	(Table 5	.——— 5а)	•	•			•		•	!		
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporation	n (nega	tive valu	es) (Tab	le 5)							•	
(71)m= -90.	84 -90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84		(71)
Water heat	ng gains (rable 5)						l				•	
(72)m= 80.8	~~	73.39	67.03	62.7	56.84	52.37	58.7	61.34	67.89	75.21	78.83		(72)
Total inter	nal gains =	:			(66)	m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72))m	ı	
(73)m= 358.	_ `	342.88	322.28	301.45	281.27	268.49	274.73	285.55	306.34	330.15	348.1		(73)
						L	<u> </u>						
6. Solar ga	ains:												
ŭ	ains: ire calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to co	onvert to th	e applicat	ole orientat	tion.		
ŭ	re calculated	actor	r flux from Area m²		Flu			onvert to the g_ sable 6b		ole orientat FF able 6c	tion.	Gains (W)	

Northoast a ou		1		1		1		l		1		7(75)
Northeast 0.9x	0.77	X	0.9	X	11.28	X	0.55	X	0.8] = 1	3.1	(75)
Northeast 0.9x	0.77	X	0.9	X	22.97	X	0.55	X	0.8] = 1	6.3	(75)
Northeast 0.9x	0.77	X	0.9	X	41.38	X	0.55	X	0.8] =	11.36	(75)
Northeast _{0.9x}	0.77	X	0.9	X	67.96	X	0.55	X	0.8] =	18.65	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.35	X	0.55	X	0.8	=	25.07	(75)
Northeast _{0.9x}	0.77	X	0.9	X	97.38	X	0.55	X	0.8] =	26.73	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.1	X	0.55	X	0.8	=	25	(75)
Northeast _{0.9x}	0.77	X	0.9	X	72.63	X	0.55	X	0.8	=	19.93	(75)
Northeast _{0.9x}	0.77	X	0.9	X	50.42	X	0.55	X	0.8	=	13.84	(75)
Northeast _{0.9x}	0.77	X	0.9	X	28.07	X	0.55	X	0.8	=	7.7	(75)
Northeast _{0.9x}	0.77	X	0.9	X	14.2	X	0.55	X	0.8	=	3.9	(75)
Northeast _{0.9x}	0.77	X	0.9	X	9.21	X	0.55	X	0.8	=	2.53	(75)
Southeast _{0.9x}	0.77	X	5.79	X	36.79	X	0.55	X	0.8	=	64.96	(77)
Southeast _{0.9x}	0.77	X	5.79	X	62.67	X	0.55	X	0.8	=	110.65	(77)
Southeast _{0.9x}	0.77	X	5.79	X	85.75	X	0.55	X	0.8	=	151.4	(77)
Southeast _{0.9x}	0.77	X	5.79	X	106.25	x	0.55	x	0.8	=	187.59	(77)
Southeast _{0.9x}	0.77	X	5.79	X	119.01	X	0.55	x	0.8	=	210.11	(77)
Southeast 0.9x	0.77	X	5.79	X	118.15	x	0.55	x	0.8	=	208.59	(77)
Southeast _{0.9x}	0.77	X	5.79	x	113.91	x	0.55	x	0.8] =	201.11	(77)
Southeast _{0.9x}	0.77	X	5.79	X	104.39	x	0.55	X	0.8] =	184.3	(77)
Southeast _{0.9x}	0.77	X	5.79	x	92.85	x	0.55	x	0.8] =	163.93	(77)
Southeast _{0.9x}	0.77	x	5.79	x	69.27	x	0.55	x	0.8] =	122.29	(77)
Southeast _{0.9x}	0.77	x	5.79	x	44.07	x	0.55	x	0.8] =	77.81	(77)
Southeast _{0.9x}	0.77	X	5.79	x	31.49	x	0.55	x	0.8] =	55.59	(77)
Northwest _{0.9x}	0.77	X	1.37	x	11.28	x	0.55	x	0.8] =	23.57	(81)
Northwest _{0.9x}	0.77	X	2.19	x	11.28	x	0.55	x	0.8] =	7.53	(81)
Northwest _{0.9x}	0.77	x	1.37	x	22.97	x	0.55	x	0.8	j =	47.97	(81)
Northwest 0.9x	0.77	x	2.19	x	22.97	x	0.55	x	0.8	j =	15.34	(81)
Northwest _{0.9x}	0.77	x	1.37	x	41.38	x	0.55	x	0.8] =	86.43	(81)
Northwest 0.9x	0.77	x	2.19	x	41.38	x	0.55	x	0.8	j =	27.63	(81)
Northwest _{0.9x}	0.77	x	1.37	x	67.96	x	0.55	х	0.8	j =	141.94	(81)
Northwest _{0.9x}	0.77	x	2.19	x	67.96	х	0.55	x	0.8	j =	45.38	(81)
Northwest 0.9x	0.77	x	1.37	x	91.35	x	0.55	х	0.8	j =	190.79	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.35	x	0.55	х	0.8	j =	61	(81)
Northwest _{0.9x}	0.77	x	1.37	x	97.38	х	0.55	х	0.8	j =	203.41	(81)
Northwest _{0.9x}	0.77	x	2.19	x	97.38	x	0.55	x	0.8	j =	65.03	(81)
Northwest _{0.9x}	0.77	x	1.37	×	91.1	x	0.55	x	0.8	j =	190.28	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.1	x	0.55	x	0.8	i =	60.84	(81)
Northwest _{0.9x}	0.77	X	1.37	X	72.63	X	0.55	x	0.8] =	151.7	(81)
Northwest _{0.9x}	0.77	X	2.19	X	72.63	X	0.55	x	0.8] =	48.5	(81)
Northwest _{0.9x}	0.77	X	1.37	X	50.42	X	0.55	X	0.8] =	105.31	(81)
_		1		1		1		I		1		_ ' '

Northwest _{0.9x}	0.77	X	2.1	9	x [50.4	-2	X		0.55	x	0.8	=	33.67	(81)
Northwest _{0.9x}	0.77	Х	1.3	7	x	28.0	17	X		0.55	х	0.8	=	58.62	(81)
Northwest _{0.9x}	0.77	Х	2.1	9	x	28.0	17	X		0.55	х	0.8	=	18.74	(81)
Northwest _{0.9x}	0.77	X	1.3	7	x	14.2	2	X		0.55	x	0.8	=	29.65	(81)
Northwest _{0.9x}	0.77	Х	2.1	9	x	14.2	2	X		0.55	х	0.8	=	9.48	(81)
Northwest _{0.9x}	0.77	X	1.3	7	x [9.21	1	x		0.55	x	0.8	=	19.25	(81)
Northwest 0.9x	0.77	X	2.1	9	x	9.21	1	X		0.55	x	0.8	=	6.15	(81)
Solar gains in	watts, ca	alculated	for eacl	n month				(83)m	= St	um(74)m .	(82)m	_			
(83)m= 99.16	180.26	276.81	393.55	486.97			77.22	404.	.43	316.75	207.36	120.84	83.52		(83)
Total gains – ii					È							<u>, </u>		Ī	
(84)m= 457.6	536.14	619.69	715.84	788.43	78	5.03 74	45.71	679.	.16	602.29	513.7	450.99	431.61		(84)
7. Mean inter	nal temp	erature	(heating	season)										
Temperature	during h	eating p	eriods ir	the livi	ng a	ırea froi	m Tab	ole 9,	Th	1 (°C)				21	(85)
Utilisation fac	tor for g	ains for l	iving are	a, h1,m	(se	e Table	e 9a)							•	
Jan	Feb	Mar	Apr	May	J	lun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.97	0.89	0.72	0.	.51 (0.37	0.4	3	0.7	0.95	0.99	1		(86)
Mean interna	l temper	ature in	living are	ea T1 (fo	ollov	v steps	3 to 7	in T	able	e 9c)					
(87)m= 20.11	20.28	20.52	20.81	20.96	2	21	21	2	1	20.97	20.75	20.38	20.09		(87)
Temperature	durina h	eating n	eriods ir	rest of	dwe	ellina fra	om Ta	hle C) Th	n2 (°C)		•			
(88)m= 20.14	20.15	20.15	20.16	20.16	_	<u> </u>	20.18	20.		20.17	20.16	20.16	20.15		(88)
				ب مالامی	L		Table	0-1	!						
Utilisation fac	0.99	0.96	0.87	0.67	_	<u> </u>	0.3	9a) 0.3	5 1	0.63	0.92	0.99	1		(89)
								<u> </u>				0.00	<u> </u>		()
Mean interna	· ·	1			Ť	<u> </u>		i 				T 40.05	10.00	Ī	(00)
(90)m= 18.96	19.2	19.55	19.95	20.13	20).17 2	20.18	20.	18	20.15	19.88	19.35	18.92	0.00	(90)
										'	LA - LIV	ing area ÷ (4	+) -	0.39	(91)
Mean interna		— <u> </u>			Ť	' 		<u> </u>						Ī	
(92)m= 19.4	19.61	19.93	20.28	20.45			20.49	20.4		20.47	20.21	19.75	19.37		(92)
Apply adjustn					_			ī				T 40.0	40.00	1	(02)
(93)m= 19.25	19.46	19.78	20.13	20.3	20).34 2	20.34	20.3	34	20.32	20.06	19.6	19.22		(93)
8. Space hea				o obtoir	d	at atan	11 of	Tabl	o 0h	oo tha	t Tim-	(76)m on	d ro ool	vulata	
Set Ti to the return the utilisation					ieu a	at step	1101	rabi	e ar), so ma	L 11,111-	(76)III an	u re-caic	uiale	
Jan	Feb	Mar	Apr	May	J	lun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
Utilisation fac	tor for g	ains, hm	:						<u> </u>			!		ı	
(94)m= 0.99	0.99	0.96	0.86	0.67	0.	.46 (0.32	0.3	37	0.64	0.92	0.99	1		(94)
Usefu <mark>l gains,</mark>	hmGm	, W = (94	1)m x (84	4)m										•	
(95)m= 455.11	528.73	594.13	618.4	532.08	36	1.48 2	36.68	248.	.43	385.17	473.1	445.17	429.9		(95)
Monthly avera					able	8								Ī	
(96)m= 4.3	4.9	6.5	8.9	11.7	<u> </u>		16.6	16.		14.1	10.6	7.1	4.2		(96)
Heat loss rate					_	<u></u> -			∸¬			T 000 5:	l a== ==	Ī	(07)
(97)m= 985.12	956.41	869.18	723.79	552.47			36.81	248.		395.91	608.25		977.56		(97)
Space heatin (98)m= 394.33	g require	ement to 204.63		15.17		month =	0.02	24 x [0	Ì	m – (95 0)m] x (- 100.56		407.46	Ī	
(98)m= 394.33	201.4	204.03	75.88	10.17	<u> </u>	<u> </u>	U			U	100.50	201.39	407.46		

					Tota	l per year	(kWh/yeaı	r) = Sum(9	08) _{15,912} =	1746.81	(98)
Space heating requirement in	kWh/m²/	year								24.59	(99)
9a. Energy requirements – Indi	vidual he	eating sy	/stems i	ncluding	micro-C	CHP)					
Space heating:									г		_
Fraction of space heat from se	•		mentary	-					ļ	0	(201)
Fraction of space heat from m	•	` ,			(202) = 1	, ,			ļ	1	(202)
Fraction of total heating from r	•				(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heati										90.3	(206)
Efficiency of secondary/supple	ementary	heating	g system	າ, %						0	(208)
Jan Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement (c		i		_			400.50	204.20	107.40		
394.33 287.4 204.63	75.88	15.17	0	0	0	0	100.56	261.39	407.46		(0.4.4)
(211) m = {[(98)m x (204)] } x 1 436.69 318.27 226.61	00 ÷ (206 84.03	0) 16.8	0	0	0	0	111.36	289.47	451.23		(211)
430.09 310.27 220.01	04.03	10.0	U	U		l (kWh/yea				1934.45	(211)
Space heating fuel (secondary	v). kWh/n	nonth					,	7 15, 10 1.		1001.10	(= · · · /
$= \{[(98)\text{m x } (201)]\} \times 100 \div (208)$	• •										
(215)m= 0 0 0	0	0	0	0	0	0	0	0	0		
					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,101}	= 2	0	(215)
Water heating											
Output from water heater (calculated) 193.18 168.75 175.57	ulated ab 155.73	ove) 150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		
Efficiency of water heater			.020				100.20		1 .00.00	81	(216)
(217)m= 87.01 86.62 85.75	83.83	81.77	81	81	81	81	84.31	86.33	87.13		(217)
Fuel for water heating, kWh/mc	onth										
(219) m = (64) m x $100 \div (217)$ (219)m = 222.01 194.82 204.74		184.38	163.94	157.07	175.09	177.02	102.67	201.88	216.5		
(219)m= 222.01 194.82 204.74	105.77	104.30	103.94	157.07		I = Sum(2	193.67 19a), ,, =	201.00	210.5	2276.89	(219)
Annual totals						•		Wh/yea	<u>,</u>	kWh/yea	
Space heating fuel used, main	system 1	I								1934.45	
Water heating fuel used										2276.89	
Electricity for pumps, fans and	electric k	eep-hot	t						L		
mechanical ventilation - balan	ced. extr	act or p	ositive ir	nout fron	n outside	.			222.31		(230a
central heating pump:	oou, on	чот от р		ipat iron	ii oatola				30		(230c
Total electricity for the above, k	:Wh/vear	<u>-</u>			sum	of (230a).	(230a) =			252.31	(231)
Electricity for lighting	, y can					,	(0,		l T		(232)
, ,	200 /044\	(004)	. (004)	. (000)	(007L)	_			[[314.43	=
Total delivered energy for all us		` ′	` ′	, ,	` ′				L	4778.08	(338)
12a. CO2 emissions – Individu	ual heatir	ng syste	ms inclu	uding mi	cro-CHF						
				ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	

Space heating (main system 1)	(211) x	0.216	=	417.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	491.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =			909.65	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	130.95	(267)
Electricity for lighting	(232) x	0.519	=	163.19	(268)
Total CO2, kg/year	sum	of (265)(271) =		1203.79	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		16.95	(273)
El rating (section 14)				86	(274)

User Details:	
Assessor Name: Chris Hocknell Stroma Number: STRO01	16363
	: 1.0.5.51
Property Address: Flat-202-LEAN	
Address:	
Overall dwelling dimensions:	
Area(m²) Av. Height(m) Ground floor $50.44 (1a) \times 2.7 (2a) = $	Volume(m³) 136.19 (3a)
	136.19
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ [4]	
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$	136.19 (5)
2. Ventilation rate: main secondary other total	m³ per hour
heating heating	
Number of chimneys $0 + 0 + 0 = 0$ $\times 40 = 0$	0 (6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 =$	0 (6b)
Number of intermittent fans 0 x 10 =	0 (7a)
Number of passive vents 0 x 10 =	0 (7b)
Number of flueless gas fires 0 x 40 =	0 (7c)
Air char	nges per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$ $\div (5) = 0$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)	0 (8)
Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration [(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35	
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$	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	3 (17)
If based on air permeability value, then (18) = [(17) ÷ 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 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	2 (19) 0.85 (20)
Infiltration rate incorporating shelter factor (21) = (18) x (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	

	ation rate				r	i í	` ´ 	` ´ 		0.44		7	
0.16 Calculate effec	0.16 ctive air c	0.16 change i	0.14 ate for t	0.14 he appli	0.12 cable ca	0.12 se	0.12	0.13	0.14	0.14	0.15]	
If mechanica		-										0.5	(23
If exhaust air he	at pump us	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recov	/ery: effici	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mecha	nical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)) ÷ 100]	
24a)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(24
b) If balance	d mecha	nical ve	ntilation	without	heat red	covery (I	ИV) (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 extr ı < 0.5 ×			•	•				.5 × (23b)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	ventilation n = 1, the			•	•				0.5]		•	•	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
Effective air	change r	ate - er	iter (24a) or (24k	o) or (24	c) or (24	d) in bo	x (25)	_		-	-	
25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
3. Heat losses	s and hea	at loss r	paramete	er:									
LEMENT	Gross area (s	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	〈)	k-value kJ/m²·		A X k kJ/K
oors	,				1.99	X	1	=	1.99	,			(2
Vindows Type	1				1.37	x1	/[1/(1.4)+	0.04] =	1.82				(2
/indows Type	2				4.65	x1	/[1/(1.4)+	0.04] =	6.16				(2
/indows Type	3				1.54	x1	/[1/(1.4)+	0.04] =	2.04				(2
/alls Type1	55.8		8.93		46.87	7 X	0.15	─	7.03			$\neg \vdash$	(2
/alls Type2	22.49	=	1.99		20.5	X	0.15	-	3.08	7 7		i ii	(2
otal area of e					78.29	9							(3
arty wall					9.64	x	0		0	п г		\neg	(3
arty floor					50.44							-	(3
arty ceiling					50.44	=						╡┝	(3
for windows and include the area					alue calcul		formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragrapl	 n 3.2	(
abric heat los							(26)(30)) + (32) =				23.93	(3
eat capacity	2m = S(<i>F</i>	Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	18066.3	3 (3
hermal mass	paramet	er (TMF	P = Cm ÷	· TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(3
or design assess an be used instea				construct	ion are no	t known pi	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridge	s : S (L)	x Y) cal	culated ı	using Ap	pendix l	<						10.71	(3
details of therma		ire not kn	own (36) =	0.05 x (3	1)				(0.0)				
otal fabric hea	at loss							(33) +	(36) =			34.64	(3
entilation hea									= 0.33 × (

(20)m= 12.4	12.25	12.11	11.39	11.25	10.53	10.53	10.39	10.82	11.25	11.54	11.82		(38)
(38)m= 12.4	12.25		11.39	11.25	10.53	10.53	10.39				11.02		(30)
Heat transfer (39)m= 47.04	46.89	1t, VV/K 46.75	46.04	45.89	45.18	45.18	45.03	(39)m 45.46	= (37) + (3 45.89	46.18	46.47		
(00)III= 47.04	40.00	40.73	40.04	40.00	40.10	40.10	40.00			Sum(39) ₁ .		46	(39)
Heat loss para	meter (H	HLP), W	m²K						= (39)m ÷				`
(40)m= 0.93	0.93	0.93	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.92		_
Number of day	ıc in moı	oth (Tab	lo 1a)					A	Average =	Sum(40) _{1.}	12 /12=	0.91	(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	fing ener	av regui	rement:								kWh/ye	var:	
4. Walei ilea	ung ener	gy requi	rement.								KVVII/ye	aı.	
Assumed occu			[4	/ n nnnn	140 /TF	- A - A - O - O	۱۵۱۱ ، ۵ ()040 /T	FFA 40	1	.7		(42)
if TFA > 13.9		+ 1.76 X	[1 - exp	(-0.0003	649 X (1F	-A -13.9)2)] + 0.(JU13 X (1	IFA -13.	9)			
Annual averag	,	ater usaç	ge in litre	s per da	ıy Vd,av	erage =	(25 x N)	+ 36		74	.65		(43)
Reduce the annua not more that 125	-				-	-	o achieve	a water us	e target o	ŗ l			
			· ·		_	,							
Jan Hot water usage ii	Feb	Mar day for ea	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
							. ,	70.45	70.44	70.40	00.44		
44)m= 82.11	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11	005.77	
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x D	Tm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	895.77	(44)
(45)m= 121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		
` ′									Γotal = Su	m(45) ₁₁₂ =	-	1174.5	(45)
lf instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)	to (61)			L		
(46)m= 18.27	15.98	16.48	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(46)
Water storage					/\/\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\								
Storage volum	,		,			J		ime vess	sel		0		(47)
If community h Otherwise if no	•			_			, ,	ers) ente	er'∩'in (4 7)			
Water storage		not wate	, (uno m	iciaacs ii	nstantan	10003 00	TIDI DON	ora, crite	, 0 111 (71)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	_			0		
L \ If f f							(. 0) / (. 0)	_		1	-		(50)
b) If manufact			ylinder l	oss facto		known:	(10) // (10)	_					` '
Hot water stor	age loss	factor fr	ylinder l om Tabl	oss facto		known:	(10) 11 (10)	_			0		` '
Hot water storal of community h	age loss neating s	factor fr ee secti	ylinder l om Tabl	oss facto		known:	(10) 11 (10)	_					(51)
Hot water stora f community h Volume factor	age loss neating s from Tal	factor fr ee section ble 2a	cylinder I om Tabl on 4.3	oss facto		known:	(10)11(10)	_			0 0		(51) (52)
Hot water storal If community had to the volume factor Temperature f	age loss neating s from Tal actor fro	factor fr ee section ble 2a m Table	cylinder I om Tabl on 4.3 2b	oss facto e 2 (kWl		known: ay)			53) =		0		(51) (52) (53)
Hot water storall foommunity holume factor Temperature footbody	age loss neating s from Ta actor fro om water	factor fr ee section ble 2a m Table storage	cylinder I om Tabl on 4.3 2b	oss facto e 2 (kWl		known: ay)	(47) × (51)		53) =		0		(51) (52) (53) (54)
Hot water store If community he Volume factor Temperature for Energy lost fro Enter (50) or (Water storage	age loss neating s from Tal actor fro om water (54) in (5	factor fr ee section ble 2a m Table storage (55)	eylinder I om Tabl on 4.3 2b , kWh/ye	oss facto e 2 (kWl ear		known: y)		x (52) x (5			0 0		(51) (52) (53) (54)
Hot water stord If community had be a community had be a community of the	age loss neating s from Tal actor fro om water (54) in (5	factor fr ee section ble 2a m Table storage (55)	eylinder I om Tabl on 4.3 2b , kWh/ye	oss facto e 2 (kWl ear		known: y)	(47) × (51)	x (52) x (5			0 0		(50) (51) (52) (53) (54) (55)
Hot water storal from munity holume factor Temperature for Energy lost from Enter (50) or (age loss neating s from Tal actor fro m water (54) in (5	factor free section from Table storage culated f	eylinder I om Tabl on 4.3 2b , kWh/ye	oss factore 2 (kWl	h/litre/da	known: y)	(47) x (51) ((56)m = (x (52) x (555) x (41)r	m 0	0	0 0 0 0 0 0 0	x H	(51) (52) (53) (54) (55)

Primary circuit loss (annual) from Table 3				0		(58)
Primary circuit loss calculated for each mor	nth (59)m = (58) ÷ 36	55 × (41)m	-			
(modified by factor from Table H5 if there	e is solar water heatir	ng and a cylinder	thermostat)			
(59)m= 0 0 0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each month (61)	n = (60) ÷ 365 × (41))m				
	.76 33.13 34.24	35.76 36.08	38.8 39.02	41.84		(61)
Total heat required for water heating calcul	ated for each month	(62)m = 0.85 × (4	45)m + (46)m +	(57)m +	(59)m + (61)m	
	7.69 112.46 107.75	120.12 121.44	138.29 147.62	159.77	(00) (01)	(62)
Solar DHW input calculated using Appendix G or App				er heating)		
(add additional lines if FGHRS and/or WWI						
·		0 0	0 0	0		(63)
Output from water heater						
· 	7.69 112.46 107.75	120.12 121.44	138.29 147.62	159.77		
(6.)	100 112110 101110		ter heater (annual) ₁		1622.26	(64)
Heat gains from water heating, kWh/month	0.25 ′ [0.85 x (45)m	•	, ,			100
	.51 34.66 33	36.99 37.4	42.78 45.86	49.67	1	(65)
` '						(00)
include (57)m in calculation of (65)m only	/ if cylinder is in the d	dwelling or hot wa	ater is from com	munity h	eating	
5. Internal gains (see Table 5 and 5a):						
Metabolic gains (Table 5), Watts			<u> </u>			
	lay Jun Jul	Aug Sep	Oct Nov	Dec		
(66)m= 85.15 85.15 85.15 85.15 85	.15 85.15 85.15	85.15 85.15	85.15 85.15	85.15		(66)
Lighting gains (calculated in Appendix L, ed	quation L9 or L9a), a	lso see Table 5				
(67)m= 13.31 11.82 9.61 7.28 5.	44 4.59 4.96	6.45 8.66	10.99 12.83	13.68		(67)
Appliances gains (calculated in Appendix L	, equation L13 or L1	3a), also see Tab	ole 5			
(68)m= 148.38 149.92 146.04 137.78 127	7.35 117.55 111	109.46 113.34	121.6 132.03	141.83		(68)
Cooking gains (calculated in Appendix L, e	quation L15 or L15a)	, also see Table	5			
(69)m= 31.52 31.52 31.52 31	.52 31.52 31.52	31.52 31.52	31.52 31.52	31.52		(69)
Pumps and fans gains (Table 5a)		<u> </u>	•			
(70)m= 3 3 3 3 3	3 3 3	3 3	3 3	3		(70)
Losses e.g. evaporation (negative values)	(Table 5)					
	.12 -68.12 -68.12	-68.12 -68.12	-68.12 -68.12	-68.12		(71)
Water heating gains (Table 5)		<u> </u>				
(72)m= 68.48 66.24 62.15 56.77 53	3.1 48.14 44.36	49.72 51.95	57.5 63.7	66.76		(72)
Total internal gains =	!	ı + (68)m + (69)m + (7				` '
	7.44 221.83 211.87	217.17 225.49	241.64 260.1	273.81		(73)
6. Solar gains:	.44 221.03 211.07	217.17 223.49	241.04 200.1	273.01		(10)
Solar gains are calculated using solar flux from Table	e 6a and associated equa	tions to convert to the	e applicable orientat	ion.		
Orientation: Access Factor Area	Flux	g_	FF		Gains	
Table 6d m ²	Table 6a	9_ Table 6b	Table 6c		(W)	
Northeast 0.9x 0.77 x 4.65	x 11.28	x 0.55	x 0.8		16	(75)
N	= ====		╡ ├──	╡┇		(75) (75)
Nortneast 0.9x 0.77 x 1.54	X 11.28	X 0.55	X 0.8	[5.3	$I^{(i,j)}$

Utilisation fac	Feb	Mar	Apr	May	Ť	Jun Jul	I A	ug Sep	Oct	Nov	Dec	1	
Temperature	_	٠.			•		ole 9,	Th1 (°C)				21	(85)
7. Mean inter	•		`										
(84)m= 333.75	375.24	419.09	470.41	509.28	50	4.35 478.99	441	.47 398.24	352.4	323.72	317.51]	(84)
Total gains – i	nternal a	nd sola	r (84)m =	(73)m	+ (8	3)m , watts		·				_	
(83)m= 52.04	95.71	149.75	217.03	271.84	$\overline{}$	2.52 267.12	224	<u> </u>	110.8	63.62	43.7]	(83)
Solar gains in	watts. ca	lculated	d for each	n month	1		(83)m	= Sum(74)m	(82)m				
Southwest _{0.9x}	0.77	Х	1.3	7	x	31.49]	0.55	X	0.8	=	26.31	(79)
Southwest _{0.9x}	0.77	×		==	X	44.07]	0.55	×	0.8	_ =	36.82	(79)
Southwest _{0.9x}	0.77	X			x [69.27]	0.55	X	0.8	=	57.87	(79)
Southwest _{0.9x}	0.77	х	1.3	7	X	92.85]	0.55	х	0.8	=	77.58	(79)
Southwest _{0.9x}	0.77	x	1.3	7	x [104.39]	0.55	X	0.8	=	87.22	(79)
Southwest _{0.9x}	0.77	х	1.3	7	x	113.91		0.55	X	0.8	=	95.17	(79)
Southwest _{0.9x}	0.77	x	1.3	7	x	118.15]	0.55	×	0.8	=	98.71	(79)
Southwest _{0.9x}	0.77	x	1.3	7	x	119.01]	0.55	X	0.8	=	99.43	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	106.25]	0.55	X	0.8	=	88.77	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	85.75]	0.55	X	0.8	=	71.64	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	62.67]	0.55	X	0.8	=	52.36	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	36.79]	0.55	X	0.8	=	30.74	(79)
Northeast 0.9x	0.77	X	1.5	4	x	9.21	x	0.55	X	0.8	=	4.33	(75)
Northeast _{0.9x}	0.77	X	4.6	5	x	9.21	x	0.55	X	0.8	=	13.06	(75)
Northeast _{0.9x}	0.77	X	1.5	4	x	14.2	x	0.55	X	0.8	=	6.67	(75)
Northeast _{0.9x}	0.77	x	4.6	5	x	14.2	x	0.55	X	0.8	=	20.13	(75)
Northeast _{0.9x}	0.77	X	1.5	4	x	28.07	x	0.55	X	0.8	=	13.18	(75)
Northeast 0.9x	0.77	x	4.6	5	x	28.07	x	0.55	X	0.8	=	39.8	(75)
Northeast 0.9x	0.77	X	1.5	4	x [50.42	x	0.55	×	0.8	=	23.68	(75)
Northeast _{0.9x}	0.77	x	4.6	5	x [50.42	x	0.55	×	0.8	=	71.49	(75)
Northeast _{0.9x}	0.77	x	1.5	4	x	72.63	x	0.55	x	0.8	-	34.1	(75)
Northeast _{0.9x}	0.77	x	4.6	5	x	72.63	x	0.55	×	0.8	=	102.98	(75)
Northeast _{0.9x}	0.77	x			x [91.1	X	0.55	×	0.8	= =	42.78	(75)
Northeast 0.9x	0.77	x	4.6		x [91.1] x	0.55	×	0.8	=	129.17	(75)
Northeast 0.9x	0.77	_ x			^ L	97.38] ^] x	0.55	= ^	0.8	= =	45.73	(75)
Northeast 0.9x	0.77	×			^ L	97.38] ^] x	0.55	X	0.8	= =	138.08	(75)
Northeast 0.9x	0.77	×			~ _L	91.35]	0.55	x	0.8	= =	42.89	(75)
Northeast 0.9x	0.77	×			^ L	91.35]	0.55	×	0.8	=	129.52	(75)
Northeast 0.9x	0.77	x			~ _L	67.96)	0.55	×	0.8	=	31.91	(75)
Northeast 0.9x	0.77	×			x [67.96]]	0.55	×	0.8	=	96.35	(75)
Northeast 0.9x	0.77	x	1.5		x [41.38] x	0.55	×	0.8	=	19.43	(75)
Northeast 0.9x	0.77	X			x [41.38	x	0.55	X	0.8	=	58.67	(75)
Northeast _{0.9x}	0.77	x			x [22.97]]	0.55	= x	0.8	= =	10.78	(75)
i i	0.11		4.6	٠	X	22.97	X	0.55	X	0.8	=	32.56	(75)

Separation 1		<u> </u>		0.92	0.77	0.57	0.41	0.47	0.74	0.95	0.99	1		(86)
Common C	Mean inte	rnal temper					-	-	0.7 1					(00)
Common C			ature in	living are	ea T1 (fc	ollow ste	ps 3 to 7	' in Table	e 9c)				1	
Case Case	(87)m= 20.	12 20.26	20.48	20.76	20.94	20.99	21	21	20.96	20.72	20.38	20.1		(87)
Case Case	Temperat	ure durina h	neating p	eriods ir	rest of	dwellina	from Ta	ble 9. Ti	h2 (°C)				I	
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2	· —									20.16	20.15	20.15		(88)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2	Litilisation	factor for a	ains for i	rest of d	welling l	n2 m (se	e Table	9a)					J	
(80) (80) (80) (18.97 19.17 19.43 19.88 20.1 20.17 20.17 20.17 20.14 19.85 19.35 18.94 (90)		 _				<u> </u>			0.67	0.93	0.99	1		(89)
(80) (80) (80) (18.97 19.17 19.43 19.88 20.1 20.17 20.17 20.17 20.14 19.85 19.35 18.94 (90)	—— Mean inte	rnal temner	ature in	the rest	of dwelli	na T2 (f	ollow ste	one 3 to T	7 in Tahl	e 9c)			Į.	
Mean internal temperature (for the whole dwelling) = ft.A × T1 + (1 - ft.A) × T2				r		<u> </u>					19.35	18.94		(90)
19.6 19.76 20.03 20.36 20.55 20.62 20.62 20.59 20.32 20.31 19.91 19.57 19.57 19.57 19.58 20.21 20.4 20.47	. ,		ļ						f	LA = Livin	g area ÷ (4	1) =	0.54	(91)
19.6 19.76 20.03 20.36 20.55 20.62 20.62 20.59 20.32 20.31 19.91 19.57 19.57 19.57 19.58 20.21 20.4 20.47	Moon into	rnal tampar	oturo (fo	r tho wh	مام طبيرما	ling) – fl	Λ ∨ T1	т /1 fl	∧\					_
Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)me			· `					·		20.32	19.91	19.57		(92)
33 19.45 19.61 19.88 20.21 20.4 20.47	` '										10.01	10.07		(/
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: Using Janis, hm: Useful gains, hmGm, W = (94)m x (84)m Useful gains, hmGm, W = (94)m x (84)m (95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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 Heat loss rate for mean internal temperature, Lm, W = ((39)m x ((93)m - (96)m) = (97)m= 712.41 689.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 0 0 0 81.82 190.73 291 Total per year (kWhiyear) = Sum(98)3s = 1313.02 (98) Space heating requirement in kWh/m²/year Total per year (kWhiyear) = Sum(98)3s = 1313.02 (98) Space heating: Fraction of space heat from secondary/supplementary systems including micro-CHP) Space heating: Fraction of space heat from main system 1 (202) × [1 - (201)] = 1 (202) Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 1 (204) Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec KWhi/year	· · · · · · ·	1	r	r						•	19.76	19.42		(93)
The utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	8. Space	neating requ	uirement											
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Set Ti to t	he mean int	ternal ter	mperatur	e obtain	ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
Utilisation factor for gains, hm: (94)m= 0.99 0.99 0.99 0.97 0.9 0.74 0.52 0.36 0.41 0.69 0.93 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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= 712.41 [889.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 (97) Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 177.79 0 0 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98)s. u = 1313.02 (98) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) (202) = 1 - (201) =	the utilisa												I	
(94)m= 0.99 0.99 0.99 0.97 0.9 0.74 0.52 0.36 0.41 0.69 0.93 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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= 712.41 689.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 (97) Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98). ss. p = 1313.02 (98) Space heating: Fraction of space heat from secondary/supplementary systems including micro-CHP) Space heating: Fraction of space heat from main system 1 (204) = (202) × [1 - (203)] = 1 (202)				<u> </u>	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains, hmGm , W = (94)m x (84)m (95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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= 712.41 689.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 (97) Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98). xs. 12 = 1313.02 (98) Space heating requirement in kWh/m²/year Space heating requirements — Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system (s) (202) = 1 - (201) = 1 (202) Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 1 (204) Efficiency of main space heating system 1 90.3 (206) Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec KWh/year Space heating requirement (calculated above)				1	0.74	0.50	0.26	0.44	0.60	0.02	0.00	4		(04)
(95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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= 712.41 689.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 (97) Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98)ssu = 1313.02 (98) Space heating requirement in kWh/m²/year 26.03 (99) 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system 0 (201) Fraction of total heating from main system(s) (202) = 1 - (201) = 1 (202) Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 1 (204) Efficiency of secondary/supplementary heating system, % 0 (208) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	(3)					0.52	0.36	0.41	0.09	0.93	0.99	ı		(34)
Monthly average external temperature from Table 8 (96)m= 4.3		- i	<u>`</u>	ŕ		262.58	174.67	182.89	275.98	329.43	319.63	316.1		(95)
(96)m=	` '			l										` '
(97) (97) (97) (97) (97) (97) (97) (97) (97) (97) (98) (97) (98) (9			1	i –			16.6	16.4	14.1	10.6	7.1	4.2		(96)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m	Heat loss	rate for me	an intern	al tempe	erature, l	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			J	
(98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98)ssz = 1313.02 (98) Space heating requirements in kWh/m²/year 26.03 (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 1 (202) Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 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/year Space heating requirement (calculated above)	(97)m= 712	.41 689.83	625.42	520.6	399.48	264.98	174.89	183.36	288.11	439.4	584.52	707.23		(97)
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)		_ ř ·				Wh/mont	h = 0.02	24 x [(97)m – (95	, - 、	1)m		1	
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	(98)m= 283	.17 214.47	163.44	70.61	17.79	0	0	0	0	81.82	190.73	291		_
9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Individual heating system 0 (202) = 1 – (201) = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (204) = (202) × [1 – (203)] = 1 (204) = (204) = (202) × [1 – (203)] = 1 (204) =								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1313.02	(98)
Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 In (202) Efficiency of secondary/supplementary heating system, % In (204) I	Space he	ating require	ement in	kWh/m²	/year								26.03	(99)
Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 In (202) Efficiency of secondary/supplementary heating system, % In (204) = (202) × [1 – (203)] =	9a. Energy	requiremer	nts – Indi	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	•	•										,		_
Fraction of total heating from main system 1 (204) = (202) × [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/year Space heating requirement (calculated above)	Fraction o	f space hea	at from so	econdar	y/supple	mentary	system						0	(201)
Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	Fraction of	f space hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year	Fraction o	f total heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	Efficiency	of main spa	ace heat	ing syste	em 1								90.3	(206)
Space heating requirement (calculated above)	Efficiency	of seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Já	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye:	⊐ ar
283.17 214.47 163.44 70.61 17.79 0 0 0 81.82 190.73 291	Space he	ating require	ement (c	alculate	d above)								-	
	283	.17 214.47	163.44	70.61	17.79	0	0	0	0	81.82	190.73	291		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206) $ (211)	(211)m = {	(98)m x (20)4)] } x 1	00 ÷ (20	16)								_	(211)
313.59 237.51 181 78.19 19.7 0 0 0 0 90.61 211.21 322.26	313	.59 237.51	181	78.19	19.7	0	0							
Total (kWh/year) = Sum(211) _{15,1012} = 1454.07 (211)								Tota	l (kWh/yea	r) =Sum(2	211),15,1012	=	1454.07	(211)

$= \{[(98)m \times (201)]\} \times 100 \div (208)$		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0		
Total (kWh/year) =Sum(215) _{15,1012} =	0	(215)
Water heating		_
Output from water heater (calculated above) 163.61		
Efficiency of water heater	81	(216)
(217)m= 86.66 86.34 85.62 84.02 82.03 81 81 81 84.22 85.99 86.77		(217)
Fuel for water heating, kWh/month		
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 188.81 165.54 173.68 156.98 155.66 138.84 133.02 148.29 149.93 164.19 171.66 184.13 $		
Total = Sum(219a) ₁₁₂ =	1930.74	(219)
Annual totals kWh/year	kWh/year	┙`
Space heating fuel used, main system 1	1454.07	
Water heating fuel used	1930.74	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside		(230a)
central heating pump:		(230c)
Total electricity for the above, kWh/year sum of (230a)(230g) =	187.84	(231)
Electricity for lighting	234.98	(232)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =	3807.63	(338)
12a. CO2 emissions – Individual heating systems including micro-CHP		
Energy Emission factor kWh/year kg CO2/kWh	Emissions kg CO2/yea	
0 ,		
kWh/year kg CO2/kWh	kg CO2/yea	ar -
kWh/year kg CO2/kWh Space heating (main system 1) (211) x 0.216 =	kg CO2/yea	ar](261)
kWh/year kg CO2/kWh Space heating (main system 1) Space heating (secondary) (211) x 0.216 = (215) x 0.519 =	kg CO2/yea	(261) (263)
kWh/year kg CO2/kWh Space heating (main system 1) (211) x 0.216 = Space heating (secondary) (215) x 0.519 = Water heating (219) x 0.216 =	314.08 0 417.04	(261) (263) (264)
kWh/year kg CO2/kWh Space heating (main system 1) (211) x 0.216 = Space heating (secondary) (215) x 0.519 = Water heating (219) x 0.216 = Space and water heating (261) + (262) + (263) + (264) =	314.08 0 417.04 731.12	(261) (263) (264) (265)
$ kWh/year \qquad kg CO2/kWh $ Space heating (main system 1) $ (211) \times 0.216 = $ Space heating (secondary) $ (215) \times 0.519 = $ Water heating $ (219) \times 0.216 = $ Space and water heating $ (261) + (262) + (263) + (264) = $ Electricity for pumps, fans and electric keep-hot $ (231) \times 0.519 = $	314.08 0 417.04 731.12 97.49	(261) (263) (264) (265) (267)
kWh/year kg CO2/kWh Space heating (main system 1) (211) x 0.216 = Space heating (secondary) (215) x 0.519 = Water heating (219) x 0.216 = Space and water heating (261) + (262) + (263) + (264) = Electricity for pumps, fans and electric keep-hot (231) x 0.519 = Electricity for lighting (232) x 0.519	314.08 0 417.04 731.12 97.49 121.95	(261) (263) (264) (265) (267) (268)

		l Isar-E	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	<u> </u>	Strom Softwa	_				0016363 on: 1.0.5.51	
Software Name:		Property	Address				versio	n: 1.0.5.51	
Address :	'	Toporty	Addiess	. 1 lat-50					
1. Overall dwelling dime	ensions:								
		Are	a(m²)	,	Av. He	ight(m)	,	Volume(m ³	<u> </u>
Ground floor		-	71.04	(1a) x		2.7	(2a) =	191.81	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	71.04	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	191.81	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+ [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	+ [0] = [0	x :	20 =	0	(6b)
Number of intermittent fa	ans				0	x -	10 =	0	(7a)
Number of passive vents	3			Ē	0	x ·	10 =	0	(7b)
Number of flueless gas f	ires			F	0	x	40 =	0	(7c)
				L					
							Air ch	nanges per ho	our
	eys, flues and fans = $(6a)+(6b)+(6b)+(6a)$				0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in t	been carried out or is intended, procee he dwelling (ns)	ed to (17),	otherwise (continue fr	rom (9) to	(16)		0	(9)
Additional infiltration	rie dweiling (113)					[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber frame o	r 0.35 fo	r masoni	ry constr	ruction	1(-7	•	0	(11)
	resent, use the value corresponding t	o the grea	ter wall are	a (after					
deducting areas of openi	<i>ngs); if equal user 0.35</i> floor, enter 0.2 (unsealed) or (.1 (seale	ed). else	enter 0				0	(12)
If no draught lobby, en	,	(/,					0	(13)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)					0	(16)
•	q50, expressed in cubic metro	•	•	•	etre of e	envelope	area	3	(17)
•	lity value, then $(18) = [(17) \div 20] +$ es if a pressurisation test has been do				is heina u	sad		0.15	(18)
Number of sides sheltere		ne or a de	gree an pe	Titleability	is being u	seu		2	(19)
Shelter factor			(20) = 1 -	[0.075 x (19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18) x (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 sp	 	_	1	1			1	1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
-								_	

Adjusted infiltra	ation rate ((allowi	ng for sh	nelter an	ıd wind s	speed) =	: (21a) x	(22a)m					
0.16	1 1	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effect		•	ate for t	he appli	cable ca	ise			•				
If mechanica			endix N (2	(3h) = (23;	a) × Fmv (6	eguation (N5)) othe	rwise (23h	n) = (23a)			0.5	(23a
If balanced with									(===;			0.5	==
a) If balance		-	-	_					2h\m + (23P) × [1 (23c)	77.35 ÷ 1001	(230
(24a)m= 0.28		0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	100]	(24a
b) If balance				<u> </u>			<u> </u>	1	ļ		0.20		•
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole h	ouse extra n < 0.5 × (2			•	•				5 × (23h))	!		
(24c)m = 0	0	0	0	0	0	0	0	0	0	0	0		(240
d) If natural	ventilation	or wh	ole hous	ke positi	ve input	ventilati	on from	I loft	<u>!</u>	<u>!</u>	ļ.		
,	n = 1, then			•	•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air	change ra	ite - en	iter (24a) or (24h	o) or (24	c) or (24	ld) in bo	x (25)				_	
(25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(25)
3. Heat losses	s and heat	t loss r	paramete	er:									
ELEMENT	Gross area (m		Openin m	ıgs	Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²·l		A X k kJ/K
Doors	,	,			1.99		1	=	1.99	$\stackrel{\prime}{\Box}$			(26)
Windows Type	: 1				1.37	x1	/[1/(1.4)+	0.04] =	1.82	Ħ			(27)
Windows Type	2				0.9	x1	/[1/(1.4)+	0.04] =	1.19				(27)
Windows Type	3				5.79	x1	/[1/(1.4)+	0.04] =	7.68	=			(27)
Windows Type	4				2.19	x1	/[1/(1.4)+	0.04] =	2.9	Ħ			(27)
Walls Type1	75.26	\neg	15.73	3	59.53	=	0.15		8.93	=			(29)
Walls Type2	27.91	=	1.99	=	25.92	=	0.15	_	3.89	=		-	(29)
Total area of e		 n²			103.1	_	00		0.00				(31)
Party wall	,				10.99	=	0		0				(32)
Party floor					71.04	=						╡	(32
Party ceiling					71.04	_							(32)
* for windows and	roof window:	s. use e	ffective wi	ndow U-va			a formula 1	1/[(1/U-valu	ue)+0.041 a	L as aiven in	paragraph		(02)
** include the area							,		,	J	, .		
Fabric heat los	s, W/K = 5	3 (A x	U)				(26)(30) + (32) =				35.66	(33)
Heat capacity	Cm = S(A	xk)						((28).	(30) + (32	2) + (32a).	(32e) =	23186.5	(34)
Thermal mass	parameter	r (TMF	' = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assess can be used instead				construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
The support levides	es : S (L x	Y) cald	culated ι	using Ap	pendix I	K						12.73	(36)
mermai bridge	`												
if details of therma Total fabric hea	al bridging are	e not kn	own (36) =	= 0.05 x (3	11)			(00)	· (36) =			48.39	(37)

Ventilatio	on hea	t loss ca	alculated	d monthly	y				(38)m	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	17.46	17.26	17.05	16.05	15.84	14.84	14.84	14.63	15.24	15.84	16.25	16.65		(38)
Heat trar	nsfer c	oefficier	nt, W/K	-	-	-	-		(39)m	= (37) + (38)m	-	•	
(39)m=	65.85	65.65	65.45	64.44	64.24	63.23	63.23	63.03	63.63	64.24	64.64	65.04		
			II D) \\/	/m=21/				•		Average = = (39)m ÷	Sum(39) ₁	12 /12=	64.39	(39)
Heat los: _{(40)m=}	0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.9	0.9	0.91	0.92		
(40)111–	0.93	0.92	0.92	0.91	0.9	0.09	0.09	0.09			Sum(40) ₁		0.91	(40)
Number	of day	s in mor	nth (Tab	le 1a)					•	Wordgo	Oum(40)	12712	0.01	(```
	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	gy requi	irement:								kWh/ye	ear:	
												<u> </u>	Ī	
Assumed if TFA				11 - exp	(- 0 0003	R49 x (TF	-A -13 9)2)] + 0.	0013 x (ΓFA -13		27		(42)
), N = 1	· 1.70 A	i oxp	(0.0000) 10 X (11	71 10.0	<i>)</i> _/] · 0.) 10 10 11 (.0)			
Annual a												3.14		(43
Reduce the not more th								to achieve	a water us	se target o	f		•	
101 more ti							•	Γ.			·	I _	I	
-lot water i	Jan usage ir	Feb	Mar day for ea	Apr	May	Jun	Jul Table 10 v	Aug	Sep	Oct	Nov	Dec		
_		-						· ·					İ	
(44)m=	96.95	93.43	89.9	86.38	82.85	79.32	79.32	82.85	86.38	89.9	93.43	96.95		— ,,,,
Energy cor	ntent of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x [OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		1057.67	(44)
(45)m= 1	143.78	125.75	129.76	113.13	108.55	93.67	86.8	99.6	100.79	117.47	128.22	139.24		
If instantan	20015 W	ater heati	ag at point	of use (no	hot water	r storage)	enter O in	hoves (46		Total = Su	m(45) ₁₁₂ =	=	1386.77	(45)
If instantan				·				· `	. , ,	1-00	T 40.00		I	(40)
(46)m= Water st	21.57 Orage	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.89		(46)
Storage	•		includin	ng anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If commu		, ,		•			_							(**)
Otherwis	•	•			•			` '	ers) ente	er '0' in ((47)			
Water st	orage	loss:												
a) If mai	nufact	urer's de	eclared l	oss facto	or is kno	wn (kWl	n/day):					0		(48)
Tempera	ature fa	actor fro	m Table	2b								0		(49)
Energy lo			•					(48) x (49) =			0		(50)
b) If mai				•									I	
Hot wate If commu		_			ie 2 (KVV	n/litre/da	ay)					0		(51)
Volume 1	-	_		011 4.5								0		(52
rempera				2b								0		(52)
-			storage		ear			(47) x (51) x (52) x (53) =		0		(54)
Enter (5			_	, KVVII/ y	Jui			(T) X (U)	, ^ (UZ) ^ (0		(54)
•	, ,	, ,	culated f	for each	month			((56)m = 0)	55) × (41)	m		•	I	(00)
_	0	0		0						0		0		(56)
(56)m=	V	U	0	l "	0	0	0	0	0	l ^U	0	0		(50

If cylinder con	tains dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	om Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circ	cuit loss (ar	nnual) fro	om Table	 ∋ 3	•						0		(58)
Primary circ	•	•			59)m = ((58) ÷ 36	65 × (41)	m				•	
(modified	by factor f	rom Tab	le H5 if t	here is	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	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 49.4	11 43	45.81	42.6	42.22	39.12	40.42	42.22	42.6	45.81	46.07	49.41		(61)
Total heat r	equired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 193	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		(62)
Solar DHW in	out calculated	using App	endix G or	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add addition	nal 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	n water hea	iter											
(64)m= 193.	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		
	•						Outp	out from wa	ater heate	r (annual)₁	12	1915.45	(64)
Heat gains	from water	heating,	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m]	
(65)m= 60.	16 52.56	54.6	48.26	46.65	40.93	38.97	43.67	44.16	50.51	54.15	58.65		(65)
include (57)m in cal	culation o	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Interna	l gains (see	e Table 5	5 and 5a):									
Metabolic g	ains (Table	e 5). Wat	ts	,									
Ja		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.	56 113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56		(66)
Lighting ga	ns (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 17.	8 15.81	12.86	9.74	7.28	6.14	6.64	8.63	11.58	14.71	17.17	18.3		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	•	•	•	
(68)m= 199.	71 201.78	196.56	185.44	171.41	158.22	149.41	147.34	152.56	163.68	177.71	190.9		(68)
Cooking ga	ins (calcula	ated in A	ppendix	L, equat	tion L15	or L15a), also se	ee Table	5	•	•		
(69)m= 34.3	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36		(69)
Pumps and	fans gains	(Table 5	.——— 5а)	•	•			•		•	•		
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporation	n (nega	tive valu	es) (Tab	le 5)							•	
(71)m= -90.	84 -90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84		(71)
Water heat	ng gains (rable 5)						l				•	
(72)m= 80.8	~~	73.39	67.03	62.7	56.84	52.37	58.7	61.34	67.89	75.21	78.83		(72)
Total inter	nal gains =	:			(66)	m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72))m	ı	
(73)m= 358.	_ `	342.88	322.28	301.45	281.27	268.49	274.73	285.55	306.34	330.15	348.1		(73)
						L	<u> </u>						
6. Solar ga	ains:												
ŭ	ains: ire calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to co	onvert to th	e applicat	ole orientat	tion.		
ŭ	re calculated	actor	r flux from Area m²		Flu			onvert to the g_ sable 6b		ole orientat FF able 6c	tion.	Gains (W)	

Northoast a ou		1		1		1		l		1		7(75)
Northeast 0.9x	0.77	X	0.9	X	11.28	X	0.55	X	0.8] = 1	3.1	(75)
Northeast 0.9x	0.77	X	0.9	X	22.97	X	0.55	X	0.8] = 1	6.3	(75)
Northeast 0.9x	0.77	X	0.9	X	41.38	X	0.55	X	0.8] =	11.36	(75)
Northeast _{0.9x}	0.77	X	0.9	X	67.96	X	0.55	X	0.8] =	18.65	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.35	X	0.55	X	0.8	=	25.07	(75)
Northeast _{0.9x}	0.77	X	0.9	X	97.38	X	0.55	X	0.8] =	26.73	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.1	X	0.55	X	0.8	=	25	(75)
Northeast _{0.9x}	0.77	X	0.9	X	72.63	X	0.55	X	0.8	=	19.93	(75)
Northeast _{0.9x}	0.77	X	0.9	X	50.42	X	0.55	X	0.8	=	13.84	(75)
Northeast _{0.9x}	0.77	X	0.9	X	28.07	X	0.55	X	0.8	=	7.7	(75)
Northeast _{0.9x}	0.77	X	0.9	X	14.2	X	0.55	X	0.8	=	3.9	(75)
Northeast _{0.9x}	0.77	X	0.9	X	9.21	X	0.55	X	0.8	=	2.53	(75)
Southeast _{0.9x}	0.77	X	5.79	X	36.79	X	0.55	X	0.8	=	64.96	(77)
Southeast _{0.9x}	0.77	X	5.79	X	62.67	X	0.55	X	0.8	=	110.65	(77)
Southeast _{0.9x}	0.77	X	5.79	X	85.75	X	0.55	X	0.8	=	151.4	(77)
Southeast _{0.9x}	0.77	X	5.79	X	106.25	X	0.55	x	0.8	=	187.59	(77)
Southeast _{0.9x}	0.77	X	5.79	X	119.01	X	0.55	x	0.8	=	210.11	(77)
Southeast 0.9x	0.77	X	5.79	X	118.15	x	0.55	x	0.8	=	208.59	(77)
Southeast _{0.9x}	0.77	X	5.79	X	113.91	x	0.55	x	0.8] =	201.11	(77)
Southeast _{0.9x}	0.77	X	5.79	X	104.39	x	0.55	X	0.8] =	184.3	(77)
Southeast _{0.9x}	0.77	X	5.79	x	92.85	x	0.55	X	0.8] =	163.93	(77)
Southeast _{0.9x}	0.77	x	5.79	x	69.27	x	0.55	x	0.8] =	122.29	(77)
Southeast _{0.9x}	0.77	x	5.79	x	44.07	x	0.55	x	0.8] =	77.81	(77)
Southeast _{0.9x}	0.77	X	5.79	x	31.49	x	0.55	x	0.8] =	55.59	(77)
Northwest _{0.9x}	0.77	X	1.37	x	11.28	x	0.55	x	0.8] =	23.57	(81)
Northwest _{0.9x}	0.77	X	2.19	x	11.28	x	0.55	x	0.8] =	7.53	(81)
Northwest _{0.9x}	0.77	x	1.37	x	22.97	x	0.55	x	0.8	j =	47.97	(81)
Northwest 0.9x	0.77	x	2.19	x	22.97	x	0.55	x	0.8	j =	15.34	(81)
Northwest _{0.9x}	0.77	x	1.37	x	41.38	x	0.55	x	0.8] =	86.43	(81)
Northwest 0.9x	0.77	x	2.19	x	41.38	x	0.55	x	0.8	j =	27.63	(81)
Northwest _{0.9x}	0.77	x	1.37	x	67.96	x	0.55	x	0.8	j =	141.94	(81)
Northwest _{0.9x}	0.77	x	2.19	x	67.96	х	0.55	x	0.8	j =	45.38	(81)
Northwest 0.9x	0.77	x	1.37	x	91.35	x	0.55	х	0.8	j =	190.79	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.35	x	0.55	х	0.8	j =	61	(81)
Northwest _{0.9x}	0.77	x	1.37	x	97.38	х	0.55	х	0.8	j =	203.41	(81)
Northwest _{0.9x}	0.77	x	2.19	x	97.38	x	0.55	x	0.8	j =	65.03	(81)
Northwest _{0.9x}	0.77	x	1.37	×	91.1	x	0.55	x	0.8	j =	190.28	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.1	x	0.55	x	0.8	i =	60.84	(81)
Northwest _{0.9x}	0.77	X	1.37	X	72.63	X	0.55	x	0.8] =	151.7	(81)
Northwest _{0.9x}	0.77	X	2.19	X	72.63	X	0.55	x	0.8] =	48.5	(81)
Northwest _{0.9x}	0.77	X	1.37	X	50.42	X	0.55	X	0.8] =	105.31	(81)
_		1		1		1		I		1		_ ' '

Northwest _{0.9x}	0.77	X	2.1	9	x	50	.42	X		0.55	x	0.8	=	33.67	(81)
Northwest _{0.9x}	0.77	x	1.3	7	x	28	3.07	X		0.55	x	0.8	=	58.62	(81)
Northwest _{0.9x}	0.77	X	2.1	9	x	28	3.07	x		0.55	x	0.8	=	18.74	(81)
Northwest _{0.9x}	0.77	X	1.3	7	x	14	4.2	x		0.55	×	0.8	=	29.65	(81)
Northwest _{0.9x}	0.77	x	2.1	9	x	14	4.2	X		0.55	x	0.8	=	9.48	(81)
Northwest _{0.9x}	0.77	x	1.3	7	x [9.	.21	x		0.55	_ x [0.8	=	19.25	(81)
Northwest 0.9x	0.77	x	2.1	9	x [9.	.21	X		0.55		0.8	=	6.15	(81)
L					_										
Solar gains in	watts, ca	alculated	for eacl	n month				(83)m	ı = Sı	um(74)m .	(82)m				
(83)m= 99.16	180.26	276.81	393.55	486.97	50	3.76	477.22	404	.43	316.75	207.36	120.84	83.52		(83)
Total gains – i	nternal a	nd solar	(84)m =	(73)m	+ (8	3)m ,	watts								
(84)m= 457.6	536.14	619.69	715.84	788.43	78	5.03	745.71	679	.16	602.29	513.7	450.99	431.61		(84)
7. Mean inter	nal temp	erature	(heating	season)										
Temperature	•					area fr	om Tab	ole 9.	, Th	1 (°C)				21	(85)
Utilisation fac	•	٠.			_			,	,	` ,					
Jan	Feb	Mar	Apr	May	Ė	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.97	0.89	0.72	0.	.51	0.37	0.4	Ť	0.7	0.95	0.99	1		(86)
Moon interna	l tompor	aturo in l	living or	22 T1 /f/	المال	v ston	o 2 to 7	l In T		2 00)		·	<u> </u>		
Mean interna (87)m= 20.11	20.28	20.52	20.81	20.96		w step	21	2		20.97	20.75	20.38	20.09		(87)
` ′		ļ						<u> </u>			20.10	20.00	20.00		(- /
Temperature					_	Ť		r		<u> </u>	00.40	T 00.40	00.45	1	(00)
(88)m= 20.14	20.15	20.15	20.16	20.16	20	0.18	20.18	20.	18	20.17	20.16	20.16	20.15		(88)
Utilisation fac	tor for g	ains for r	est of d	welling,	h2,r	n (see	e Table	9a)			<u> </u>	•	ı	1	
(89)m= 1	0.99	0.96	0.87	0.67	0.	.45	0.3	0.3	35	0.63	0.92	0.99	1		(89)
Mean interna	l temper	ature in t	the rest	of dwell	ng -	T2 (fo	llow ste	ps 3	to 7	in Tabl	e 9c)				
(90)m= 18.96	19.2	19.55	19.95	20.13	20).17	20.18	20.	18	20.15	19.88	19.35	18.93		(90)
										f	LA = Livi	ng area ÷ (4) =	0.39	(91)
Mean interna	ıl temper	ature (fo	r the wh	ole dwe	lling	ı) = fL.	A × T1	+ (1	– fL	A) × T2					
(92)m= 19.4	19.61	19.93	20.28	20.45	Ť	0.49	20.49	20.		20.47	20.22	19.75	19.37		(92)
Apply adjustr	nent to t	he mean	internal	temper	<u> </u>	e fron	n Table	4e,	whe	re appro	priate				
(93)m= 19.25	19.46	19.78	20.13	20.3	20	0.34	20.34	20.	35	20.32	20.07	19.6	19.22		(93)
8. Space hea	iting requ	uirement													
Set Ti to the					ed	at ste _l	p 11 of	Tabl	le 9b	o, so tha	t Ti,m=	(76)m an	d re-cald	culate	
the utilisation								_		_		1		1	
Jan	Feb	Mar	Apr	May	٦	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac	0.99	ains, nm _{0.96}	0.86	0.67	<u> </u>	.46	0.32	0.3	7	0.64	0.92	0.99	1]	(94)
Useful gains,					0.	.40	0.32	0.3	07	0.04	0.92	0.99	'		(94)
(95)m= 455.11	528.73	594.11	618.32	531.92	36	1.34	236.59	248	34	385.06	473.06	445.17	429.9		(95)
Monthly aver							200.00			000.00	170.00	1 10.17	120.0		()
(96)m= 4.3	4.9	6.5	8.9	11.7		4.6	16.6	16.	.4	14.1	10.6	7.1	4.2		(96)
Heat loss rat	e for mea	an intern	al tempe	erature.	<u> </u>		[(39)m :	x [(9:	 3)m-	 – (96)m]	1	<u> </u>	I	•
(97)m= 984.78	956.07	868.87	723.52	552.26	_		236.72	248	_	395.76	608.03	807.92	977.21		(97)
Space heating	g require	ement fo	r each m	nonth, k	Wh/	month	n = 0.02	24 x [<u>_</u> [(97))m – (95)m] x (4	11)m		1	
(98)m= 394.07	287.17	204.42	75.74	15.13		0	0	0	Ó	0	100.42	 	407.2		
	•							•				•	•	•	

				Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	1745.34	(98)
Space heating requirement in kV	Wh/m²/year								24.57	(99)
9a. Energy requirements – Individ	dual heating s	ystems i	ncluding	micro-C	CHP)			_		_
Space heating:								г		_
Fraction of space heat from seco		mentary	-						0	(201)
Fraction of space heat from mair	• ()			(202) = 1 -					1	(202)
Fraction of total heating from ma	ain system 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating	system 1							ļ	90.3	(206)
Efficiency of secondary/supplement	nentary heating	g system	າ, %						0	(208)
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement (calc	<u> </u>									
	75.74 15.13	0	0	0	0	100.42	261.18	407.2		
$(211)m = \{[(98)m \times (204)] \} \times 100$	```				0	444.04	000.04	450.04		(211)
436.41 318.02 226.38 8	33.88 16.75	0	0	0 Tota	0 I (kWh/yea	111.21 ar) =Sum(3	289.24	450.94	1932.82	(211)
Space heating fuel (secondary),	k\Mh/month			Tota	i (kwii) you	ar) Garri(z	- ' '/15,1012	2	1932.02	(211)
$= \{[(98)\text{m x } (201)] \} \text{ x } 100 \div (208)$	KVVII/IIIOIIIII									
(215)m = 0 0 0	0 0	0	0	0	0	0	0	0		
				Tota	l (kWh/yea	ar) =Sum(2	215),,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	=	0	(215)
Water heating										
Output from water heater (calculated)										
	55.73 150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65	04	7(216)
Efficiency of water heater (217)m= 87.01 86.62 85.75 8:	33.82 81.77	04	81	0.1	0.1	04.24	86.33	07.12	81	(216)
Fuel for water heating, kWh/month		81	01	81	81	84.31	00.33	87.13		(217)
(219) m = (64) m x $100 \div (217)$ m	.11									
(219)m= 222.02 194.82 204.75 18	85.78 184.39	163.94	157.07	175.09	177.02	193.67	201.89	216.51		_
				Tota	I = Sum(2	19a) ₁₁₂ =			2276.93	(219)
Annual totals	rataus 1					k'	Wh/yeaı	r F	kWh/yea	r_
Space heating fuel used, main sys	Stem							[1932.82	╡
Water heating fuel used								L	2276.93	
Electricity for pumps, fans and ele	ectric keep-ho	t								
mechanical ventilation - balanced	d, extract or p	ositive ir	nput fron	n outside	Э			222.31		(230a
central heating pump:								30		(2300
Total electricity for the above, kWl	/h/year			sum	of (230a).	(230g) =			252.31	(231)
Electricity for lighting								Ī	314.43	(232)
Total delivered energy for all uses	s (211)(221)	+ (231)	+ (232).	(237b)	=			[4776.5	(338)
12a. CO2 emissions – Individual	. , , , ,	` ′	, ,					L		
- marriadar		En	ergy /h/year			Emiss kg CO:	ion fac 2/kWh	tor	Emissions	

Space heating (main system 1)	(211) x	0.216	=	417.49	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	491.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =			909.31	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	130.95	(267)
Electricity for lighting	(232) x	0.519	=	163.19	(268)
Total CO2, kg/year	sum	of (265)(271) =		1203.45	(272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =		16.94	(273)
El rating (section 14)				86	(274)

			Llser	Details:						
Access Manage	Chris He	len all	– USEFI		_ NI	.b.a		OTD A	016262	
Assessor Name: Software Name:	Chris Hoo Stroma F				a Num are Vei				016363 on: 1.0.5.51	
			Property	Address						
Address :										
1. Overall dwelling dir	nensions:									
0 15			Are	ea(m²)	1	Av. He	ight(m)	7	Volume(m³	_
Ground floor				50.44	(1a) x	2	2.7	(2a) =	136.19	(3a)
Total floor area TFA =	(1a)+(1b)+(1c)+	+(1d)+(1e)+(1n)	50.44	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	l)+(3e)+	.(3n) =	136.19	(5)
2. Ventilation rate:										
	main heating	second heating		other		total			m³ per hou	r
Number of chimneys	0	+ 0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0	+ 0	+	0	Ī = [0	x 2	20 =	0	(6b)
Number of intermittent	fans					0	x -	10 =	0	(7a)
Number of passive ven	ts				F	0	x -	10 =	0	(7b)
Number of flueless gas					F	0	x	40 =	0	(7c)
5					L					
								Air ch	nanges per ho	ur
Infiltration due to chimr	neys, flues and	fans = (6a)+(6b)+	·(7a)+(7b)+	(7c) =	Γ	0		÷ (5) =	0	(8)
If a pressurisation test has			eed to (17),	otherwise of	continue fr	rom (9) to ((16)			_
Number of storeys in	the dwelling (r	ıs)						41.04	0	(9)
Additional infiltration Structural infiltration:	0.25 for stool o	or timbor frama	or 0 25 fo	r masan	n, constr	ruotion	[(9)	-1]x0.1 =	0	(10)
if both types of wall are					•	uction			0	(11)
deducting areas of ope	nings); if equal use	er 0.35								_
If suspended wooder		•	0.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, e									0	(13)
Percentage of windo Window infiltration	ws and doors d	iraugnt stripped		0.25 - 10.2	? x (14) ÷ 1	1001 -			0	(14)
Infiltration rate					+ (11) + (1		+ (15) =		0	(15)
Air permeability value	e a50 express	ed in cubic met	res ner h					area	3	(17)
If based on air permea			-	-	-	0.10 01 0	лиоторо	aroa	0.15	(18)
Air permeability value app	•					is being u	sed		00	
Number of sides shelte	red								2	(19)
Shelter factor				` '	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorpor	•			(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified	<u> </u>	 	1	1.				_	1	
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind	· 		1	1 6-		T 4.2	1 4 =	1 4 -	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	1.23 1.1	1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

	ation rate				r	i í	` ´ 	`		0.44		7	
0.16 Calculate effec	0.16 ctive air c	0.16 change i	0.14 ate for t	0.14 he appli	0.12 cable ca	0.12 se	0.12	0.13	0.14	0.14	0.15]	
If mechanica		-										0.5	(23
If exhaust air he	at pump us	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recov	/ery: effici	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mecha	nical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)) ÷ 100]	
24a)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(24
b) If balance	d mecha	nical ve	ntilation	without	heat red	covery (I	ИV) (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 extr ı < 0.5 ×			•	•				.5 × (23b)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	ventilation n = 1, the			•	•				0.5]		•	•	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
Effective air	change r	ate - er	iter (24a) or (24k	o) or (24	c) or (24	d) in bo	x (25)	_		-	-	
25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
3. Heat losses	s and hea	at loss r	paramete	er:									
LEMENT	Gross area (s	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	〈)	k-value kJ/m²·		A X k kJ/K
oors	,				1.99	X	1	=	1.99	,			(2
Vindows Type	1				1.37	x1	/[1/(1.4)+	0.04] =	1.82				(2
/indows Type	2				4.65	x1	/[1/(1.4)+	0.04] =	6.16				(2
/indows Type	3				1.54	x1	/[1/(1.4)+	0.04] =	2.04				(2
/alls Type1	55.8		8.93		46.87	7 X	0.15	─	7.03			$\neg \vdash$	(2
/alls Type2	22.49	=	1.99		20.5	X	0.15	-	3.08	7 7		i ii	(2
otal area of e					78.29	<u> </u>							(3
arty wall					9.64	x	0		0	п г		\neg	(3
arty floor					50.44							-	(3
arty ceiling					50.44	=						╡┝	(3
for windows and include the area					alue calcul		formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragrapl	 n 3.2	(
abric heat los							(26)(30)) + (32) =				23.93	(3
eat capacity	2m = S(<i>F</i>	Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	18066.3	3 (3
hermal mass	paramet	er (TMF	P = Cm ÷	· TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(3
or design assess an be used instea				construct	ion are no	t known pi	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridge	s : S (L)	x Y) cal	culated ı	using Ap	pendix l	<						10.71	(3
details of therma		ire not kn	own (36) =	0.05 x (3	1)				(0.0)				
otal fabric hea	at loss							(33) +	(36) =			34.64	(3
entilation hea									= 0.33 × (

(20)m= 12.4	12.25	12.11	11.39	11.25	10.53	10.53	10.39	10.82	11.25	11.54	11.82		(38)
(38)m= 12.4	12.25		11.39	11.25	10.53	10.53	10.39				11.02		(30)
Heat transfer (39)m= 47.04	46.89	1t, VV/K 46.75	46.04	45.89	45.18	45.18	45.03	(39)m 45.46	= (37) + (3 45.89	46.18	46.47		
(00)III= 47.04	40.00	40.73	40.04	40.00	40.10	40.10	40.00			Sum(39) ₁ .		46	(39)
Heat loss para	meter (H	HLP), W	m²K						= (39)m ÷				`
(40)m= 0.93	0.93	0.93	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.92		_
Number of day	ıc in moı	oth (Tab	lo 1a)					A	Average =	Sum(40) _{1.}	12 /12=	0.91	(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	fing ener	av regui	rement:								kWh/ye	var:	
4. Walei ilea	ung ener	gy requi	rement.								KVVII/ye	aı.	
Assumed occu			[4	/ n nnnn	140 /TF	- A - A - O - O	۱۵۱۱ ، ۵ ()040 /T	FFA 40	1	.7		(42)
if TFA > 13.9		+ 1.76 X	[1 - exp	(-0.0003	649 X (1F	-A -13.9)2)] + 0.(JU13 X (1	IFA -13.	9)			
Annual averag	,	ater usaç	ge in litre	s per da	ıy Vd,av	erage =	(25 x N)	+ 36		74	.65		(43)
Reduce the annua not more that 125	-				-	-	o achieve	a water us	e target o	ŗ l			
			· ·		_	,							
Jan Hot water usage ii	Feb	Mar day for ea	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
							. ,	70.45	70.44	70.40	00.44		
44)m= 82.11	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11	005.77	
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x D	Tm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	895.77	(44)
(45)m= 121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		
` ′									Γotal = Su	m(45) ₁₁₂ =	-	1174.5	(45)
lf instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)	to (61)			L		
(46)m= 18.27	15.98	16.48	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(46)
Water storage					/\/\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\								
Storage volum	,		,			J		ime vess	sel		0		(47)
If community h Otherwise if no	•			_			, ,	ers) ente	er'∩'in (4 7)			
Water storage		not wate	, (uno m	iciaacs ii	nstantan	10003 00	TIDI DON	ora, crite	, 0 111 (71)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	_			0		
L \ If f f							(. 0) / (. 0)	_		1	-		(50)
b) If manufact			ylinder l	oss facto		known:	(10) // (10)	_					` '
Hot water stor	age loss	factor fr	ylinder l om Tabl	oss facto		known:	(10) 11 (10)	_			0		` '
Hot water storal of community h	age loss neating s	factor fr ee secti	ylinder l om Tabl	oss facto		known:	(10) 11 (10)	_					(51)
Hot water stora f community h Volume factor	age loss neating s from Tal	factor fr ee section ble 2a	cylinder I om Tabl on 4.3	oss facto		known:	(10)11(10)	_			0 0		(51) (52)
Hot water storal If community had to the volume factor Temperature f	age loss neating s from Tal actor fro	factor fr ee section ble 2a m Table	cylinder I om Tabl on 4.3 2b	oss facto e 2 (kWl		known: ay)			53) =		0		(51) (52) (53)
Hot water storall foommunity holume factor Temperature footbody	age loss neating s from Ta actor fro om water	factor fr ee section ble 2a m Table storage	cylinder I om Tabl on 4.3 2b	oss facto e 2 (kWl		known: ay)	(47) × (51)		53) =		0		(51) (52) (53) (54)
Hot water store If community he Volume factor Temperature for Energy lost fro Enter (50) or (Water storage	age loss neating s from Tal actor fro om water (54) in (5	factor fr ee section ble 2a m Table storage (55)	eylinder I om Tabl on 4.3 2b , kWh/ye	oss facto e 2 (kWl ear		known: y)		x (52) x (5			0 0		(51) (52) (53) (54)
Hot water stord If community had be a community had be a community of the	age loss neating s from Tal actor fro om water (54) in (5	factor fr ee section ble 2a m Table storage (55)	eylinder I om Tabl on 4.3 2b , kWh/ye	oss facto e 2 (kWl ear		known: y)	(47) × (51)	x (52) x (5			0 0		(50) (51) (52) (53) (54) (55)
Hot water storal from munity holume factor Temperature for Energy lost from Enter (50) or (age loss neating s from Tal actor fro m water (54) in (5	factor free section from Table storage culated f	eylinder I om Tabl on 4.3 2b , kWh/ye	oss factore 2 (kWl	h/litre/da	known: y)	(47) x (51) ((56)m = (x (52) x (555) x (41)r	m 0	0	0 0 0 0 0 0 0	x H	(51) (52) (53) (54) (55)

Primary circuit loss (annual) from Table 3				0		(58)
Primary circuit loss calculated for each mor	nth (59)m = (58) ÷ 36	55 × (41)m	-			
(modified by factor from Table H5 if there	e is solar water heatir	ng and a cylinder	thermostat)			
(59)m= 0 0 0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each month (61)	n = (60) ÷ 365 × (41))m				
	.76 33.13 34.24	35.76 36.08	38.8 39.02	41.84		(61)
Total heat required for water heating calcul	ated for each month	(62)m = 0.85 × (4	45)m + (46)m +	(57)m +	(59)m + (61)m	
	7.69 112.46 107.75	120.12 121.44	138.29 147.62	159.77	(00) (01)	(62)
Solar DHW input calculated using Appendix G or App				er heating)		
(add additional lines if FGHRS and/or WWI						
·		0 0	0 0	0		(63)
Output from water heater						
· 	7.69 112.46 107.75	120.12 121.44	138.29 147.62	159.77		
(6.)	100 112110 101110		ter heater (annual) ₁		1622.26	(64)
Heat gains from water heating, kWh/month	0.25 ′ [0.85 x (45)m	•	, ,			100
	.51 34.66 33	36.99 37.4	42.78 45.86	49.67	1	(65)
` '						(00)
include (57)m in calculation of (65)m only	/ if cylinder is in the d	dwelling or hot wa	ater is from com	munity h	eating	
5. Internal gains (see Table 5 and 5a):						
Metabolic gains (Table 5), Watts			<u> </u>			
	lay Jun Jul	Aug Sep	Oct Nov	Dec		
(66)m= 85.15 85.15 85.15 85.15 85	.15 85.15 85.15	85.15 85.15	85.15 85.15	85.15		(66)
Lighting gains (calculated in Appendix L, ed	quation L9 or L9a), a	lso see Table 5				
(67)m= 13.31 11.82 9.61 7.28 5.	44 4.59 4.96	6.45 8.66	10.99 12.83	13.68		(67)
Appliances gains (calculated in Appendix L	, equation L13 or L1	3a), also see Tab	ole 5			
(68)m= 148.38 149.92 146.04 137.78 127	7.35 117.55 111	109.46 113.34	121.6 132.03	141.83		(68)
Cooking gains (calculated in Appendix L, e	quation L15 or L15a)	, also see Table	5			
(69)m= 31.52 31.52 31.52 31	.52 31.52 31.52	31.52 31.52	31.52 31.52	31.52		(69)
Pumps and fans gains (Table 5a)		<u> </u>	•			
(70)m= 3 3 3 3 3	3 3 3	3 3	3 3	3		(70)
Losses e.g. evaporation (negative values)	(Table 5)					
	.12 -68.12 -68.12	-68.12 -68.12	-68.12 -68.12	-68.12		(71)
Water heating gains (Table 5)		<u> </u>				
(72)m= 68.48 66.24 62.15 56.77 53	3.1 48.14 44.36	49.72 51.95	57.5 63.7	66.76		(72)
Total internal gains =	!	ı + (68)m + (69)m + (7				` '
	7.44 221.83 211.87	217.17 225.49	241.64 260.1	273.81		(73)
6. Solar gains:	.44 221.03 211.07	217.17 223.49	241.04 200.1	273.01		(10)
Solar gains are calculated using solar flux from Table	e 6a and associated equa	tions to convert to the	e applicable orientat	ion.		
Orientation: Access Factor Area	Flux	g_	FF		Gains	
Table 6d m ²	Table 6a	9_ Table 6b	Table 6c		(W)	
Northeast 0.9x 0.77 x 4.65	x 11.28	x 0.55	x 0.8		16	(75)
N	= ====		╡ ├──	╡┇		(75) (75)
Nortneast 0.9x 0.77 x 1.54	X 11.28	X 0.55	X 0.8	[5.3	$I^{(i,j)}$

Utilisation fac	Feb	Mar	Apr	May	Ť	Jun Jul	I A	ug Sep	Oct	Nov	Dec	1	
Temperature	_	٠.			•		ole 9,	Th1 (°C)				21	(85)
7. Mean inter	•		`										
(84)m= 333.75	375.24	419.09	470.41	509.28	50	4.35 478.99	441	.47 398.24	352.4	323.72	317.51]	(84)
Total gains – i	nternal a	nd sola	r (84)m =	(73)m	+ (8	3)m , watts		·				_	
(83)m= 52.04	95.71	149.75	217.03	271.84	$\overline{}$	2.52 267.12	224	<u> </u>	110.8	63.62	43.7]	(83)
Solar gains in	watts. ca	lculated	d for each	n month	1		(83)m	= Sum(74)m	(82)m				
Southwest _{0.9x}	0.77	Х	1.3	7	x	31.49]	0.55	X	0.8	=	26.31	(79)
Southwest _{0.9x}	0.77	×		==	X	44.07]	0.55	×	0.8	_ =	36.82	(79)
Southwest _{0.9x}	0.77	X			x [69.27]	0.55	X	0.8	=	57.87	(79)
Southwest _{0.9x}	0.77	х	1.3	7	X	92.85]	0.55	х	0.8	=	77.58	(79)
Southwest _{0.9x}	0.77	x	1.3	7	x [104.39]	0.55	X	0.8	=	87.22	(79)
Southwest _{0.9x}	0.77	х	1.3	7	x	113.91		0.55	X	0.8	=	95.17	(79)
Southwest _{0.9x}	0.77	x	1.3	7	x	118.15]	0.55	×	0.8	=	98.71	(79)
Southwest _{0.9x}	0.77	x	1.3	7	x	119.01]	0.55	X	0.8	=	99.43	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	106.25]	0.55	X	0.8	=	88.77	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	85.75]	0.55	X	0.8	=	71.64	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	62.67]	0.55	X	0.8	=	52.36	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	36.79]	0.55	X	0.8	=	30.74	(79)
Northeast 0.9x	0.77	X	1.5	4	x	9.21	x	0.55	X	0.8	=	4.33	(75)
Northeast _{0.9x}	0.77	X	4.6	5	x	9.21	x	0.55	X	0.8	=	13.06	(75)
Northeast _{0.9x}	0.77	X	1.5	4	x	14.2	x	0.55	X	0.8	=	6.67	(75)
Northeast _{0.9x}	0.77	x	4.6	5	x	14.2	x	0.55	X	0.8	=	20.13	(75)
Northeast _{0.9x}	0.77	X	1.5	4	x	28.07	x	0.55	X	0.8	=	13.18	(75)
Northeast 0.9x	0.77	x	4.6	5	x	28.07	x	0.55	X	0.8	=	39.8	(75)
Northeast 0.9x	0.77	X	1.5	4	x [50.42	x	0.55	×	0.8	=	23.68	(75)
Northeast _{0.9x}	0.77	x	4.6	5	x [50.42	x	0.55	×	0.8	=	71.49	(75)
Northeast _{0.9x}	0.77	x	1.5	4	x	72.63	x	0.55	x	0.8	-	34.1	(75)
Northeast _{0.9x}	0.77	x	4.6	5	x	72.63	x	0.55	×	0.8	=	102.98	(75)
Northeast _{0.9x}	0.77	x			x [91.1	X	0.55	×	0.8	= =	42.78	(75)
Northeast 0.9x	0.77	x	4.6		x [91.1] x	0.55	×	0.8	=	129.17	(75)
Northeast 0.9x	0.77	_ x			^ L	97.38] ^] x	0.55	= ^	0.8	= =	45.73	(75)
Northeast 0.9x	0.77	×			^ L	97.38] ^] x	0.55	X	0.8	= =	138.08	(75)
Northeast 0.9x	0.77	×			~ _L	91.35]	0.55	x	0.8	= =	42.89	(75)
Northeast 0.9x	0.77	×			^ L	91.35]	0.55	×	0.8	=	129.52	(75)
Northeast 0.9x	0.77	x			~ _L	67.96]	0.55	×	0.8	=	31.91	(75)
Northeast 0.9x	0.77	×			x [67.96]]	0.55	×	0.8	=	96.35	(75)
Northeast 0.9x	0.77	x	1.5		x [41.38] x	0.55	×	0.8	=	19.43	(75)
Northeast 0.9x	0.77	X			x [41.38	x	0.55	X	0.8	=	58.67	(75)
Northeast _{0.9x}	0.77	x			x [22.97]]	0.55	= x	0.8	= =	10.78	(75)
i i	0.11		4.6	٠	X	22.97	X	0.55	X	0.8	=	32.56	(75)

Separation 1		<u> </u>		0.92	0.77	0.57	0.41	0.47	0.74	0.95	0.99	1		(86)
Common C	Mean inte	rnal temper					-	-	0.7 1					(00)
Common C			ature in	living are	ea T1 (fc	ollow ste	ps 3 to 7	' in Table	e 9c)				1	
Case Case	(87)m= 20.	12 20.26	20.48	20.76	20.94	20.99	21	21	20.96	20.72	20.38	20.1		(87)
Case Case	Temperat	ure durina h	neating p	eriods ir	rest of	dwellina	from Ta	ble 9. Ti	h2 (°C)				I	
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2	· —									20.16	20.15	20.15		(88)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2	Litilisation	factor for a	ains for i	rest of d	welling l	n2 m (se	e Table	9a)					J	
(80) (80) (80) (18.97 19.17 19.43 19.88 20.1 20.17 20.17 20.17 20.14 19.85 19.35 18.94 (90)		 _				<u> </u>			0.67	0.93	0.99	1		(89)
(80) (80) (80) (18.97 19.17 19.43 19.88 20.1 20.17 20.17 20.17 20.14 19.85 19.35 18.94 (90)	—— Mean inte	rnal temner	ature in	the rest	of dwelli	na T2 (f	ollow ste	one 3 to T	7 in Tahl	e 9c)			Į.	
Mean internal temperature (for the whole dwelling) = ft.A × T1 + (1 - ft.A) × T2				r		<u> </u>					19.35	18.94		(90)
19.6 19.76 20.03 20.36 20.55 20.62 20.62 20.59 20.32 20.31 19.91 19.57 19.57 19.57 19.58 20.21 20.4 20.47	. ,		ļ						f	LA = Livin	g area ÷ (4	1) =	0.54	(91)
19.6 19.76 20.03 20.36 20.55 20.62 20.62 20.59 20.32 20.31 19.91 19.57 19.57 19.57 19.58 20.21 20.4 20.47	Moon into	rnal tampar	oturo (fo	r tho wh	مام طبيرما	ling) – fl	Λ ∨ T1	т /1 fl	∧\					_
Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)me			· `					·		20.32	19.91	19.57		(92)
33 19.45 19.61 19.88 20.21 20.4 20.47	` '										10.01	10.07		(/
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: Using Janis, hm: Useful gains, hmGm, W = (94)m x (84)m Useful gains, hmGm, W = (94)m x (84)m (95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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 Heat loss rate for mean internal temperature, Lm, W = ((39)m x ((93)m - (96)m) = (97)m= 712.41 689.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 0 0 0 81.82 190.73 291 Total per year (kWhiyear) = Sum(98)3s = 1313.02 (98) Space heating requirement in kWh/m²/year Total per year (kWhiyear) = Sum(98)3s = 1313.02 (98) Space heating: Fraction of space heat from secondary/supplementary systems including micro-CHP) Space heating: Fraction of space heat from main system 1 (202) × [1 - (201)] = 1 (202) Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 1 (204) Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec KWhi/year	· · · · · · ·	1	r	r						•	19.76	19.42		(93)
The utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	8. Space	neating requ	uirement											
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Set Ti to t	he mean int	ternal ter	mperatur	e obtain	ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
Utilisation factor for gains, hm: (94)m= 0.99 0.99 0.99 0.97 0.9 0.74 0.52 0.36 0.41 0.69 0.93 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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= 712.41 [889.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 (97) Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 177.79 0 0 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98)s. u = 1313.02 (98) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) (202) = 1 - (201) =	the utilisa												I	
(94)m= 0.99 0.99 0.99 0.97 0.9 0.74 0.52 0.36 0.41 0.69 0.93 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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= 712.41 689.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 (97) Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98). ss. p = 1313.02 (98) Space heating: Fraction of space heat from secondary/supplementary systems including micro-CHP) Space heating: Fraction of space heat from main system 1 (204) = (202) × [1 - (203)] = 1 (202)				<u> </u>	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains, hmGm , W = (94)m x (84)m (95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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= 712.41 689.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 (97) Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98). xs. 12 = 1313.02 (98) Space heating requirement in kWh/m²/year Space heating requirements — Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system (s) (202) = 1 - (201) = 1 (202) Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 1 (204) Efficiency of main space heating system 1 90.3 (206) Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec KWh/year Space heating requirement (calculated above)				1	0.74	0.50	0.26	0.44	0.60	0.02	0.00	4		(04)
(95)m= 331.81 370.68 405.74 422.53 375.57 262.58 174.67 182.89 275.98 329.43 319.63 316.1 (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= 712.41 689.83 625.42 520.6 399.48 264.98 174.89 183.36 288.11 439.4 584.52 707.23 (97) Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98)ssu = 1313.02 (98) Space heating requirement in kWh/m²/year 26.03 (99) 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system 0 (201) Fraction of total heating from main system(s) (202) = 1 - (201) = 1 (202) Fraction of total heating from main system 1 (204) = (202) × [1 - (203)] = 1 (204) Efficiency of secondary/supplementary heating system, % 0 (208) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	(3)					0.52	0.36	0.41	0.09	0.93	0.99	ı		(34)
Monthly average external temperature from Table 8 (96)m= 4.3		- i	<u>`</u>	ŕ		262.58	174.67	182.89	275.98	329.43	319.63	316.1		(95)
(96)m=	` '			l										` '
(97) (97) (97) (97) (97) (97) (97) (97) (97) (97) (98) (97) (98) (9			1	i –			16.6	16.4	14.1	10.6	7.1	4.2		(96)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m	Heat loss	rate for me	an intern	al tempe	erature, l	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			J	
(98)m= 283.17 214.47 163.44 70.61 17.79 0 0 0 81.82 190.73 291 Total per year (kWh/year) = Sum(98)ssz = 1313.02 (98) Space heating requirements in kWh/m²/year 26.03 (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 1 (202) Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 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/year Space heating requirement (calculated above)	(97)m= 712	.41 689.83	625.42	520.6	399.48	264.98	174.89	183.36	288.11	439.4	584.52	707.23		(97)
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)		_ ř ·				Wh/mont	h = 0.02	24 x [(97)m – (95	, - 、	1)m		1	
Space heating requirement in kWh/m²/year 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	(98)m= 283	.17 214.47	163.44	70.61	17.79	0	0	0	0	81.82	190.73	291		_
9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Individual heating system 0 (202) = 1 – (201) = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (204) = (202) × [1 – (203)] = 1 (204) = (204) = (202) × [1 – (203)] = 1 (204) =								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1313.02	(98)
Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 In (202) Efficiency of secondary/supplementary heating system, % In (204) I	Space he	ating require	ement in	kWh/m²	/year								26.03	(99)
Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 In (202) Efficiency of secondary/supplementary heating system, % In (204) = (202) × [1 – (203)] =	9a. Energy	requiremer	nts – Indi	ividual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Fraction of space heat from main system(s) Fraction of total heating from main system 1 Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	•	•										,		_
Fraction of total heating from main system 1 (204) = (202) × [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/year Space heating requirement (calculated above)	Fraction o	f space hea	at from so	econdar	y/supple	mentary	system						0	(201)
Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	Fraction of	f space hea	at from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year	Fraction o	f total heati	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year Space heating requirement (calculated above)	Efficiency	of main spa	ace heat	ing syste	em 1								90.3	(206)
Space heating requirement (calculated above)	Efficiency	of seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Já	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye:	⊐ ar
283.17 214.47 163.44 70.61 17.79 0 0 0 81.82 190.73 291	Space he	ating require	ement (c	alculate	d above)								-	
	283	.17 214.47	163.44	70.61	17.79	0	0	0	0	81.82	190.73	291		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206) $ (211)	(211)m = {	(98)m x (20)4)] } x 1	00 ÷ (20	16)								_	(211)
313.59 237.51 181 78.19 19.7 0 0 0 0 90.61 211.21 322.26	313	.59 237.51	181	78.19	19.7	0	0							
Total (kWh/year) = Sum(211) _{15,1012} = 1454.07 (211)								Tota	l (kWh/yea	r) =Sum(2	211),15,1012	=	1454.07	(211)

$= \{[(98)m \times (201)]\} \times 100 \div (208)$		
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0		
Total (kWh/year) =Sum(215) _{15,1012} =	0	(215)
Water heating		_
Output from water heater (calculated above) 163.61		
Efficiency of water heater	81	(216)
(217)m= 86.66 86.34 85.62 84.02 82.03 81 81 81 84.22 85.99 86.77		(217)
Fuel for water heating, kWh/month		
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 188.81 165.54 173.68 156.98 155.66 138.84 133.02 148.29 149.93 164.19 171.66 184.13 $		
Total = Sum(219a) ₁₁₂ =	1930.74	(219)
Annual totals kWh/year	kWh/year	┙`
Space heating fuel used, main system 1	1454.07	
Water heating fuel used	1930.74	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside		(230a)
central heating pump:		(230c)
Total electricity for the above, kWh/year sum of (230a)(230g) =	187.84	(231)
Electricity for lighting	234.98	(232)
Total delivered energy for all uses (211)(221) + (231) + (232)(237b) =	3807.63	(338)
12a. CO2 emissions – Individual heating systems including micro-CHP		
Energy Emission factor kWh/year kg CO2/kWh	Emissions kg CO2/yea	
0 ,		
kWh/year kg CO2/kWh	kg CO2/yea	ar -
kWh/year kg CO2/kWh Space heating (main system 1) (211) x 0.216 =	kg CO2/yea	ar](261)
kWh/year kg CO2/kWh Space heating (main system 1) Space heating (secondary) (211) x 0.216 = (215) x 0.519 =	kg CO2/yea	(261) (263)
kWh/year kg CO2/kWh Space heating (main system 1) (211) x 0.216 = Space heating (secondary) (215) x 0.519 = Water heating (219) x 0.216 =	314.08 0 417.04	(261) (263) (264)
kWh/year kg CO2/kWh Space heating (main system 1) (211) x 0.216 = Space heating (secondary) (215) x 0.519 = Water heating (219) x 0.216 = Space and water heating (261) + (262) + (263) + (264) =	314.08 0 417.04 731.12	(261) (263) (264) (265)
$ kWh/year \qquad kg CO2/kWh $ Space heating (main system 1) $ (211) \times 0.216 = $ Space heating (secondary) $ (215) \times 0.519 = $ Water heating $ (219) \times 0.216 = $ Space and water heating $ (261) + (262) + (263) + (264) = $ Electricity for pumps, fans and electric keep-hot $ (231) \times 0.519 = $	314.08 0 417.04 731.12 97.49	(261) (263) (264) (265) (267)
kWh/year kg CO2/kWh Space heating (main system 1) (211) x 0.216 = Space heating (secondary) (215) x 0.519 = Water heating (219) x 0.216 = Space and water heating (261) + (262) + (263) + (264) = Electricity for pumps, fans and electric keep-hot (231) x 0.519 = Electricity for lighting (232) x 0.519	314.08 0 417.04 731.12 97.49 121.95	(261) (263) (264) (265) (267) (268)

Stroma Number: STRO016363 Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.5.51
Property Address: Flat-401-LEAN Address: 1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³) Ground floor $ 71.04 (1a) \times 2.7 (2a) = 191.81 (3a) $ Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ $ 71.04 (4) $ Dwelling volume $ (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 191.81 (5) $ 2. Ventilation rate: main secondary other total m³ per hour
Address: 1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³) Ground floor $ 71.04 $
Ground floor
Ground floor 71.04 (1a) x 2.7 (2a) = 191.81 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) 71.04 (4) Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 191.81$ (5) 2. Ventilation rate: main secondary other total m^3 per hour
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 191.81$ 2. Ventilation rate: main secondary other total m³ per hour
Dwelling volume $ (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 191.81 $
2. Ventilation rate: main secondary other total m³ per hour
main secondary other total m³ per hour
heating heating
Number of chimneys 0 + 0 + 0 = 0 x 40 = 0 (6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 = 0$ (6b)
Number of intermittent fans $0 x 10 = 0 (7a)$
Number of passive vents $0 x 10 = 0 (7b)$
Number of flueless gas fires $0 x 40 = 0 (7c)$
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
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 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0$ (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 If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ On the permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 3 (17)
If based on air permeability value, then $(18) = [(17) \div 20] \div (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used
Number of sides sheltered 2 (19)
Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85$ (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 (allo	wing for sl	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
0.16	0.16 0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effec	_	e rate for t	he appli	cable ca	se			!				
	al ventilation: eat pump using Ap	nendiy N (2	23h) = (23a	a) x Emy (4	equation (N5)) othe	nwise (23h	n) = (23a)			0.5	(23a)
	heat recovery: ef							, (20a)			0.5	(23b)
	ed mechanical		_					2h\m + /	23P) ^ [-	1 (22a)	77.35 ÷ 1001	(23c)
(24a)m= 0.28	0.27 0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	+ 100j	(24a)
` ′	ed mechanical		<u> </u>			<u> </u>	1	ļ		0.20		(= : =)
(24b)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24b)
	ouse extract v		n nositiv	/e innut	ventilatio	on from	nutside					, ,
,	n < 0.5 × (23b)		•	•				.5 × (23b	o)			
(24c)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24c)
,	ventilation or w n = 1, then (24			•				0.5]			•	
(24d)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change rate -	enter (24a) or (24b	o) or (24	c) or (24	ld) in bo	x (25)	•	•	•	•	
(25)m= 0.28	0.27 0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(25)
3 Heat losse	s and heat loss	s paramet	er.									
ELEMENT	Gross area (m²)	Openin m	ıgs	Net Ar A ,r		U-val W/m2		A X U (W/I		k-value		A X k kJ/K
Doors	()			1.99		1	=	1.99	$\stackrel{\prime}{\Box}$			(26)
Windows Type	e 1			1.37	x1	/[1/(1.4)+	0.04] =	1.82	=			(27)
Windows Type	2			0.9	x1	/[1/(1.4)+	0.04] =	1.19	冒			(27)
Windows Type	3			5.79	x1	/[1/(1.4)+	0.04] =	7.68	=			(27)
Windows Type	e 4			2.19	x1	/[1/(1.4)+	0.04] =	2.9	一			(27)
Walls Type1	75.26	15.7	3	59.53	3 X	0.15	=	8.93				(29)
Walls Type2	27.91	1.99		25.92	2 x	0.15	_	3.89	F i			(29)
Roof	75.26	0	=	75.26	5 X	0.13		9.78	F i			(30)
Total area of e	lements, m²			178.4	.3							(31)
Party wall				10.99) x	0	=	0				(32)
Party floor				71.04	_							(32a)
* for windows and ** include the area					lated using	g formula 1	1/[(1/U-valu	ue)+0.04] a	as given in	paragraph	3.2	``
Fabric heat los	ss, W/K = S (A	x U)				(26)(30) + (32) =				45.45	(33)
Heat capacity	Cm = S(A x k))					((28).	(30) + (32	2) + (32a).	(32e) =	21732.64	(34)
Thermal mass	parameter (TN	/IP = Cm -	+ TFA) ir	n kJ/m²K			Indica	ative Value	: Medium		250	(35)
For design assess can be used instead			construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L x Y) c	alculated	using Ap	pendix l	K						31.57	(36)
if details of therma		known (36) =	= 0.05 x (3	1)			(0.5)	(0.6)				
Total fabric he	at loss						(33) +	(36) =			77.02	(37)

Ventila	ation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	17.46	17.26	17.05	16.05	15.84	14.84	14.84	14.63	15.24	15.84	16.25	16.65		(38)
Heat tr	ansfer c	coefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
(39)m=	94.48	94.28	94.07	93.07	92.86	91.85	91.85	91.65	92.26	92.86	93.27	93.67		
Heat Id	oss para	meter (H	HLP), W	/m²K			-	-		Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	93.01	(39)
(40)m=	1.33	1.33	1.32	1.31	1.31	1.29	1.29	1.29	1.3	1.31	1.31	1.32		
Numbe	er of day	s in moi	nth (Tab	le 1a)			•	•		Average =	Sum(40) ₁	12 /12=	1.31	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
			-	-		-	-	-	-	-	-	-		
4. Wa	ater heat	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assum	ned occu	inancy I	N								2	27		(42)
if TF		9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		21		(42)
Annua	l averag	e hot wa	ater usaç									3.14		(43)
		-	hot water person per			-	-	to achieve	a water us	se target o	f			
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,									0	0-4	NI	D		
Hot wate	Jan er usage ii	Feb	Mar day for ea	Apr	May Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	96.95	93.43	89.9	86.38	82.85	79.32	79.32	82.85	86.38	89.9	93.43	96.95		
(44)111-	90.93	30.40	09.9	00.00	02.00	19.52	79.52	02.00			m(44) ₁₁₂ =	l	1057.67	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600					1007.07	()
(45)m=	143.78	125.75	129.76	113.13	108.55	93.67	86.8	99.6	100.79	117.47	128.22	139.24		
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	1386.77	(45)
(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.89		(46)
	storage													
•		, ,) includir	•			•		ame ves	sel		0		(47)
	•	•	ind no ta		_			. ,	ara) ant	or 'O' in /	47)			
	storage		hot wate	ei (uiis ii	iciuues i	IIStaiitai	ieous cc	ווטט וטוווע	ers) erik	ei U III (41)			
	•		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(48) x (49) =			0		(50)
•			eclared o	-										
		_	factor fr		e 2 (kW	h/litre/da	ay)					0		(51)
	munity n e factor	•	ee secti	on 4.3								0		(52)
			m Table	2b								0		(52) (53)
			storage		ear			(47) x (51) x (52) x (53) =		0		(54)
	(50) or (•	, 1	-41			() A (O1	, (0 2)	,	-	0		(55)
	• • •	. , .	culated t	for each	month			((56)m = (55) × (41)	m		-		V - 7
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
(55)111			<u> </u>	<u> </u>	L							L		(30)

If cylinder con	tains dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	om Append	lix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circ	cuit loss (ar	nnual) fro	om Table	 ∋ 3	•						0		(58)
Primary circ	•	•			59)m = ((58) ÷ 36	65 × (41)	m				•	
(modified	by factor f	rom Tab	le H5 if t	here is	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	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 49.4	11 43	45.81	42.6	42.22	39.12	40.42	42.22	42.6	45.81	46.07	49.41		(61)
Total heat r	equired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 193	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		(62)
Solar DHW in	out calculated	using App	endix G or	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add addition	nal 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	n water hea	iter											
(64)m= 193.	18 168.75	175.57	155.73	150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65		
	•						Outp	out from wa	ater heate	r (annual)₁	12	1915.45	(64)
Heat gains	from water	heating,	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m]	
(65)m= 60.	16 52.56	54.6	48.26	46.65	40.93	38.97	43.67	44.16	50.51	54.15	58.65		(65)
include (57)m in cal	culation o	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Interna	l gains (see	e Table 5	5 and 5a):									
Metabolic g	ains (Table	e 5). Wat	ts	,									
Ja		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.	56 113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56		(66)
Lighting ga	ns (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 17.	8 15.81	12.86	9.74	7.28	6.14	6.64	8.63	11.58	14.71	17.17	18.3		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5	•	•	•	
(68)m= 199.	71 201.78	196.56	185.44	171.41	158.22	149.41	147.34	152.56	163.68	177.71	190.9		(68)
Cooking ga	ins (calcula	ated in A	ppendix	L, equat	tion L15	or L15a), also se	ee Table	5	•	•		
(69)m= 34.3	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36	34.36		(69)
Pumps and	fans gains	(Table 5	.——— 5а)	•	•			•		•	•		
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporation	n (nega	tive valu	es) (Tab	le 5)							•	
(71)m= -90.	84 -90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84	-90.84		(71)
Water heat	ng gains (rable 5)						l				•	
(72)m= 80.8	~~	73.39	67.03	62.7	56.84	52.37	58.7	61.34	67.89	75.21	78.83		(72)
Total inter	nal gains =	:			(66)	m + (67)m	ı + (68)m -	+ (69)m + ((70)m + (7	1)m + (72))m	ı	
(73)m= 358.	_ `	342.88	322.28	301.45	281.27	268.49	274.73	285.55	306.34	330.15	348.1		(73)
						L	<u> </u>						
6. Solar ga	ains:												
ŭ	ains: ire calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to co	onvert to th	e applicat	ole orientat	tion.		
ŭ	re calculated	actor	r flux from Area m²		Flu			onvert to the g_ sable 6b		ole orientat FF able 6c	tion.	Gains (W)	

Northoast a ou		1		1		1		l		1		7(75)
Northeast 0.9x	0.77	X	0.9	X	11.28	X	0.55	X	0.8] = 1	3.1	(75)
Northeast 0.9x	0.77	X	0.9	X	22.97	X	0.55	X	0.8] = 1	6.3	(75)
Northeast 0.9x	0.77	X	0.9	X	41.38	X	0.55	X	0.8] =	11.36	(75)
Northeast _{0.9x}	0.77	X	0.9	X	67.96	X	0.55	X	0.8] =	18.65	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.35	X	0.55	X	0.8	=	25.07	(75)
Northeast _{0.9x}	0.77	X	0.9	X	97.38	X	0.55	X	0.8] =	26.73	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.1	X	0.55	X	0.8	=	25	(75)
Northeast _{0.9x}	0.77	X	0.9	X	72.63	X	0.55	X	0.8	=	19.93	(75)
Northeast _{0.9x}	0.77	X	0.9	X	50.42	X	0.55	X	0.8	=	13.84	(75)
Northeast _{0.9x}	0.77	X	0.9	X	28.07	X	0.55	X	0.8	=	7.7	(75)
Northeast _{0.9x}	0.77	X	0.9	X	14.2	X	0.55	X	0.8	=	3.9	(75)
Northeast _{0.9x}	0.77	X	0.9	X	9.21	X	0.55	X	0.8	=	2.53	(75)
Southeast _{0.9x}	0.77	X	5.79	X	36.79	X	0.55	X	0.8	=	64.96	(77)
Southeast _{0.9x}	0.77	X	5.79	X	62.67	X	0.55	X	0.8	=	110.65	(77)
Southeast _{0.9x}	0.77	X	5.79	X	85.75	X	0.55	X	0.8	=	151.4	(77)
Southeast _{0.9x}	0.77	X	5.79	X	106.25	X	0.55	x	0.8	=	187.59	(77)
Southeast _{0.9x}	0.77	X	5.79	X	119.01	X	0.55	x	0.8	=	210.11	(77)
Southeast 0.9x	0.77	X	5.79	X	118.15	x	0.55	x	0.8	=	208.59	(77)
Southeast _{0.9x}	0.77	X	5.79	x	113.91	x	0.55	x	0.8] =	201.11	(77)
Southeast _{0.9x}	0.77	X	5.79	X	104.39	x	0.55	X	0.8] =	184.3	(77)
Southeast _{0.9x}	0.77	X	5.79	x	92.85	x	0.55	x	0.8] =	163.93	(77)
Southeast _{0.9x}	0.77	x	5.79	x	69.27	x	0.55	x	0.8] =	122.29	(77)
Southeast _{0.9x}	0.77	x	5.79	x	44.07	x	0.55	x	0.8] =	77.81	(77)
Southeast _{0.9x}	0.77	X	5.79	x	31.49	x	0.55	x	0.8] =	55.59	(77)
Northwest _{0.9x}	0.77	X	1.37	x	11.28	x	0.55	x	0.8] =	23.57	(81)
Northwest _{0.9x}	0.77	X	2.19	x	11.28	x	0.55	x	0.8] =	7.53	(81)
Northwest _{0.9x}	0.77	x	1.37	x	22.97	x	0.55	x	0.8	j =	47.97	(81)
Northwest 0.9x	0.77	x	2.19	x	22.97	x	0.55	x	0.8	j =	15.34	(81)
Northwest _{0.9x}	0.77	x	1.37	x	41.38	x	0.55	x	0.8] =	86.43	(81)
Northwest 0.9x	0.77	x	2.19	x	41.38	x	0.55	x	0.8	j =	27.63	(81)
Northwest _{0.9x}	0.77	x	1.37	x	67.96	x	0.55	х	0.8	j =	141.94	(81)
Northwest _{0.9x}	0.77	x	2.19	x	67.96	х	0.55	x	0.8	j =	45.38	(81)
Northwest 0.9x	0.77	x	1.37	x	91.35	x	0.55	х	0.8	j =	190.79	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.35	x	0.55	х	0.8	j =	61	(81)
Northwest _{0.9x}	0.77	x	1.37	x	97.38	х	0.55	х	0.8	j =	203.41	(81)
Northwest _{0.9x}	0.77	x	2.19	x	97.38	x	0.55	x	0.8	j =	65.03	(81)
Northwest _{0.9x}	0.77	x	1.37	x	91.1	x	0.55	x	0.8	j =	190.28	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.1	x	0.55	x	0.8	i =	60.84	(81)
Northwest _{0.9x}	0.77	X	1.37	X	72.63	X	0.55	x	0.8] =	151.7	(81)
Northwest _{0.9x}	0.77	X	2.19	X	72.63	X	0.55	x	0.8] =	48.5	(81)
Northwest _{0.9x}	0.77	X	1.37	X	50.42	X	0.55	X	0.8	=	105.31	(81)
_		1		1		1		I		1		_ ' '

Northwest _{0.9x}	0.77	X	2.1	9	x	50.42	X		0.55	x	0.8	=	33.67	(81)
Northwest _{0.9x}	0.77	Х	1.3	57	x	28.07	X		0.55	x	0.8	=	58.62	(81)
Northwest _{0.9x}	0.77	X	2.1	9	x	28.07	X		0.55	x	0.8	=	18.74	(81)
Northwest _{0.9x}	0.77	X	1.3	57	x	14.2	X		0.55	x	0.8	=	29.65	(81)
Northwest _{0.9x}	0.77	Х	2.1	9	x	14.2	X		0.55	x	0.8	=	9.48	(81)
Northwest _{0.9x}	0.77	X	1.3	37	x	9.21	X		0.55	x	0.8	=	19.25	(81)
Northwest 0.9x	0.77	X	2.1	9	x	9.21	X		0.55	x	0.8	=	6.15	(81)
_							_							
Solar gains in	watts, ca	alculated	for eacl	n month			(83)n	n = S	um(74)m .	(82)m	_			
(83)m= 99.16	180.26	276.81	393.55	486.97	503		404	1.43	316.75	207.36	120.84	83.52		(83)
Total gains – i			<u> </u>		· `								Ī	
(84)m= 457.6	536.14	619.69	715.84	788.43	785	5.03 745.71	679	9.16	602.29	513.7	450.99	431.61		(84)
7. Mean inter	nal temp	erature	(heating	season)									
Temperature	during h	eating p	eriods ir	the livi	ng ai	rea from Ta	ble 9	, Th	1 (°C)				21	(85)
Utilisation fac	tor for g	ains for l	iving are	ea, h1,m	(see	e Table 9a)					_		•	
Jan	Feb	Mar	Apr	May	J۱	un Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.98	0.95	0.85	0.6	69 0.53	0.5	59	0.84	0.97	0.99	1		(86)
Mean interna	I temper	ature in	living are	ea T1 (fo	ollow	steps 3 to	7 in 1	Γable	e 9c)					
(87)m= 19.56	19.74	20.03	20.43	20.76	20.	.94 20.99	20.	.98	20.83	20.4	19.91	19.53		(87)
Temperature	during h	eating p	eriods ir	rest of	dwe	lling from Ta	able !	—— 9 TI	ոշ (°C)		•	•	•	
(88)m= 19.82	19.82	19.82	19.83	19.84	19.		1	.85	19.84	19.84	19.83	19.83		(88)
Litilization for	tor for a	cina for	oot of d	volling	L—— h2 ~	· /ooo Toblo	. 00)				ļ			
Utilisation fac	0.99	0.98	0.93	0.8	0.5	<u> </u>	9a) 0.4	46	0.76	0.96	0.99	1		(89)
						ļ .	<u> </u>				0.00			()
Mean interna	· ·	1			Ť	<u>`</u>	i 				1 40 44	47.00	1	(90)
(90)m= 17.92	18.18	18.61	19.17	19.6	19.	.81 19.84	19.	.84	19.71	19.15	18.44 ng area ÷ (4	17.89	0.00	—
										LA - LIVII	ig area · (-	") =	0.39	(91)
Mean interna		<u> </u>				1	Ť					i	1	
(92)m= 18.56	18.78	19.16	19.66	20.05	20.		20.		20.14	19.63	19.01	18.52		(92)
Apply adjustr	18.63			•	_	-	1				10.06	10.27		(93)
` '		19.01	19.51	19.9	20.	.09 20.13	20.	.13	19.99	19.48	18.86	18.37		(93)
8. Space hea	·			o obtoir	od a	nt stop 11 of	Tab	la Ok	o co tha	t Ti m-/	76\m an	d ro calc	vulata	
the utilisation					icu a	at step 11 of	Tab	ic si	o, so ilia	t 11,111—((10)III all	u ie-caic	uiaic	
Jan	Feb	Mar	Apr	May	Jı	un Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac	tor for g	ains, hm	:	-		•			-					
(94)m= 0.99	0.99	0.97	0.92	0.8	0.6	61 0.43	0.4	49	0.78	0.95	0.99	1		(94)
Useful gains,	hmGm ,	, W = (94	1)m x (84	4)m								•	•	
(95)m= 455.09	530.09	602.77	660.68	634.62	478		334	1.24	467.41	489.38	446.2	429.78		(95)
Monthly aver	. 					<u> </u>						1	1	
(96)m= 4.3	4.9	6.5	8.9	11.7	14		16		14.1	10.6	7.1	4.2		(96)
Heat loss rate											1000.00	1007.5	1	(07)
(97)m= 1332.83		1176.71	987.03	761.32	504			I.66	543.81	824.79	1096.63	1327.5		(97)
Space heatin (98)m= 653.04	g require	427.01	r eacn m 234.97	94.26	/vn/n		T	<u>[(97)</u>)m – (95 0)MJ X (4 249.55	468.31	667.9		
(30)111- 033.04	J 13.1	721.01	۷۵4.31	∂4.ZU		<u>, I , , , , , , , , , , , , , , , , , ,</u>	1 ,		U	248.00	700.31	8.100		

				Tota	l per year	(kWh/year	r) = Sum(9	08) _{15,912} =	3308.74	(98)
Space heating requirement in kWl	h/m²/year								46.58	(99)
9a. Energy requirements – Individu	ıal heating s	ystems i	ncluding	micro-C	CHP)					
Space heating:								Г		¬
Fraction of space heat from secon		mentary	•		(224)				0	(201)
Fraction of space heat from main	• ,			(202) = 1				ļ	1	(202)
Fraction of total heating from mair	-			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space heating s	-								90.3	(206)
Efficiency of secondary/suppleme	ntary heating	g systen	า, %						0	(208)
	pr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement (calcu										
	1.97 94.26	0	0	0	0	249.55	468.31	667.9		
(211)m = {[(98)m x (204)] } x 100 ÷		0		0	0	276.35	518.62	739.65		(211)
723.19 300.00 472.00 200	0.21 104.39	U	0		l (kWh/yea				3664.17	(211)
Space heating fuel (secondary), k	\Mh/month				(,	- 1 715,101	2	3004.17	(211)
$= \{[(98) \text{m x } (201)] \} \text{ x } 100 \div (208)$.vvii/iiiOiiui									
	0 0	0	0	0	0	0	0	0		
	•	•		Tota	l (kWh/yea	ar) =Sum(2	215),5,101	=	0	(215)
Water heating								-		
Output from water heater (calculate		400.70	407.00	444.00	440.00	400.00	174.0	100.05		
193.18 168.75 175.57 155 Efficiency of water heater	5.73 150.77	132.79	127.22	141.82	143.39	163.28	174.3	188.65	0.1	(216)
<u> </u>	.35 84.34	81	81	81	81	86.38	87.57	88.07	81	(217)
Fuel for water heating, kWh/month					01	00.00	07.07	00.07		(= · · ·)
(219) m = (64) m x $100 \div (217)$ m										
(219)m= 219.54 192.18 200.94 180	0.35 178.76	163.94	157.07	175.09	177.02	189.03	199.03	214.19		_
				Tota	I = Sum(2				2247.15	(219)
Annual totals Space heating fuel used, main syst	tom 1					k'	Wh/yea	r 「	kWh/yea 3664.17	r ¬
	leili i							<u>[</u>		╡
Water heating fuel used									2247.15	
Electricity for pumps, fans and elec	tric keep-ho	t								
mechanical ventilation - balanced	, extract or p	ositive ii	nput fron	n outside	Э			222.31		(230a
central heating pump:								30		(2300
Total electricity for the above, kWh	/year			sum	of (230a).	(230g) =			252.31	(231)
Electricity for lighting									314.43	(232)
Total delivered energy for all uses	(211)(221)	+ (231)	+ (232).	(237b)	=				6478.05	(338)
12a. CO2 emissions – Individual h	neating sys <u>t</u> e	ems i <u>ncl</u> u	udin <u>g mi</u>	cro-CHF				L		
		En	ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	

Space heating (main system 1)	(211) x	0.216 =	791.46	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	485.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1276.84	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	130.95	(267)
Electricity for lighting	(232) x	0.519 =	163.19	(268)
Total CO2, kg/year	sum	n of (265)(271) =	1570.98	(272)
Dwelling CO2 Emission Rate	(272	2) ÷ (4) =	22.11	(273)
El rating (section 14)			82	(274)

		l Isar I	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	<u> </u>	Strom Softwa	_				0016363 on: 1.0.5.51	
Contware Hame.	-	Property	Address				VCISIC	71. 1.0.0.01	
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			a(m²)	(4 -)		ight(m)	7,0-2	Volume(m ³	<u>^</u>
				(1a) x	2	2.7	(2a) =	136.19	(3a)
•	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	50.44	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	136.19	(5)
2. Ventilation rate:	main acconda	P\$3.4	other		total			m³ nor hou	
	main seconda heating heating	<u> </u>	otner	, –	total			m³ per hou	_
Number of chimneys	0 + 0	+	0] = <u>L</u>	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0] + [0] = [0	x 2	20 =	0	(6b)
Number of intermittent fa	ans				0	Χ.	10 =	0	(7a)
Number of passive vents	3			Γ	0	X ·	10 =	0	(7b)
Number of flueless gas f	ires			Ī	0	X 4	40 =	0	(7c)
								_	
							Air ch	nanges per ho	our —
	eys, flues and fans = (6a)+(6b)+(_	0		÷ (5) =	0	(8)
Number of storeys in t	been carried out or is intended, procee he dwelling (ns)	ea to (17),	otnerwise (ontinue tr	om (9) to ((16)		0	(9)
Additional infiltration	ne arraining (na)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	0.25 for steel or timber frame o	r 0.35 fo	r masoni	y constr	uction			0	(11)
	resent, use the value corresponding t	o the grea	ter wall are	a (after					
deducting areas of openi	floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	,	`	,,					0	(13)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)					0	(16)
•	q50, expressed in cubic metro	•	•	•	etre of e	envelope	area	3	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$ es if a pressurisation test has been do				is heina u	sed		0.15	(18)
Number of sides sheltere		ne or a ac	gree an pe	moubinty	io being a			2	(19)
Shelter factor			(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified	for monthly wind speed					•		1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7					•		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 = (2	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		
		-	-		-	-	•	•	

djusted infiltra	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
alculate effec					1	· ·	1 0=	1 00			00	l	
If mechanica	I ventila	tion:										0.5	(23
If exhaust air he	at pump ι	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat reco	very: effic	iency in %	allowing 1	for in-use f	actor (fror	m Table 4h) =				77.35	(2:
a) If balance						- ` ` 	- 	ŕ	r `		1 – (23c)	÷ 100]	
la)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(24
b) If balance			1		1		MV) (24k	ŕ	2b)m + (2	23b)		ı	
lb)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole ho				-					.5 × (23b)			
lc)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural v if (22b)m				•	•				0.5]				
ld)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change	rate - er	nter (24a	or (24l	o) or (24	c) or (24	1d) in bo	x (25)					
5)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
. Heat losses	and he	at loss i	paramet	er:									
LEMENT	Gros area	ss	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	()	k-value kJ/m²·ł		A X k kJ/K
oors					1.99	x	1	=	1.99				(2
indows Type	1				1.37	x1	I/[1/(1.4)+	0.04] =	1.82	Ħ			(2
indows Type	2				4.65	x1	I/[1/(1.4)+	0.04] =	6.16	Ħ			(2
indows Type	3				1.54	x1	I/[1/(1.4)+	0.04] =	2.04	=			(2
alls Type1	55.8	3	8.93		46.87	7 X	0.15	─ = i	7.03	T [\neg	(2
alls Type2	22.4	.9	1.99		20.5	x	0.15	-	3.08			i iii	(2
oof	50.4		0	=	50.44	=	0.13	=	6.56	=		=	(3
tal area of el					128.7	=							^ (3
arty wall					9.64	_	0		0			-	(3
arty floor					50.44	=						╡┝	(3
or windows and in nclude the areas					alue calcul		g formula 1	/[(1/U-valu	ıe)+0.04] a	L s given in	paragraph	3.2	(
bric heat los				•			(26)(30) + (32) =				30.49	(3
eat capacity (•						((28).	(30) + (32	!) + (32a).	(32e) =	17007.06	
ermal mass	parame	ter (TMF	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(3
r design assessi n be used instea				construct	ion are no	t known p	recisely the	e indicative	values of	TMP in Ta	able 1f		
nermal bridge	s : S (L	x Y) cal	culated (using Ap	pendix l	K						24.32	(3
letails of therma otal fabric hea		are not kn	own (36) =	= 0.05 x (3	11)			(33) +	(36) =		,	54.81	(3
	t loss ca	alculated	d monthly	,				(38)m	= 0.33 × (2	25)m x (5))		
entilation hea	. 1000 00			,						, , ,			

											·			
(38)m= 1	12.4 12	2.25	12.11	11.39	11.25	10.53	10.53	10.39	10.82	11.25	11.54	11.82		(38)
Heat trans							·			= (37) + (·			
(39)m= 6	7.21 6	7.06	66.92	66.2	66.06	65.34	65.34	65.2	65.63	66.06	66.35	66.63		¬,,,,,,
Heat loss	parame	ter (F	ILP), W/	m²K						Average = = (39)m ÷	Sum(39) ₁ (4)	12 /12=	66.17	(39)
(40)m= 1	1.33 1	.33	1.33	1.31	1.31	1.3	1.3	1.29	1.3	1.31	1.32	1.32		_
Number o	of days ir	n mor	nth (Tabl	le 1a)					/	Average =	Sum(40) ₁	12 /12=	1.31	(40)
Г	Jan I	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
	·													
4. Water	heating	ener	gy requi	rement:								kWh/ye	ear:	
Assumed	occupa	nov N	NI.									_		(40)
if TFA >		1 = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (T	ΓFA -13.		.7		(42)
Annual a	•		iter usag	ge in litre	s per da	ıy Vd,av	erage =	(25 x N)	+ 36		74	.65		(43)
Reduce the not more that		•		• .		•	•	to achieve	a water us	e target o	f			
					<i>'</i>	_	<u> </u>	I .				_		
Hot water us		Feb es ner	Mar day for ea	Apr	May	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
_								, ,	70.45	70.44	70.40	00.44		
(44)m= 8	2.11 79	9.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11	905 77	(44)
Energy cont	tent of hot	water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D)Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		895.77	(44)
(45)m= 12	21.77 10	06.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		_
If instantane	eous water	r heatir	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)		Γotal = Su	m(45) ₁₁₂ =	=	1174.5	(45)
_		5.98	16.48	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(46)
Water sto	I							.2.00	.2.0					,
Storage v	olume (l	litres)	includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If commu	•	-			_			, ,						
Otherwise			hot wate	er (this in	ıcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water sto a) If man	U		eclared l	oss facto	or is kno	wn (kWł	n/day).					0		(48)
Temperat), 10 mile	("uay).				_	0		(49)
Energy lo					ear			(48) x (49)	· =			0		(50)
b) If man			•	•		or is not		(12)11(12)				U		(00)
Hot water	_				e 2 (kW	h/litre/da	ıy)					0		(51)
If commu	•	-		on 4.3										
Volume fa Temperat				2h							-	0		(52)
·								(47) (54)	(50) (-0)		0		(53)
Energy lo Enter (50			_	, KVVN/ye	ear			(47) x (51)	X (52) X (53) =		0		(54) (55)
Water sto	, , ,	, ,	•	or each	month			((56)m = (55) × (41)r	n		U		(33)
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder co	-		-							-		_	ix H	(00)
	0	0	0	0	0	0	0	0	0	0	0	0		(57)
(57)m=	<u> </u>	U	U	U					U	U				(01)

Primary circuit loss (annual) from Table 3				0		(58)
Primary circuit loss calculated for each mor	nth (59)m = (58) ÷ 36	55 × (41)m	-			
(modified by factor from Table H5 if there	e is solar water heatir	ng and a cylinder	thermostat)			
(59)m= 0 0 0 0	0 0	0 0	0 0	0		(59)
Combi loss calculated for each month (61)	n = (60) ÷ 365 × (41))m				
	.76 33.13 34.24	35.76 36.08	38.8 39.02	41.84		(61)
Total heat required for water heating calcul	ated for each month	(62)m = 0.85 × (4	45)m + (46)m +	(57)m +	(59)m + (61)m	
	7.69 112.46 107.75	120.12 121.44	138.29 147.62	159.77	(00) (01)	(62)
Solar DHW input calculated using Appendix G or App				er heating)		
(add additional lines if FGHRS and/or WWI						
·		0 0	0 0	0		(63)
Output from water heater						
· 	7.69 112.46 107.75	120.12 121.44	138.29 147.62	159.77		
(6.)	100 112110 101110		ter heater (annual) ₁		1622.26	(64)
Heat gains from water heating, kWh/month	0.25 ′ [0.85 x (45)m	•	, ,			100
	.51 34.66 33	36.99 37.4	42.78 45.86	49.67	1	(65)
` '						(00)
include (57)m in calculation of (65)m only	/ if cylinder is in the d	dwelling or hot wa	ater is from com	munity h	eating	
5. Internal gains (see Table 5 and 5a):						
Metabolic gains (Table 5), Watts			<u> </u>			
	lay Jun Jul	Aug Sep	Oct Nov	Dec		
(66)m= 85.15 85.15 85.15 85.15 85	.15 85.15 85.15	85.15 85.15	85.15 85.15	85.15		(66)
Lighting gains (calculated in Appendix L, ed	quation L9 or L9a), a	lso see Table 5				
(67)m= 13.31 11.82 9.61 7.28 5.	44 4.59 4.96	6.45 8.66	10.99 12.83	13.68		(67)
Appliances gains (calculated in Appendix L	, equation L13 or L1	3a), also see Tab	ole 5			
(68)m= 148.38 149.92 146.04 137.78 127	7.35 117.55 111	109.46 113.34	121.6 132.03	141.83		(68)
Cooking gains (calculated in Appendix L, e	quation L15 or L15a)	, also see Table	5			
(69)m= 31.52 31.52 31.52 31	.52 31.52 31.52	31.52 31.52	31.52 31.52	31.52		(69)
Pumps and fans gains (Table 5a)		<u> </u>	•			
(70)m= 3 3 3 3 3	3 3 3	3 3	3 3	3		(70)
Losses e.g. evaporation (negative values)	(Table 5)					
	.12 -68.12 -68.12	-68.12 -68.12	-68.12 -68.12	-68.12		(71)
Water heating gains (Table 5)		<u> </u>				
(72)m= 68.48 66.24 62.15 56.77 53	3.1 48.14 44.36	49.72 51.95	57.5 63.7	66.76		(72)
Total internal gains =	!	ı + (68)m + (69)m + (7				` '
	7.44 221.83 211.87	217.17 225.49	241.64 260.1	273.81		(73)
6. Solar gains:	.44 221.03 211.07	217.17 223.49	241.04 200.1	273.01		(10)
Solar gains are calculated using solar flux from Table	e 6a and associated equa	tions to convert to the	e applicable orientat	ion.		
Orientation: Access Factor Area	Flux	g_	FF		Gains	
Table 6d m ²	Table 6a	9_ Table 6b	Table 6c		(W)	
Northeast 0.9x 0.77 x 4.65	x 11.28	x 0.55	x 0.8		16	(75)
N	= ====		╡ ├──	╡┇		(75) (75)
Northeast 0.9x 0.77 x 1.54	X 11.28	X 0.55	X 0.8	[5.3	$I^{(i,j)}$

Utilisation fac	Feb	Mar	Apr	May	Ť	Jun Jul	I A	ug Sep	Oct	Nov	Dec	1	
Temperature	_	٠.			_		ole 9,	Th1 (°C)				21	(85)
7. Mean inter	•		`										
(84)m= 333.75	375.24	419.09	470.41	509.28	50	4.35 478.99	441	.47 398.24	352.4	323.72	317.51]	(84)
Total gains – i	nternal a	nd sola	r (84)m =	(73)m	+ (8	3)m , watts		·				_	
(83)m= 52.04	95.71	149.75	217.03	271.84	$\overline{}$	2.52 267.12	224	<u> </u>	110.8	63.62	43.7]	(83)
Solar gains in	watts. ca	lculated	d for each	n month	1		(83)m	= Sum(74)m	(82)m				
Southwest _{0.9x}	0.77	Х	1.3	7	x	31.49]	0.55	X	0.8	=	26.31	(79)
Southwest _{0.9x}	0.77	×		==	X	44.07]	0.55	×	0.8	_ =	36.82	(79)
Southwest _{0.9x}	0.77	X			x [69.27]	0.55	X	0.8	=	57.87	(79)
Southwest _{0.9x}	0.77	х	1.3	7	X	92.85]	0.55	х	0.8	=	77.58	(79)
Southwest _{0.9x}	0.77	x	1.3	7	x [104.39]	0.55	X	0.8	=	87.22	(79)
Southwest _{0.9x}	0.77	х	1.3	7	x	113.91		0.55	X	0.8	=	95.17	(79)
Southwest _{0.9x}	0.77	x	1.3	7	x	118.15]	0.55	×	0.8	=	98.71	(79)
Southwest _{0.9x}	0.77	x	1.3	7	x	119.01]	0.55	X	0.8	=	99.43	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	106.25]	0.55	X	0.8	=	88.77	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	85.75]	0.55	X	0.8	=	71.64	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	62.67]	0.55	X	0.8	=	52.36	(79)
Southwest _{0.9x}	0.77	X	1.3	7	x	36.79]	0.55	X	0.8	=	30.74	(79)
Northeast 0.9x	0.77	X	1.5	4	x	9.21	x	0.55	X	0.8	=	4.33	(75)
Northeast _{0.9x}	0.77	X	4.6	5	x	9.21	x	0.55	X	0.8	=	13.06	(75)
Northeast _{0.9x}	0.77	X	1.5	4	x	14.2	x	0.55	X	0.8	=	6.67	(75)
Northeast _{0.9x}	0.77	x	4.6	5	x	14.2	x	0.55	X	0.8	=	20.13	(75)
Northeast _{0.9x}	0.77	X	1.5	4	x	28.07	x	0.55	X	0.8	=	13.18	(75)
Northeast 0.9x	0.77	x	4.6	5	x	28.07	x	0.55	X	0.8	=	39.8	(75)
Northeast 0.9x	0.77	X	1.5	4	x [50.42	x	0.55	×	0.8	=	23.68	(75)
Northeast _{0.9x}	0.77	x	4.6	5	x [50.42	x	0.55	×	0.8	=	71.49	(75)
Northeast _{0.9x}	0.77	x	1.5	4	x	72.63	x	0.55	x	0.8	-	34.1	(75)
Northeast _{0.9x}	0.77	x	4.6	5	x	72.63	x	0.55	×	0.8	=	102.98	(75)
Northeast _{0.9x}	0.77	x			x [91.1	X	0.55	×	0.8	= =	42.78	(75)
Northeast 0.9x	0.77	x	4.6		x [91.1] x	0.55	×	0.8	=	129.17	(75)
Northeast 0.9x	0.77	_ x			^ L	97.38] ^] x	0.55	= x	0.8	= =	45.73	(75)
Northeast 0.9x	0.77	×			^ L	97.38] ^] x	0.55	X	0.8	= =	138.08	(75)
Northeast 0.9x	0.77	×			^ L	91.35]	0.55		0.8	= =	42.89	(75)
Northeast 0.9x	0.77	×			^ L	91.35]	0.55	×	0.8	=	129.52	(75)
Northeast 0.9x	0.77	x			~ _L	67.96]	0.55	×	0.8	=	31.91	(75)
Northeast 0.9x	0.77	×			x [67.96]]	0.55	×	0.8	=	96.35	(75)
Northeast 0.9x	0.77	x	1.5		x [41.38] x	0.55	×	0.8	=	19.43	(75)
Northeast 0.9x	0.77	X			x [41.38	x	0.55	X	0.8	=	58.67	(75)
Northeast _{0.9x}	0.77	x			x [22.97]]	0.55	= x	0.8	= =	10.78	(75)
i i	0.11		4.6	٠	X	22.97	X	0.55	X	0.8	=	32.56	(75)

(86)m=	1	0.99	0.99	0.96	0.89	0.74	0.58	0.64	0.87	0.98	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)				•	
(87)m=	19.58	19.73	20	20.37	20.71	20.92	20.98	20.97	20.81	20.38	19.91	19.55		(87)
Temp	erature	durina h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9 T	h2 (°C)					
(88)m=	19.82	19.82	19.82	19.83	19.83	19.84	19.84	19.85	19.84	19.83	19.83	19.82		(88)
Litilio	tion foo	tor for a	oine for I	root of d	volling	h2 m /oc	L Tabla	00)	l		l			
(89)m=	1	0.99	ains for 0.98	0.95	0.84	0.64	0.44	9a) 0.5	0.8	0.96	0.99	1		(89)
						<u> </u>		<u> </u>	l	<u> </u>	0.00	·		()
			ature in	the rest	of dwelli 19.54	- ` `	ollow ste	ps 3 to 19.83	7 in Tabl	e 9c) 19.12	18.44	17.01		(90)
(90)m=	17.94	18.16	10.55	19.09	19.54	19.79	19.04	19.03		l	g area ÷ (4	17.91	0.54	(91)
										LA - LIVIII	g arca · (-	•) =	0.54	(91)
			ature (fo			lling) = fl		+ (1 – fL	A) × T2	1			i	
(92)m=	18.83	19.01	19.34	19.79	20.18	20.4	20.46	20.45	20.29	19.8	19.24	18.8		(92)
			r			r	r		ere appro	 	40.00	40.05	Ī	(02)
(93)m=	18.68	18.86	19.19	19.64	20.03	20.25	20.31	20.3	20.14	19.65	19.09	18.65		(93)
			uirement		o obtain	and at et	on 11 of	Table 0	h so tha	t Ti m=/	76)m an	d ro colo	vulato	
			or gains	•		ieu ai sii	ғр п о	Table 9	b, so tha	ıt 11,111 – (rojili ali	u re-carc	uiale	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac		ains, hm		,	ļ.	ļ.		<u>'</u>	<u>I</u>	ļ	ļ.		
(94)m=	0.99	0.99	0.98	0.94	0.85	0.67	0.49	0.56	0.82	0.96	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	1)m x (84	4)m								ı	
(95)m=	331.86	371.48	409.99	443.07	432.56	340.43	236.86	245.23	325.93	338.58	320.4	316.07		(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)
Heat	loss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]			•	
(97)m=	966.47	936.29	849.03	710.79	550.01	369.27	242.29	254.25	396.64	598.07	795.74	962.95		(97)
-)m – (95		·		I	
(98)m=	472.15	379.56	326.65	192.76	87.38	0	0	0	0	193.06	342.24	481.27		_
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2475.07	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								49.07	(99)
9a. En	ergy red	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:												
Fracti	ion of sp	ace hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fracti	ion of sp	ace hea	nt 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	nain spa	ace heat	ing syste	em 1								90.3	(206)
Efficie	encv of s	seconda	ry/supple	ementar	v heatin	a svsten	າ. %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	
Snace			ement (c				Jui	Aug	Sep	Oct	INOV	Dec	KVVII/ye	aı
Орио	472.15	379.56	326.65	192.76	87.38	0	0	0	0	193.06	342.24	481.27		
(211\ ~			4)] } x 1						<u> </u>				1	(211)
(411)11	522.87	420.33	361.74	213.47	96.77	0	0	0	0	213.8	379.01	532.97		(411)
	<u> </u>	0.00	551.7 =	_ , 0. +1	20.11	L	L		l (kWh/yea				2740.95	(211)
									,	,	₹15,1012		2170.90	

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		
	-	Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating								
Output from water heater (calculated above) 163.61 142.92 148.7 131.89 127.69 1	12.46 107.75	120.12	121.44	138.29	147.62	159.77		
Efficiency of water heater							81	(216)
(217)m= 87.71 87.55 87.17 86.28 84.54	81 81	81	81	86.17	87.28	87.79		(217)
Fuel for water heating, kWh/month	-							
(219) m = (64) m x $100 \div (217)$ m (219)m = 186.54 163.24 170.59 152.87 151.05 13	38.84 133.02	148.29	149.93	160.48	169.13	182		
		Tota	I = Sum(2	19a) ₁₁₂ =			1905.99	(219)
Annual totals				k۱	Wh/year	•	kWh/year	_
Space heating fuel used, main system 1							2740.95	_
Water heating fuel used							1905.99	
Electricity for pumps, fans and electric keep-hot								
mechanical ventilation - balanced, extract or pos	itive input fror	m outside	e			157.84		(230a)
central heating pump:						30		(230c)
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =			187.84	(231)
Electricity for lighting							234.98	(232)
Total delivered energy for all uses (211)(221) +	(231) + (232)	(237b)	=				5069.75	(338)
12a. CO2 emissions – Individual heating system	s including mi	icro-CHP)					
	Energy kWh/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	ır
Space heating (main system 1)	(211) x			0.2	16	=	592.04	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.2	16	=	411.69	(264)
Space and water heating	(261) + (262)	+ (263) + (264) =				1003.74	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	97.49	(267)
Electricity for lighting	(232) x			0.5	19	=	121.95	(268)
Total CO2, kg/year			sum o	f (265)(2	271) =		1223.18	(272)
Dwelling CO2 Emission Rate			(272)	÷ (4) =			24.25	(273)

El rating (section 14)

83

(274)

Energy Assessment The Bird in Hand, Kilburn

eight associates

+44 (0)20 7043 0418 www.eightassociates.co.uk info@eightassociates.co.uk

Be Green- DER from the Be Green scenario DER SAP worksheet

Appendix B 34

		Llear Dataile:					
Access an Names		User Details:	N	han	CTDA	016363	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012		na Num are Ve			016363 n: 1.0.5.51	
Software Name.		operty Address				11. 1.0.5.51	
Address :	West End Lane, LONDON, N	•	3. 1 10 d 3 C	TIOT ONLL			
Overall dwelling dimen							
		Area(m²)		Av. Height	(m)	Volume(m³))
Basement		57.4	(1a) x	2.1	(2a) =	120.54	(3a)
Ground floor		53.06	(1b) x	2.85	(2b) =	151.22	(3b)
First floor		53.06	(1c) x	3.08	(2c) =	163.42	(3c)
Second floor		43.77	(1d) x	2.26	(2d) =	98.92	(3d)
Total floor area TFA = (1a)	+(1b)+(1c)+(1d)+(1e)+(1n)	207.29	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e	e)+(3n) =	534.11	(5)
2. Ventilation rate:							
	main secondary heating heating	other		total		m³ per houi	r
Number of chimneys		+ 0	- -	0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0	<u> </u>	0	x 20 =	0	(6b)
Number of intermittent fans	3			0	x 10 =	0	(7a)
Number of passive vents			Ī	0	x 10 =	0	(7b)
Number of flueless gas fire	es			0	x 40 =	0	(7c)
					Air ch	anges per ho	ur
Infiltration due to chimnous	s, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	Г				_
	en carried out or is intended, proceed		continue fr	0 om (9) to (16)	÷ (5) =	0	(8)
Number of storeys in the		(/ ,		o (o) to (10)		0	(9)
Additional infiltration	J , ,				[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.2	5 for steel or timber frame or 0	.35 for masor	ry constr	ruction		0	(11)
	sent, use the value corresponding to the	he greater wall ar	ea (after		•		
deducting areas of opening	s);	(sealed) else	enter 0			0	(12)
If no draught lobby, ente	· · ·	(000,000), 0,000	onioi o			0	(13)
•	and doors draught stripped					0	(14)
Window infiltration	and deere area give empress	0.25 - [0.	2 x (14) ÷ 1	00] =		0	(15)
Infiltration rate		(8) + (10)) + (11) + (1	12) + (13) + (15)) =	0	(16)
	50, expressed in cubic metres	per hour per s	square m	etre of enve	lope area	15	(17)
, ,	/ value, then (18) = [(17) ÷ 20]+(8)		•		'	0.75	(18)
·	if a pressurisation test has been done			is being used		00	` ′
Number of sides sheltered						2	(19)
Shelter factor		(20) = 1 -	· [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating	g shelter factor	(21) = (18	8) x (20) =			0.64	(21)
Infiltration rate modified for	monthly wind speed						

Jul

Jun

Sep

Aug

Oct

Nov

Dec

Mar

Apr

May

Feb

Jan

Monthly average	ge wind	speed fr	om Tabl	e 7									
(22)m= 5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\)O -)	(00)			•	•	•	•	•	•	•	•	
Wind Factor (2 (22a)m= 1.27	22a)m = 1.25	(22)m ÷	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
(224)111- 1.27	1.23	1.25	1.1	1.00	0.93	0.93	0.92		1.00	1.12	1.10		
Adjusted infiltra		`				i 	`	` ´		1	1	1	
0.81 Calculate effect	0.8	0.78	0.7 rate for t	0.69 he appli	0.61 cable ca	0.61	0.59	0.64	0.69	0.72	0.75		
If mechanica		•	ato for t	пс арри	oubic ou	00						0.5	(23a)
If exhaust air he	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	o) = (23a)			0.5	(23b)
If balanced with	n heat rec	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23c)
a) If balance	d mech	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)	÷ 100]	_
(24a)m= 0.93	0.91	0.89	0.81	0.8	0.72	0.72	0.7	0.75	0.8	0.83	0.86		(24a)
b) If balance	d mech	anical ve	entilation	without	heat red	covery (N	ЛV) (24b	o)m = (2	2b)m + (23b)		-	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h				•	•								
if (22b)m	1	r` ´	· ` `	ŕ	ŕ	`	r ` ` 	ŕ	`	i 		1	(0.4 -)
(24c)m= 0	0	0		0	0	0	0	0	0	0	0		(24c)
d) If natural i if (22b)m				•	•				0.51				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)	1	•	1	1	
(25)m= 0.93	0.91	0.89	0.81	0.8	0.72	0.72	0.7	0.75	0.8	0.83	0.86		(25)
3. Heat losses	s and he	eat loss i	paramete	er:									
ELEMENT	Gro		Openin		Net Ar	ea	U-val	ue	AXU		k-value	e A.	X k
	area	(m²)	· m		A ,r	m²	W/m2	2K	(W/	K)	kJ/m²·l	K kJ	/K
Doors Type 1					3.67	X	1.6	=	5.872				(26)
Doors Type 2					2.85	X	1.6	=	4.56				(26)
Doors Type 3					2.35	X	1	=	2.35				(26)
Windows Type	1				2.22	х1	/[1/(1.6)+	0.04] =	3.34				(27)
Windows Type	2				1.13	х1	/[1/(1.6)+	0.04] =	1.7				(27)
Windows Type	3				0.61	х1	/[1/(1.6)+	0.04] =	0.92				(27)
Windows Type	e 4				2.25	х1	/[1/(1.6)+	0.04] =	3.38				(27)
Windows Type	5				1.77	x1	/[1/(1.6)+	0.04] =	2.66				(27)
Windows Type	6				1.31	x1	/[1/(1.6)+	0.04] =	1.97				(27)
Windows Type	e 7				0.68	x1	/[1/(1.6)+	0.04] =	1.02				(27)
Windows Type	. 0				2.69	x1	/[1/(1.6)+	0.04] =	4.05				(27)
	0												
Windows Type					1.03	x1	/[1/(1.6)+	0.04] =	1.55				(27)
Windows Type Windows Type	9						/[1/(1.6)+ /[1/(1.6)+		1.55 4.36				(27) (27)

Floor T	ype 1					57.4	X	0.25	=	14.35				(28)
Floor T	ype 2					53.06	x	0.25	=	13.265				(28)
Walls 7	Гуре1	81.4	3	0		81.43	3 X	0.55	=	44.79				(29)
Walls 7	Гуре2	15.3	31	6.41		8.9	X	0.15	=	1.34				(29)
Walls 7	Гуре3	24.3	3	0		24.3	x	0.15	=	3.65	= [(29)
Walls 7	Гуре4	101.4	44	33.5	7	67.87	7 X	0.55	-	37.33				(29)
Roof T	ype1	62.7	<u>'</u> 4	3.34		59.4	X	0.18	= i	10.69	= i			(30)
Roof T	ype2	10.9	06	0	一	10.96	3 X	0.18	= i	1.97	₹ i			(30)
Total a	rea of e	lements	, m²			406.6	4							(31)
Party w	vall					58.5	x	0		0				(32)
* for wind	dows and	roof wind	ows, use e	ffective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valu	ne)+0.04] a	ıs given in	paragraph	3.2	
					ls and pan	titions								_
			= S (A x	U)				(26)(30)					191.96	(33)
		Cm = S(,							(30) + (32		(32e) =	39052.95	(34)
		•	`		+ TFA) ir 					tive Value:			250	(35)
7			ere the de tailed calci		construct	ion are not	t known pr	ecisely the	indicative	values of	IMP IN T	able 1f		
Therma	al bridge	es : S (L	x Y) cal	culated i	using Ap	pendix l	<						61	(36)
if details	of therma	l bridging	are not kn	own (36) =	= 0.05 x (3	1)								
	abric he								(33) +	(36) =			252.95	(37)
Ventila	tion hea		alculated	l monthly	<u> </u>	1	1	1		= 0.33 × (25)m x (5)) 	1	
(2.2)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00)
(38)m=	163.22	160.41	157.6	143.56	140.75	126.71	126.71	123.9	132.32	140.75	146.37	151.99		(38)
ı		oefficier		i -						= (37) + (3		<u> </u>	1	
(39)m=	416.18	413.37	410.56	396.51	393.7	379.66	379.66	376.85	385.28	393.7	399.32	404.94	225.24	— (20)
Heat lo	ss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷		12 /12=	395.81	(39)
(40)m=	2.01	1.99	1.98	1.91	1.9	1.83	1.83	1.82	1.86	1.9	1.93	1.95		
NIla	£ .l	:	-41- /T-1-	I- 4-\						Average =	Sum(40) ₁	12 /12=	1.91	(40)
Numbe	i		nth (Tab	<u> </u>	Max	1	1	A	Can	0-4	Nav	Dag		
(41)m=	Jan 31	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31		(41)
(41)111-	31	20	31	30	31	30	31	J 31	30	31	30	31		(41)
4 10/-												1-10/1- /		
4. vva	ter neat	ing ener	rgy requi	rement:								kWh/ye	ear:	
		ipancy, I		F.4) 40 (T E	- 400	\0\1 · 0 /	2040 (TEA 40	3	.01		(42)
	A > 13.9 A £ 13.9		+ 1./6 X	[1 - ехр	(-0.0003	349 X (11	-A -13.9)2)] + 0.0	J013 x (TFA -13.	9)			
		•	ater usaç	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10	5.72		(43)
		_			5% if the d ater use, I	_	-	to achieve	a water us	se target o	f		•	
1.01 1110/6					1		<u>, </u>	Α.		·	N.1		1	
Hot wate	Jan er usage in	Feb	Mar day for ea	Apr ach month	May Vd,m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	116.29	112.06	107.84	103.61	99.38	95.15	95.15	99.38	103.61	107.84	112.06	116.29]	
(44)111-	110.29	112.00	107.04	103.01	33.30	33.13	33.13	33.30		Total = Su	<u> </u>	ļ	1268.65	(44)
										. Julia - Oui				/

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) 172.46 150.83 155.65 135.7 130.2 112.36 104.11 119.47 120.9 140.9 153.8 167.02 (45)m =Total = $Sum(45)_{1...12}$ = 1663.4 (45)If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 20.35 (46)25.87 22.63 23.35 19.53 16.85 15.62 18.14 21.13 23.07 25.05 Water storage loss: Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)If community heating and no tank in dwelling, enter 110 litres in (47) Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47) Water storage loss: a) If manufacturer's declared loss factor is known (kWh/day): (48)Temperature factor from Table 2b 0 (49)Energy lost from water storage, kWh/year $(48) \times (49) =$ (50)110 b) If manufacturer's declared cylinder loss factor is not known: Hot water storage loss factor from Table 2 (kWh/litre/day) (51)0.02 If community heating see section 4.3 Volume factor from Table 2a 1 03 (52)Temperature factor from Table 2b 0.6 (53)Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$ (54)1.03 Enter (50) or (54) in (55) (55)1.03 Water storage loss calculated for each month $((56)m = (55) \times (41)m$ (56)m =32.01 28.92 32.01 30.98 32.01 30.98 32.01 32.01 30.98 32.01 30.98 32.01 (56)If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H 32.01 28.92 32.01 30.98 32.01 30.98 32.01 32.01 30.98 32.01 30.98 32.01 (57)(57)m =(58)Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = $(58) \div 365 \times (41)$ m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) 23.26 (59)(59)m =21.01 23.26 23.26 22.51 23.26 23 26 22 51 23.26 22.51 23.26 Combi loss calculated for each month (61)m = (60) \div 365 × (41)m 0 0 0 0 0 (61)(61)m =0 0 0 Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m 227.74 200.76 210.92 189.19 185.48 165.85 159.39 174.75 174.39 (62)196.17 207.29 222.29 (62)m=Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)(63)m=0 0 0 0 0 0 0 Output from water heater 227.74 200.76 210.92 185.48 174.39 (64)m=189.19 165.85 159.39 174.75 196.17 207.29 222.29 2314.24 (64)Output from water heater (annual)_{1...12} Heat gains from water heating, kWh/month 0.25 \(^{1}\) [0.85 \times (45)m + (61)m] + 0.8 \(^{1}\) [(46)m + (57)m + (59)m] 95.97 83.95 (65)(65)m =101.56 87.91 87.51 80.15 78.84 82.99 91.07 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 Aug Jan Feb Mar Apr May Jun Jul Sep Oct Nov Dec

(66)m=	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57	150.57		(66)
Lightin	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 oı	r L9a), a	lso see	Table 5					
(67)m=	33.69	29.92	24.34	18.42	13.77	11.63	12.56	16.33	21.92	27.83	32.48	34.63		(67)
Appliar	nces ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Tal	ble 5			_	
(68)m=	377.92	381.84	371.96	350.92	324.37	299.41	282.73	278.81	288.69	309.73	336.29	361.25		(68)
Cookin	g gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a)	, also se	ee Table	5			_	
(69)m=	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06	38.06		(69)
Pumps	and far	ns gains	(Table 5	ōa)									-	
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses	e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m=	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46	-120.46		(71)
Water	heating	gains (T	able 5)											
(72)m=	136.51	134.07	129	122.1	117.63	111.32	105.97	112.83	115.27	122.41	130.46	134.08		(72)
Total i	nternal	gains =				(66)	m + (67)m	+ (68)m +	+ (69)m + (70)m + (7	1)m + (72)	m		
													1	
(73)m=	616.3	614.01	593.47	559.62	523.94	490.53	469.43	476.14	494.05	528.14	567.4	598.13		(73)

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

Orientation:	Access Facto Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	0.68	x	11.28	x	0.55	x	0.8	=	7.02	(75)
Northeast 0.9x	0.77	x	0.68	x	22.97	x	0.55	x	0.8	=	14.29	(75)
Northeast 0.9x	0.77	x	0.68	x	41.38	x	0.55	x	0.8	=	25.74	(75)
Northeast 0.9x	0.77	x	0.68	x	67.96	x	0.55	x	0.8	=	42.27	(75)
Northeast 0.9x	0.77	x	0.68	X	91.35	X	0.55	X	0.8	=	56.82	(75)
Northeast 0.9x	0.77	x	0.68	X	97.38	X	0.55	X	0.8	=	60.58	(75)
Northeast 0.9x	0.77	x	0.68	x	91.1	x	0.55	x	0.8	=	56.67	(75)
Northeast 0.9x	0.77	x	0.68	X	72.63	x	0.55	X	0.8	=	45.18	(75)
Northeast 0.9x	0.77	x	0.68	X	50.42	X	0.55	x	0.8	=	31.36	(75)
Northeast 0.9x	0.77	x	0.68	x	28.07	x	0.55	x	0.8	=	17.46	(75)
Northeast 0.9x	0.77	x	0.68	x	14.2	x	0.55	x	0.8	=	8.83	(75)
Northeast 0.9x	0.77	x	0.68	X	9.21	X	0.55	X	0.8	=	5.73	(75)
Southeast 0.9x	0.77	x	2.69	x	36.79	x	0.55	x	0.8	=	60.36	(77)
Southeast 0.9x	0.77	x	1.03	x	36.79	x	0.55	x	0.8	=	11.56	(77)
Southeast 0.9x	0.77	x	2.69	X	62.67	X	0.55	x	0.8	=	102.81	(77)
Southeast 0.9x	0.77	x	1.03	x	62.67	x	0.55	x	0.8	=	19.68	(77)
Southeast 0.9x	0.77	x	2.69	x	85.75	x	0.55	x	0.8	=	140.67	(77)
Southeast 0.9x	0.77	x	1.03	x	85.75	x	0.55	x	0.8	=	26.93	(77)
Southeast 0.9x	0.77	x	2.69	x	106.25	x	0.55	x	0.8	=	174.3	(77)
Southeast 0.9x	0.77	x	1.03	x	106.25	x	0.55	x	0.8	=	33.37	(77)
Southeast 0.9x	0.77	x	2.69	x	119.01	x	0.55	x	0.8	=	195.23	(77)

		,		1		1		ı		,		_
Southeast 0.9x	0.77	X	1.03	X	119.01	X	0.55	X	0.8] =	37.38	(77)
Southeast _{0.9x}	0.77	X	2.69	X	118.15	X	0.55	X	0.8	=	193.82	(77)
Southeast _{0.9x}	0.77	X	1.03	X	118.15	X	0.55	X	0.8	=	37.11	(77)
Southeast _{0.9x}	0.77	X	2.69	X	113.91	X	0.55	X	0.8	=	186.86	(77)
Southeast _{0.9x}	0.77	X	1.03	X	113.91	X	0.55	X	0.8	=	35.78	(77)
Southeast _{0.9x}	0.77	X	2.69	X	104.39	X	0.55	X	0.8	=	171.25	(77)
Southeast 0.9x	0.77	X	1.03	X	104.39	X	0.55	X	0.8	=	32.79	(77)
Southeast _{0.9x}	0.77	X	2.69	X	92.85	X	0.55	X	0.8	=	152.32	(77)
Southeast _{0.9x}	0.77	X	1.03	X	92.85	X	0.55	X	0.8	=	29.16	(77)
Southeast 0.9x	0.77	X	2.69	X	69.27	X	0.55	X	0.8	=	113.63	(77)
Southeast _{0.9x}	0.77	X	1.03	x	69.27	x	0.55	x	0.8] =	21.75	(77)
Southeast _{0.9x}	0.77	X	2.69	x	44.07	X	0.55	x	0.8] =	72.3	(77)
Southeast _{0.9x}	0.77	X	1.03	x	44.07	X	0.55	x	0.8] =	13.84	(77)
Southeast _{0.9x}	0.77	X	2.69	x	31.49	X	0.55	x	0.8] =	51.65	(77)
Southeast _{0.9x}	0.77	X	1.03	x	31.49	X	0.55	x	0.8	=	9.89	(77)
Southwest _{0.9x}	0.77	X	2.22	х	36.79		0.55	x	0.8] =	49.81	(79)
Southwest _{0.9x}	0.77	X	1.13	x	36.79		0.55	x	0.8] =	25.36	(79)
Southwest _{0.9x}	0.77	X	0.61	x	36.79		0.55	x	0.8] =	6.84	(79)
Southwest _{0.9x}	0.77	X	2.22	x	62.67		0.55	x	0.8] =	84.85	(79)
Southwest _{0.9x}	0.77	X	1.13	x	62.67		0.55	x	0.8] =	43.19	(79)
Southwest _{0.9x}	0.77	X	0.61	x	62.67		0.55	x	0.8	=	11.66	(79)
Southwest _{0.9x}	0.77	X	2.22	x	85.75		0.55	х	0.8] =	116.1	(79)
Southwest _{0.9x}	0.77	X	1.13	x	85.75		0.55	x	0.8] =	59.09	(79)
Southwest _{0.9x}	0.77	X	0.61	x	85.75		0.55	x	0.8] =	15.95	(79)
Southwest _{0.9x}	0.77	X	2.22	x	106.25		0.55	x	0.8	=	143.85	(79)
Southwest _{0.9x}	0.77	X	1.13	x	106.25		0.55	x	0.8] =	73.22	(79)
Southwest _{0.9x}	0.77	X	0.61	x	106.25		0.55	x	0.8] =	19.76	(79)
Southwest _{0.9x}	0.77	X	2.22	x	119.01	Ì	0.55	x	0.8] =	161.12	(79)
Southwest _{0.9x}	0.77	X	1.13	x	119.01	ĺ	0.55	x	0.8] =	82.01	(79)
Southwest _{0.9x}	0.77	X	0.61	x	119.01	ĺ	0.55	x	0.8	j =	22.14	(79)
Southwest _{0.9x}	0.77	X	2.22	x	118.15	j	0.55	x	0.8	j =	159.96	(79)
Southwest _{0.9x}	0.77	x	1.13	х	118.15	j	0.55	x	0.8	j =	81.42	(79)
Southwest _{0.9x}	0.77	x	0.61	x	118.15	j	0.55	x	0.8	j =	21.98	(79)
Southwest _{0.9x}	0.77	x	2.22	х	113.91	j	0.55	x	0.8	j =	154.22	(79)
Southwest _{0.9x}	0.77	x	1.13	х	113.91	j	0.55	x	0.8	j =	78.5	(79)
Southwest _{0.9x}	0.77	j×	0.61	x	113.91	j	0.55	x	0.8	j =	21.19	(79)
Southwest _{0.9x}	0.77	X	2.22	x	104.39	į	0.55	x	0.8	j =	141.33	(79)
Southwest _{0.9x}	0.77	x	1.13	x	104.39	ĺ	0.55	x	0.8	j =	71.94	(79)
Southwest _{0.9x}	0.77	j×	0.61	x	104.39	j	0.55	x	0.8	j =	19.42	(79)
Southwest _{0.9x}	0.77	X	2.22	x	92.85	j	0.55	x	0.8	j =	125.71	(79)
Southwest _{0.9x}	0.77	x	1.13	x	92.85	ĺ	0.55	x	0.8	j =	63.99	(79)
_		_		•		•		1		•		_

		,						ı		1		_
Southwest _{0.9x}	0.77	X	0.61	X	92.85		0.55	X	0.8] =	17.27	(79)
Southwest _{0.9x}	0.77	X	2.22	X	69.27		0.55	X	0.8	=	93.78	(79)
Southwest _{0.9x}	0.77	X	1.13	X	69.27		0.55	X	0.8	=	47.73	(79)
Southwest _{0.9x}	0.77	X	0.61	x	69.27		0.55	X	0.8	=	12.88	(79)
Southwest _{0.9x}	0.77	X	2.22	X	44.07		0.55	X	0.8	=	59.66	(79)
Southwest _{0.9x}	0.77	X	1.13	X	44.07]	0.55	X	0.8	=	30.37	(79)
Southwest _{0.9x}	0.77	X	0.61	X	44.07]	0.55	X	0.8	=	8.2	(79)
Southwest _{0.9x}	0.77	X	2.22	x	31.49		0.55	X	0.8] =	42.63	(79)
Southwest _{0.9x}	0.77	X	1.13	x	31.49		0.55	X	0.8	=	21.7	(79)
Southwest _{0.9x}	0.77	X	0.61	x	31.49]	0.55	X	0.8	=	5.86	(79)
Northwest 0.9x	0.77	X	2.25	x	11.28	x	0.55	x	0.8	=	23.22	(81)
Northwest 0.9x	0.77	X	1.77	x	11.28	X	0.55	x	0.8	=	6.09	(81)
Northwest 0.9x	0.77	X	1.31	x	11.28	X	0.55	X	0.8	=	13.52	(81)
Northwest 0.9x	0.77	X	2.9	x	11.28	X	0.55	X	0.8	=	9.98	(81)
Northwest 0.9x	0.77	X	2.25	x	22.97	X	0.55	X	0.8	=	47.27	(81)
Northwest _{0.9x}	0.77	X	1.77	x	22.97	x	0.55	x	0.8] =	12.4	(81)
Northwest 0.9x	0.77	X	1.31	x	22.97	x	0.55	x	0.8] =	27.52	(81)
Northwest 0.9x	0.77	X	2.9	x	22.97	x	0.55	x	0.8	Ī =	20.31	(81)
Northwest 0.9x	0.77	X	2.25	x	41.38	x	0.55	x	0.8	j =	85.17	(81)
Northwest _{0.9x}	0.77	X	1.77	x	41.38	x	0.55	x	0.8] =	22.33	(81)
Northwest _{0.9x}	0.77	X	1.31	x	41.38	x	0.55	x	0.8	Ī =	49.59	(81)
Northwest 0.9x	0.77	X	2.9	x	41.38	x	0.55	x	0.8	j =	36.59	(81)
Northwest _{0.9x}	0.77	X	2.25	x	67.96	x	0.55	x	0.8] =	139.87	(81)
Northwest 0.9x	0.77	x	1.77	x	67.96	x	0.55	x	0.8	j =	36.68	(81)
Northwest _{0.9x}	0.77	x	1.31	x	67.96	x	0.55	x	0.8	j =	81.43	(81)
Northwest 0.9x	0.77	x	2.9	x	67.96	X	0.55	x	0.8	j =	60.09	(81)
Northwest 0.9x	0.77	x	2.25	x	91.35	x	0.55	x	0.8	j =	188.01	(81)
Northwest _{0.9x}	0.77	x	1.77	x	91.35	x	0.55	х	0.8] =	49.3	(81)
Northwest _{0.9x}	0.77	x	1.31	x	91.35	x	0.55	x	0.8] =	109.46	(81)
Northwest 0.9x	0.77	j×	2.9	×	91.35	x	0.55	x	0.8	j =	80.77	(81)
Northwest _{0.9x}	0.77	X	2.25	x	97.38	x	0.55	x	0.8	j =	200.44	(81)
Northwest _{0.9x}	0.77	x	1.77	x	97.38	x	0.55	x	0.8] =	52.56	(81)
Northwest 0.9x	0.77	j×	1.31	×	97.38	x	0.55	x	0.8	j =	116.7	(81)
Northwest _{0.9x}	0.77	X	2.9	x	97.38	x	0.55	x	0.8] =	86.11	(81)
Northwest _{0.9x}	0.77	x	2.25	x	91.1	x	0.55	x	0.8] =	187.51	(81)
Northwest _{0.9x}	0.77	X	1.77	×	91.1	x	0.55	x	0.8] =	49.17	(81)
Northwest _{0.9x}	0.77	X	1.31	x	91.1	x	0.55	x	0.8] =	109.17	(81)
Northwest _{0.9x}	0.77	X	2.9	x	91.1	X	0.55	X	0.8] =	80.56	(81)
Northwest _{0.9x}	0.77	X	2.25	x	72.63	X	0.55	X	0.8	j =	149.48	(81)
Northwest _{0.9x}	0.77	X	1.77	x	72.63	X	0.55	x	0.8] =	39.2	(81)
Northwest _{0.9x}	0.77	X	1.31	x	72.63	X	0.55	X	0.8] =	87.03	(81)
L		J		,		.		1		ı		_

Northwest 0.9				 1 .	. —		۱ ۱		– r				7(04)
Northwest 0.9	<u> </u>	X	2.9	=		72.63	」 X □	0.55	× [0.8	_ =	64.22	(81)
		X	2.25	=	-	50.42	X	0.55	× [0.8	_ =	103.78	(81)
Northwest 0.9	0		1.77	=		50.42	」 X □	0.55	_ ×	0.8	=	27.21	(81)
Northwest 0.9	****	×	1.31	'	` <u></u>	50.42	_ X	0.55	× [8.0	=	60.42	(81)
Northwest 0.9		×	2.9	;	` <u></u>	50.42	X	0.55	×	0.8	=	44.59	(81)
Northwest 0.9		X	2.25	;	·	28.07	X	0.55	X	8.0	=	57.77	(81)
Northwest 0.9		X	1.77	,	·	28.07	X	0.55	X	8.0	=	15.15	(81)
Northwest 0.9		×	1.31	,	·	28.07	X	0.55	X	8.0	=	33.63	(81)
Northwest 0.9	•	×	2.9	;	'	28.07	X	0.55	X	0.8	=	24.82	(81)
Northwest 0.9	0.77	×	2.25	,	(14.2	X	0.55	X	0.8	=	29.22	(81)
Northwest 0.9	0.77	X	1.77	,	(14.2	X	0.55	X	8.0	=	7.66	(81)
Northwest 0.9	0.77	X	1.31	,	•	14.2	X	0.55	X	8.0	=	17.01	(81)
Northwest 0.9	0.77	X	2.9	,	(14.2	X	0.55	x	0.8	=	12.55	(81)
Northwest 0.9	0.77	x	2.25	,	(9.21	X	0.55	x	0.8	=	18.96	(81)
Northwest 0.9	0.77	x	1.77		(9.21	X	0.55	x	0.8	=	4.97	(81)
Northwest 0.9	0.77	x	1.31	,	•	9.21	x	0.55	x	0.8	=	11.04	(81)
Northwest 0.9	0.77	x	2.9	,	•	9.21	X	0.55	X	0.8	=	8.15	(81)
Rooflights 0.9	9x 1	x	1.11	,	((37.03	X	0.55	x	0.8	=	48.92	(82)
Rooflights 0.9	9x 1	×	1.11	<u> </u>	(70.28	x	0.55	x	0.8	-	92.85	(82)
Rooflights 0.9	9x 1	x	1.11	,	(1	11.87	x	0.55	x	0.8	=	147.79	(82)
Rooflights 0.9	9x 1	x	1.11	,	· 1	59.33	X	0.55	x	0.8	=	210.48	(82)
Rooflights 0.9	9x 1	x	1.11		,	193.3	j×	0.55	×	0.8		255.37	(82)
Rooflights 0.9	9x 1	×	1.11		· 1	97.35	X	0.55	x	0.8	=	260.71	(82)
Rooflights 0.9	9x 1	x	1.11		· 1	88.08	x	0.55	×	0.8	=	248.47	(82)
Rooflights 0.9	9x 1	×	1.11		· 1	62.62	X	0.55	×	0.8	=	214.83	(82)
Rooflights 0.9	9x 1	×	1.11		, <u> </u>	28.66	X	0.55	×	0.8	=	169.98	(82)
Rooflights 0.9	0x 1	×	1.11	= ,	_	32.24	X	0.55	×	0.8		108.65	(82)
Rooflights 0.9	9x 1	×	1.11		—	15.75] x	0.55	×	0.8	_ =	60.44	(82)
Rooflights 0.9)x 1	X	1.11	_	-	30.74	J X	0.55		0.8	= =	40.61	(82)
-								0.00				.0.0.	` ′
Solar gains	in watts, c	alculated	for each r	nonth			(83)m	= Sum(74)m .	(82)m				
(83)m= 262.	1	725.95	1015.33 1		1271.38	1208.08			547.26	320.09	221.2		(83)
Total gains	– internal a	and solar	(84)m = (73)m +	(83)m	, watts		!		·!			
(84)m= 878.	97 1090.84	1319.42	1574.95 1	761.55	1761.91	1677.51	151	2.8 1319.83	1075.4	887.49	819.33		(84)
7. Mean in	ternal tem	perature	(heating se	eason)				•		•			
Temperatu	·		`	· ·	g area	from Tal	ble 9.	Th1 (°C)				21	(85)
Utilisation	•	• .			•		,	, ,					
Ja		Mar	Apr	May	Jun	Jul	A	ug Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99		0.96	0.88	0.78	0.8		0.99	1	1		(86)
—— Mean inter	nal temper	rature in	living area	T1 /fo	llow sta	ns 3 to .	7 in T	able 0c)		1	1	1	
(87)m= 18.6		19.17		20.21	20.65	20.85	20.		19.79	19.15	18.63		(87)
` ′						<u> </u>	1	l	I	<u> </u>		I	, ,
Temperatu (88)m= 19.3		19.35		19.4	19.45	19.45	19.4		19.4	19.38	19.36		(88)
(00)111- 19.3	19.04	19.00	10.09	10.4	19.40	19.40	1 18.	19.43	13.4	19.50	19.00		(00)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)		
(89)m= 1 1 0.99 0.98 0.93 0.8 0.59 0.66 0.91 0.99 1 1		(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)		
(90)m= 16.24 16.53 17.06 17.86 18.59 19.19 19.39 19.37 18.93 18 17.05 16.28		(90)
fLA = Living area ÷ (4) =	0.17	(91)
Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2		•
(92)m= 16.65 16.92 17.42 18.18 18.87 19.44 19.64 19.62 19.19 18.31 17.41 16.69		(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate		
(93)m= 16.65 16.92 17.42 18.18 18.87 19.44 19.64 19.62 19.19 18.31 17.41 16.69		(93)
8. Space heating requirement		
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calcuthe utilisation factor for gains using Table 9a	ılate	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Utilisation factor for gains, hm:		
(94)m= 1 0.99 0.99 0.97 0.92 0.8 0.62 0.69 0.9 0.98 1 1		(94)
Useful gains, hmGm , W = (94)m x (84)m		
(95)m= 876.85 1085.3 1303.65 1524.33 1611.94 1401.04 1036.84 1039.23 1189.4 1055.56 883.73 817.84		(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]		(07)
(97)m= 5139.91 4969.51 4484.75 3680.08 2820.91 1837.37 1155.15 1212.2 1960.42 3033.89 4115.65 5056.44		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 3171.72 2610.19 2366.74 1552.14 899.47 0 0 0 1471.87 2326.98 3153.52		
Total per year (kWh/year) = Sum(98) ₁₅₉₁₂ =	17552.63	(98)
]
Space heating requirement in kWh/m²/year	84.68	(99)
9b. Energy requirements – Community heating scheme		
This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the		[(332)
includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.	s latter	
Fraction of heat from Community heat pump	1	(303a)
Fraction of heat from Community heat pump (Water)	0.8	(303a)
Fraction of community heat from heat source 2 (Water)	0.2	(303b)
Fraction of total space heat from Community heat pump (302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system	1] (305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)
Distribution loss factor (Table 12c) for community heating system (Water)	1.05	(306)
Space heating	kWh/year	1,200,
Annual space heating requirement	17552.63	1
L		I

Space heat from Community heat pump		(98) x (304a) x	(305) x (306) =	Г	18430.27	(307a)
Efficiency of secondary/supplementary heating	g system in % (from Table	e 4a or Appen	ıdix E)		0	(308
Space heating requirement from secondary/su	ipplementary system	(98) x (301) x 1	00 ÷ (308) =		0	(309)
Water heating						
Annual water heating requirement					2314.24	
If DHW from community scheme: Water heat from CHP (Water)		(64) x (303a) x	(305) x (306) =		1943.96	(310a)
Water heat from heat source 2 (Water)		(64) x (303a) x			485.99](310b)
Electricity used for heat distribution	0.01		'e) + (310a)(310e)]	<u>-</u>	184.3	」` ′ □(313)
Electricity used for heat distribution (Water)			'e) + (310a)(310e)]	느	24.3	(313)
Cooling System Energy Efficiency Ratio		. , ,	, , , , ,		0	(314)
Space cooling (if there is a fixed cooling syste	m, if not enter 0)	= (107) ÷ (314)	=		0	(315)
Electricity for pumps and fans within dwelling ((Table 4f):			_		_
mechanical ventilation - balanced, extract or p	ositive input from outside			Ļ	716.77	(330a)
warm air heating system fans				Ļ	0	(330b)
pump for solar water heating				L	0	(330g)
Total electricity for the above, kWh/year		=(330a) + (330	b) + (330g) =	L	716.77	(331)
Energy for lighting (calculated in Appendix L)					595.01	(332)
Electricity generated by PVs (Appendix M) (ne	egative quantity)			L	-576.34	(333)
Total delivered energy for all uses (307) + (309)	9) + (310) + (312) + (315)	+ (331) + (33	32)(237b) =	L	19165.7	(338)
12b. CO2 Emissions – Community heating scl		- way -	Emission factor	F.	ii	
		ergy h/year	kg CO2/kWh		CO2/year	
CO2 from other sources of space and water he Efficiency of heat source 1 (%)	eating (not CHP) If there is CHP using two fuels	s repeat (363) to	(366) for the second	fuel	280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x	100 ÷ (367b) x	0.52	=	3416.18	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	95.65	(372)
Water heating from separate community syste	em					
CO2 from other sources of space and water Efficiency of heat source 1 (%)	heating (not CHP) If there is CHP using two fuels	s repeat (363) to	(366) for the second	fuel	280	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels	s repeat (363) to	(366) for the second	fuel	100	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x	100 ÷ (367b) x	0	=	360.33	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x	100 ÷ (367b) x	0.52	=	252.23	(368)
Electrical energy for heat distribution	[(313) x		0.52	=	12.61	(372)
Total CO2 associated with community system	s (363)(36	66) + (368)(372	2)	=	4137	(373)
CO2 associated with space heating (secondar	y) (309) x		0	=	0	(374)
CO2 associated with water from immersion he	eater or instantaneous hea	ater (312) x	0.52	=	0	(375)
						_

Total CO2 associated with space and water heating (373) + (374) + (375) =(376)4137 CO2 associated with electricity for pumps and fans within dwelling (331)) x (378) 0.52 372 CO2 associated with electricity for lighting (332))) x (379)0.52 308.81 Energy saving/generation technologies (333) to (334) as applicable x 0.01 = Item 1 (380)0.52 -299.12 sum of (376)...(382) = Total CO2, kg/year 4518.69 (383) $(383) \div (4) =$ **Dwelling CO2 Emission Rate** (384)21.8 El rating (section 14) (385)76

User Details:	
Assessor Name: Chris Hocknell Stroma Number: STRO016363 Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.5	.51
Property Address: Flat-G01-GREEN	
Address :	
1. Overall dwelling dimensions:	- (3)
Ground floor	``
	(00)
220	43 (5)
2. Ventilation rate: main secondary other total m³ pe	hour
heating heating 7.40 - 1.50 -	(6a)
	(6b)
	(7a)
	(7b)
Number of flueless gas fires 0 x 40 = 0	(7c)
Air changes	er hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$ \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)
Additional infiltration [(9)-1]x0.1 = C Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	(10)
if both types of wall are present, use the value corresponding to the greater wall area (after	(11)
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	(12)
Percentage of windows and doors draught stripped	(14)
Window infiltration 0.25 - [0.2 x (14) ÷ 100] =	(15)
Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =	(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) ÷ 20]+(8), otherwise (18) = (16)	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered	(19)
Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.8$	
Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.	3 (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	

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	1	
Calculate effec		-	rate for t	he appli	cable ca	se	!	!	!	<u>I</u>			
If mechanica								. (00)	\ (00 \)			0.5	(2
If exhaust air h									o) = (23a)			0.5	(2
If balanced with												77.35	(2
a) If balance						, 	- 	´ `	, 	 	' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ') ÷ 100] ¬	(2)
24a)m= 0.28	<u> </u>	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
b) If balance				ı	1		- ^ ``	ŕ	- 			1	(0
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h	ouse extra n < 0.5 × (2			•	•				.5 × (23b)		_	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural if (22b)n	ventilation n = 1, then								0.5]			_	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change rat	te - er	nter (24a) or (24l	b) or (24	c) or (24	d) in bo	x (25)				_	
25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
3. Heat losse	s and heat	loss	paramet	er:									
LEMENT	Gross area (m	1²)	Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I	≺)	k-valu kJ/m²·		A X k kJ/K
oors					1.99	X	1	=	1.99				(2
/indows Type	: 1				1.37	_x 1	/[1/(1.4)+	0.04] =	1.82				(2
√indows Type	2				4.34	x1	/[1/(1.4)+	0.04] =	5.75				(2
√indows Type	3				5.76	_x 1	/[1/(1.4)+	0.04] =	7.64				(2
√indows Type	. 4				1.65	x1	/[1/(1.4)+	0.04] =	2.19				(2
loor					81.64	4 x	0.13	=	10.6132	<u>=</u> 2 [(2
Valls Type1	79.62		16.1	4	63.48	3 x	0.15	=	9.52	=		= =	(2
Valls Type2	53.08	=	1.99		51.09		0.15		7.66	F i		=	(2
Roof Type1	4.85	=		=	4.85	x	0.13		0.63	F i		=	(3
Roof Type2	1.55		0	=	1.55	=	0.13		0.2	-		= 	`(3
otal area of e		 1 ²			220.7	=	0.10		U. <u>L</u>				(3
arty ceiling	,				75.24	_				Г			(3
for windows and	roof windows	s. use e	effective wi	ndow U-v			n formula 1	/[(1/U-valı	ue)+0.041 a	L Is aiven in	paragrani		(
include the area							,		.,	3	7-1-3-1		
abric heat los	ss, W/K = S	6 (A x	U)				(26)(30) + (32) =				52.02	(3
	Cm = S(A)	xk)						((28).	(30) + (32	2) + (32a).	(32e) =	30206.1	(3
eat capacity	naramatar	r (TMF	= Cm +	+ TFA) iı	n kJ/m²K			Indica	ative Value	Medium		250	(3
	parameter	`											
eat capacity hermal mass or design assess an be used inste	sments where	the de		construct	tion are no	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		

	abric hea	at loss							(33) +	(36) =		I	73.53	(37)
Ventila	ition hea		alculated	d monthly	V				, ,		25)m x (5)	l	70.00	
1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	20.06	19.83	19.6	18.44	18.21	17.05	17.05	16.82	17.51	18.21	18.67	19.14		(38)
Heat tr	ansfer c	oefficier	nt, W/K	ı					(39)m	= (37) + (3	38)m			
(39)m=	93.59	93.36	93.13	91.97	91.74	90.58	90.58	90.35	91.04	91.74	92.2	92.67		
Heat Ic	oss para	meter (H	ILP). W	/m²K						Average = = (39)m ÷	Sum(39) _{1.}	12 /12=	91.91	(39)
(40)m=	1.15	1.14	1.14	1.13	1.12	1.11	1.11	1.11	1.12	1.12	1.13	1.14		
Numbe	er of day	re in mor	oth (Tah	L					ļ	Average =	Sum(40) _{1.}	12 /12=	1.13	(40)
Numbe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4 10/												130/1/		
4. VVa	iter heat	ing ener	gy requi	irement:								kWh/ye	ear:	
Assum	ned occu	nancy N	N								2	49		(42)
				[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (1	ΓFA -13.		49		(42)
	A £ 13.9				(- (, ,,	,		- /			
Annua	l averag	e hot wa	iter usaç	ge in litre	s per da	ıy Vd,av	erage =	(25 x N)	+ 36		93	.41		(43)
Reduce	the annua	l average	hot water	usage by	5% if the d	welling is	designed i	to achieve	a water us	se target o				
not more	e that 125	litres per p	person per	day (all w	ater use, h	not and co	ld)							
l	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate				<u> </u>	Vd,m = fa		_							
(44)m=	102.76	99.02	95.28	91.55	87.81	84.07	84.07	87.81	91.55	95.28	99.02	102.76		
()	102.70	00.02	00.20	01.00	07.01	01.07	01.07	07.01			m(44) ₁₁₂ =		1120.97	(44)
Energy (content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd.r	пхптхГ	Tm / 2600			· /		1120.91	()
							x x =	711117 3000	kWh/mon	ith (see Ta	ibles 1b, 1	-,,		
(45)m=	152.38	133.28	137.53	119.9	115.05	99.28	92	105.57	106.83	th (see Ta 124.5	135.9	147.58		_
(45)m=	152.38		137.53			· ·	1		106.83	124.5	· · ·	147.58	1469.77	(45)
` '		133.28		119.9	115.05	99.28	92		106.83	124.5	135.9	147.58	1469.77	(45)
If instant		133.28		119.9	115.05	99.28	92	105.57	106.83	124.5	135.9	147.58	1469.77	(45)
If instant (46)m=	taneous w	133.28 ater heatir 19.99	ng at point	119.9 of use (no	115.05 hot water	99.28 storage),	92 enter 0 in	105.57 boxes (46)	106.83 to (61)	124.5 Fotal = Su	135.9 m(45) ₁₁₂ =	147.58	1469.77	_
If instant (46)m= Water	taneous w 22.86 storage	133.28 ater heatir 19.99 loss:	ng at point 20.63	119.9 of use (no	115.05 hot water 17.26	99.28 storage),	92 enter 0 in 13.8	105.57 boxes (46)	106.83 to (61)	124.5 Fotal = Sur 18.67	135.9 m(45) ₁₁₂ = 20.38	147.58	1469.77	_
If instant (46)m= Water Storag	22.86 storage	133.28 ater heatin 19.99 loss: e (litres)	ng at point 20.63	119.9 f of use (no 17.99 ng any se	115.05 hot water 17.26	99.28 storage), 14.89	92 enter 0 in 13.8 storage	105.57 boxes (46) 15.83 within se	106.83 to (61)	124.5 Fotal = Sur 18.67	135.9 m(45) ₁₁₂ = 20.38	147.58	1469.77	(46)
If instant (46)m= Water Storag If comr	taneous w 22.86 storage e volum munity h	133.28 ater heatir 19.99 loss: e (litres) eating a	ng at point 20.63 includir nd no ta	119.9 fof use (not) 17.99 ng any so	115.05 hot water 17.26 plar or W yelling, e	99.28 storage), 14.89 /WHRS nter 110	92 enter 0 in 13.8 storage	105.57 boxes (46) 15.83 within sa (47)	106.83 1 to (61) 16.02	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38	147.58	1469.77	(46)
If instant (46)m= Water Storag If comr Otherw	taneous w 22.86 storage e volum munity h vise if no	133.28 ater heatin 19.99 loss: e (litres) eating a o stored	ng at point 20.63 includir nd no ta	119.9 fof use (not) 17.99 ng any so	115.05 hot water 17.26 plar or W yelling, e	99.28 storage), 14.89 /WHRS nter 110	92 enter 0 in 13.8 storage	105.57 boxes (46) 15.83 within se	106.83 1 to (61) 16.02	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38	147.58	1469.77	(46)
If instant (46)m= Water Storag If comr Otherw Water	22.86 storage e volum munity h	133.28 ater heatin 19.99 loss: e (litres) eating a o stored loss:	20.63 includir nd no ta	119.9 of use (not) 17.99 ng any so ank in dw er (this in	115.05 hot water 17.26 Dlar or Welling, e	99.28 storage), 14.89 /WHRS nter 110	92 enter 0 in 13.8 storage litres in	105.57 boxes (46) 15.83 within sa (47)	106.83 1 to (61) 16.02	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38	147.58 = 22.14	1469.77	(46) (47)
If instant (46)m= Water Storag If comr Otherw Water a) If m	taneous w 22.86 storage e volum munity h vise if no storage	133.28 ater heatir 19.99 loss: e (litres) eating a o stored loss: urer's de	20.63 including the transfer of the transfer o	119.9 of use (not) 17.99 ng any seank in dwer (this in oss factors)	115.05 hot water 17.26 plar or W yelling, e	99.28 storage), 14.89 /WHRS nter 110	92 enter 0 in 13.8 storage litres in	105.57 boxes (46) 15.83 within sa (47)	106.83 1 to (61) 16.02	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38	147.58 = 22.14 0	1469.77	(46) (47)
If instant (46)m= Water Storag If comr Otherw Water a) If m Tempe	storage e volum munity h vise if no storage nanufacti	133.28 ater heatin 19.99 loss: e (litres) eating a o stored loss: urer's de	including at point 20.63 including and no tath hot water eclared lem Table	119.9 fof use (not) 17.99 and any so ank in dweer (this in oss factors)	115.05 to hot water 17.26 Diar or W velling, encludes i	99.28 storage), 14.89 /WHRS nter 110	92 enter 0 in 13.8 storage litres in neous co	105.57 boxes (46) 15.83 within sa (47) ombi boile	106.83 1 to (61) 16.02 ame vess ers) ente	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38	147.58 = 22.14 0	1469.77	(46) (47) (48) (49)
If instant (46)m= Water Storag If comr Otherw Water a) If m Tempe Energy	taneous w 22.86 storage e volum munity h vise if no storage nanufacti erature fa / lost fro	133.28 ater heatin 19.99 loss: e (litres) eating a o stored loss: urer's de actor from	including at point 20.63 including nd no tage hot water a clared lem Table storage	119.9 of use (not) 17.99 ng any seank in dweer (this in oss factors) 2b	115.05 hot water 17.26 clar or Water velling, encludes in the control of the co	99.28 storage), 14.89 /WHRS nter 110 nstantar wn (kWh	92 enter 0 in 13.8 storage litres in neous co	105.57 boxes (46) 15.83 within sa (47)	106.83 1 to (61) 16.02 ame vess ers) ente	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38	147.58 = 22.14 0	1469.77	(46) (47)
If instant (46)m= Water Storag If comr Otherw Water a) If m Tempe Energy b) If m	taneous w 22.86 storage e volum munity h vise if no storage nanufact erature fa / lost fro	ater heatin 19.99 loss: e (litres) eating a o stored loss: urer's de actor from water urer's de	including at point 20.63 including at hot water eclared length of the storage eclared of th	119.9 of use (not) 17.99 ng any so nk in dw er (this in oss facto 2b e, kWh/ye	115.05 hot water 17.26 olar or W velling, encludes it or is known is kno	99.28 storage), 14.89 /WHRS nter 110 nstantar wn (kWh	92 enter 0 in 13.8 storage litres in neous con/day):	105.57 boxes (46) 15.83 within sa (47) ombi boile	106.83 1 to (61) 16.02 ame vess ers) ente	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38	22.14 0 0	1469.77	(46) (47) (48) (49) (50)
If instant (46)m= Water Storag If comm Otherw Water a) If m Tempe Energy b) If m Hot wa	taneous w 22.86 storage e volum munity h vise if no storage nanufacti erature fa y lost fro nanufacti ater stora	ater heatin 19.99 loss: e (litres) eating a o stored loss: urer's de actor from m water urer's de age loss	including at point 20.63 including at hot water the colored lems to rage eclared of factor from the colored factor from the co	119.9 of use (not) 17.99 ng any so ank in dw er (this in oss facto 2b c, kWh/yo cylinder com Tabi	115.05 hot water 17.26 clar or Water velling, encludes in the control of the co	99.28 storage), 14.89 /WHRS nter 110 nstantar wn (kWh	92 enter 0 in 13.8 storage litres in neous con/day):	105.57 boxes (46) 15.83 within sa (47) ombi boile	106.83 1 to (61) 16.02 ame vess ers) ente	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38	147.58 = 22.14 0	1469.77	(46) (47) (48) (49)
If instant (46)m= Water Storag If comr Otherw Water a) If m Tempe Energy b) If m Hot wa If comr	taneous w 22.86 storage e volum munity h vise if no storage nanufact erature fa / lost fro	ater heatin 19.99 loss: e (litres) eating a o stored loss: urer's de actor froi m water urer's de age loss eating s	including at point 20.63 including and no tage the colored least of the colored color	119.9 of use (not) 17.99 ng any so ank in dw er (this in oss facto 2b c, kWh/yo cylinder com Tabi	115.05 hot water 17.26 olar or W velling, encludes it or is known is kno	99.28 storage), 14.89 /WHRS nter 110 nstantar wn (kWh	92 enter 0 in 13.8 storage litres in neous con/day):	105.57 boxes (46) 15.83 within sa (47) ombi boile	106.83 1 to (61) 16.02 ame vess ers) ente	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38 47)	147.58 = 22.14	1469.77	(46) (47) (48) (49) (50) (51)
If instant (46)m= Water Storag If comr Otherw Water a) If m Tempe Energy b) If m Hot wa If comr	taneous w 22.86 storage e volum munity h vise if no storage nanufacti erature fa / lost fro nanufacti ater stora munity h e factor	ater heatin 19.99 loss: e (litres) eating a o stored loss: urer's de actor from water urer's de age loss eating s from Tal	includir nd no ta hot wate eclared la m Table storage eclared of factor fr ee section	119.9 of use (not) 17.99 ng any so ank in dwer (this in oss factors) 2b c, kWh/yo cylinder from Tablon 4.3	115.05 hot water 17.26 olar or W velling, encludes it or is known is kno	99.28 storage), 14.89 /WHRS nter 110 nstantar wn (kWh	92 enter 0 in 13.8 storage litres in neous con/day):	105.57 boxes (46) 15.83 within sa (47) ombi boile	106.83 1 to (61) 16.02 ame vess ers) ente	124.5 Total = Sui 18.67	135.9 m(45) ₁₁₂ = 20.38 47)	147.58 = 22.14	1469.77	(46) (47) (48) (49) (50) (51) (52)
If instant (46)m= Water Storag If comr Otherw Water a) If m Tempe Energy b) If m Hot wa If comr Volume Tempe	storage e volum munity h vise if no storage nanufact rature fa to lost fro nanufact ater stora munity h e factor erature fa	ater heatin 19.99 loss: e (litres) eating a o stored loss: urer's de actor froi urer's de age loss eating s from Tal actor froi	including at point 20.63 including and no tale to the eclared of	119.9 of use (not) 17.99 ng any so ank in dwer (this in oss factors) 2b c, kWh/yo cylinder from Table on 4.3	115.05 hot water 17.26 clar or Water velling, encludes in the control of the	99.28 storage), 14.89 /WHRS nter 110 nstantar wn (kWh	92 enter 0 in 13.8 storage litres in neous co	105.57 boxes (46) 15.83 within sa (47) ombi boild (48) x (49)	106.83 0 to (61) 16.02 ame vess ers) ente	124.5 Total = Sul 18.67 sel er '0' in (135.9 m(45) ₁₁₂ = 20.38 47)	147.58 = 22.14	1469.77	(46) (47) (48) (49) (50) (51) (52) (53)
If instant (46)m= Water Storag If commotherw Water a) If m Tempe Energy b) If m Hot wa If commotherw Volume Tempe Energy	taneous w 22.86 storage e volum munity h vise if no storage nanufacti erature fa / lost fro nanufacti ater stora munity h e factor	ater heatin 19.99 loss: e (litres) eating a o stored loss: urer's de actor from water urer's de age loss eating s from Tal actor from m water	includir nd no ta hot wate storage eclared of factor fr ee section ble 2a m Table storage	119.9 of use (not) 17.99 ng any so ank in dwer (this in oss factors) 2b c, kWh/yo cylinder from Table on 4.3	115.05 hot water 17.26 clar or Water velling, encludes in the control of the	99.28 storage), 14.89 /WHRS nter 110 nstantar wn (kWh	92 enter 0 in 13.8 storage litres in neous co	105.57 boxes (46) 15.83 within sa (47) ombi boile	106.83 0 to (61) 16.02 ame vess ers) ente	124.5 Total = Sul 18.67 sel er '0' in (135.9 m(45) ₁₁₂ = 20.38 20.38 47)	147.58 = 22.14	1469.77	(46) (47) (48) (49) (50) (51) (52)

Water storage	loss cal	culated 1	for each	month			((56)m = (55) × (41)ı	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circui	t loss (ar	nnual) fro	m Table	3							0		(58)
Primary circui	t loss cal	culated t	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(modified by	/ factor f	rom Tab	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss ca	lculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat req	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 207.66	183.2	192.81	173.39	170.32	152.77	147.27	160.84	160.32	179.77	189.39	202.85		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	ion to wate	er heating)		
(add additiona	al lines if	FGHRS	and/or V	WHRS	applies	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from w	ater hea	ter			•	•				•	•		
(64)m= 207.66	183.2	192.81	173.39	170.32	152.77	147.27	160.84	160.32	179.77	189.39	202.85		
	I				<u> </u>	<u> </u>	Outp	out from wa	ater heate	ı r (annual)₁	12	2120.61	(64)
Heat gains fro	m water	heating.	kWh/mo	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n1 + 0.8 x	([(46)m	+ (57)m	+ (59)m	1	-
(65)m= 94.89	84.26	89.95	82.66	82.47	75.8	<u> </u>		_		<u> </u>	<u> </u>		(GE)
		00.00	02.00	02.47	10.0	74.81	79.32	78.31	85.62	87.98	93.29		(65)
include (57)	m in cal				<u> </u>	l .		<u> </u>				eating	(65)
include (57)		culation o	of (65)m	only if c	<u> </u>	l .		<u> </u>				eating	(65)
5. Internal g	ains (see	culation of Table 5	of (65)m and 5a	only if c	<u> </u>	l .		<u> </u>				eating	(65)
5. Internal g	ains (see	culation of Table 5	of (65)m and 5a	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	rom com	munity h	eating	(65)
5. Internal g Metabolic gain	ains (see	culation of Table 5 5), Wat	of (65)m and 5a ts Apr	only if c	ylinder is Jun	s in the d	dwelling Aug	or hot w	ater is fr Oct	om com	munity h	eating	
5. Internal g Metabolic gain Jan (66)m= 124.66	ains (see ns (Table Feb 124.66	e Table 5 e 5), Wat Mar	of (65)m 5 and 5a ts Apr 124.66	only if constant of the consta	ylinder i: Jun 124.66	Jul	Aug 124.66	or hot w	ater is fr	rom com	munity h	eating	(66)
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains	ains (see ns (Table Feb 124.66 (calcula	culation of Table 5 (a) Wat Mar 124.66 (b)	of (65)m and 5a ts Apr 124.66	only if constant of the consta	Jun 124.66	Jul 124.66 r L9a), a	Aug 124.66	Sep 124.66 Table 5	Oct	Nov	Dec	eating	(66)
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86	res (Table Feb 124.66 (calcula	Example 5 ted in April 14.35	of (65)m 6 and 5a ts Apr 124.66 ppendix 10.86	May 124.66 L, equati 8.12	Jun 124.66 ion L9 o	Jul 124.66 r L9a), a	Aug 124.66 Iso see	Sep 124.66 Table 5	Oct 124.66	om com	munity h	eating	
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga	ns (Table Feb 124.66 (calcula 17.64	culation of Table 5 2 5), Wat Mar 124.66 ted in Ap 14.35	of (65)m and 5a ts Apr 124.66 ppendix 10.86	May 124.66 L, equati 8.12 dix L, eq	Jun 124.66 ion L9 of 6.85 uation L	Jul 124.66 r L9a), a 7.41 13 or L1	Aug 124.66 Iso see 9.63 3a), also	Sep 124.66 Table 5 12.92 see Tal	Oct 124.66	Nov 124.66	Dec 124.66	eating	(66) (67)
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83	res (Table Feb 124.66 (calcula 17.64 tins (calcula 225.15	culation of Table 5 (a) Wat Mar 124.66 (b) ted in Ap 14.35 (c) culated in 219.32	of (65)m and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91	only if construction in the construction in th	Jun 124.66 ion L9 o 6.85 uation L	Jul 124.66 r L9a), a 7.41 13 or L1 166.71	Aug 124.66 Iso see 9.63 3a), also	Sep 124.66 Table 5 12.92 see Ta	Oct 124.66 16.41 ble 5 182.63	Nov	Dec	eating	(66)
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83 Cooking gains	res (Table Feb 124.66 (calcula 17.64 tins (calcula 225.15 (calcula cal	culation of Table 5 (a) Wat Mar 124.66 ted in Ap 14.35 culated in 219.32 ated in Ap	of (65)m and 5a ts Apr 124.66 ppendix 10.86 Append 206.91 ppendix	May 124.66 L, equati 8.12 dix L, equati 191.26 L, equat	Jun 124.66 ion L9 of 6.85 uation L 176.54	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a	Aug 124.66 Iso see 9.63 3a), also 164.39	Sep 124.66 Table 5 12.92 see Table 170.22	Oct 124.66 16.41 ble 5 182.63	Nov 124.66	Dec 124.66 20.41	eating	(66) (67) (68)
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83	res (Table Feb 124.66 (calcula 17.64 tins (calcula 225.15	culation of Table 5 (a) Wat Mar 124.66 (b) ted in Ap 14.35 (c) culated in 219.32	of (65)m and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91	only if construction in the construction in th	Jun 124.66 ion L9 o 6.85 uation L	Jul 124.66 r L9a), a 7.41 13 or L1 166.71	Aug 124.66 Iso see 9.63 3a), also	Sep 124.66 Table 5 12.92 see Ta	Oct 124.66 16.41 ble 5 182.63	Nov 124.66	Dec 124.66	eating	(66) (67)
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83 Cooking gains	res (Table Feb 124.66 (calcula 17.64 tins (calcula 225.15 (calcula 35.47	culation of Table 5 2 5), Wat Mar 124.66 ted in Ap 14.35 culated in 219.32 ated in A 35.47	of (65)m s and 5a ts Apr 124.66 ppendix 10.86 Append 206.91 ppendix 35.47	May 124.66 L, equati 8.12 dix L, equati 191.26 L, equat	Jun 124.66 ion L9 of 6.85 uation L 176.54	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a	Aug 124.66 Iso see 9.63 3a), also 164.39	Sep 124.66 Table 5 12.92 see Table 170.22	Oct 124.66 16.41 ble 5 182.63	Nov 124.66 19.15	Dec 124.66 20.41	eating	(66) (67) (68)
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83 Cooking gains (69)m= 35.47	res (Table Feb 124.66 (calcula 17.64 tins (calcula 225.15 (calcula 35.47	culation of Table 5 2 5), Wat Mar 124.66 ted in Ap 14.35 culated in 219.32 ated in A 35.47	of (65)m s and 5a ts Apr 124.66 ppendix 10.86 Append 206.91 ppendix 35.47	May 124.66 L, equati 8.12 dix L, equati 191.26 L, equat	Jun 124.66 ion L9 of 6.85 uation L 176.54	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a	Aug 124.66 Iso see 9.63 3a), also 164.39	Sep 124.66 Table 5 12.92 see Table 170.22	Oct 124.66 16.41 ble 5 182.63	Nov 124.66 19.15	Dec 124.66 20.41	eating	(66) (67) (68)
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83 Cooking gains (69)m= 35.47 Pumps and fa	res (Table Feb 124.66 (calcula 17.64 ins (calcula 225.15 calcula 35.47 rs gains 0	culation of the ted in April 219.32 atted in	of (65)m and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47 5a) 0	only if controls: May 124.66 L, equati 8.12 dix L, equati 191.26 L, equati 35.47	Jun 124.66 ion L9 of 6.85 uation L 176.54 tion L15 35.47	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a)	Aug 124.66 Iso see 9.63 3a), also 164.39), also se 35.47	Sep 124.66 Table 5 12.92 see Ta 170.22 ee Table 35.47	Oct 124.66 16.41 ble 5 182.63 5 35.47	Nov 124.66 19.15 198.28	Dec 124.66 20.41 213 35.47	eating	(66) (67) (68) (69)
Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances gains (68)m= 222.83 Cooking gains (69)m= 35.47 Pumps and fains (70)m= 0	res (Table Feb 124.66 (calcula 17.64 ins (calcula 225.15 calcula 35.47 rs gains 0	culation of the ted in April 219.32 atted in	of (65)m and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47 5a) 0	only if controls: May 124.66 L, equati 8.12 dix L, equati 191.26 L, equati 35.47	Jun 124.66 ion L9 of 6.85 uation L 176.54 tion L15 35.47	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a)	Aug 124.66 Iso see 9.63 3a), also 164.39), also se 35.47	Sep 124.66 Table 5 12.92 see Ta 170.22 ee Table 35.47	Oct 124.66 16.41 ble 5 182.63 5 35.47	Nov 124.66 19.15 198.28	Dec 124.66 20.41 213 35.47	eating	(66) (67) (68) (69)
Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83 Cooking gains (69)m= 35.47 Pumps and fa (70)m= 0 Losses e.g. e	res (Table Feb 124.66 (calcula 17.64 ins (calcula 35.47 res gains 0 vaporatio -99.73	culation of the Table 5 2 5), Wat Mar 124.66 ted in Ap 14.35 culated in 219.32 ated in Ap 35.47 (Table 5 0 on (negation) on (negation) culated in Ap 14.35	of (65)m s and 5a ts Apr 124.66 ppendix 10.86 Append 206.91 ppendix 35.47 5a) 0 tive valu	only if construction only if c	Jun 124.66 ion L9 of 6.85 uation L 176.54 ion L15 35.47	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a) 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39 0, also se 35.47	Sep 124.66 Table 5 12.92 see Tal 170.22 ee Table 35.47	Oct 124.66 16.41 ble 5 182.63 5 35.47	Nov 124.66 19.15 198.28	Dec 124.66 20.41 213	eating	(66) (67) (68) (69) (70)
5. Internal g Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83 Cooking gains (69)m= 35.47 Pumps and fa (70)m= 0 Losses e.g. et (71)m= -99.73	res (Table Feb 124.66 (calcula 17.64 tins (calcula 35.47 ns gains 0 reportion 99.73 gains (Table Feb 124.66 (calcula 17.64 tins (calcula 18.47 tins gains (Table Feb 124.66 tins (calcula 18.47 tins gains (Table Feb 124.66 tins (calcula 18.47 tins gains (Table Feb 124.66 tins	culation of the Table 5 2 5), Wat Mar 124.66 ted in Ap 14.35 culated in 219.32 ated in Ap 35.47 (Table 5 0 on (negation) on (negation) culated in Ap 14.35	of (65)m s and 5a ts Apr 124.66 ppendix 10.86 Append 206.91 ppendix 35.47 5a) 0 tive valu	only if construction only if c	Jun 124.66 ion L9 of 6.85 uation L 176.54 ion L15 35.47	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a) 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39 0, also se 35.47	Sep 124.66 Table 5 12.92 see Tal 170.22 ee Table 35.47	Oct 124.66 16.41 ble 5 182.63 5 35.47	Nov 124.66 19.15 198.28	Dec 124.66 20.41 213	eating	(66) (67) (68) (69) (70)
Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83 Cooking gains (69)m= 35.47 Pumps and fa (70)m= 0 Losses e.g. et (71)m= -99.73 Water heating	res (Table Feb 124.66 (calcula 17.64 lins (calcula 35.47 res gains 0 response of the properties of the	culation of Earlie Solution of Earlie Solution of Earlie Solution of Earlie Solution of Earlie Solution of Earlie Solution (negative solution) and the Earlie Solution of Earlie Solution (negative solution) and the Earlie Solution of Earlie Solution (negative solution) and the Earlie Solution of Earlie Earlie Solution of Earlie Earlie Solution of Earlie	of (65)m c and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47 5a) 0 tive valu -99.73	only if construction only if c	Jun 124.66 ion L9 of 6.85 uation L 176.54 ion L15 35.47 0 le 5) -99.73	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a) 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39 0, also se 35.47 0	Sep 124.66 Table 5 12.92 See Tal 170.22 ee Table 35.47 0	Oct 124.66 16.41 ble 5 182.63 5 35.47 0 -99.73	Nov 124.66 19.15 198.28 35.47 0	Dec 124.66 20.41 213 35.47 0 -99.73	eating	(66) (67) (68) (69) (70) (71)
Metabolic gain Jan (66)m= 124.66 Lighting gains (67)m= 19.86 Appliances ga (68)m= 222.83 Cooking gains (69)m= 35.47 Pumps and fa (70)m= 0 Losses e.g. et (71)m= -99.73 Water heating (72)m= 127.54	res (Table Feb 124.66 (calcula 17.64 lins (calcula 35.47 res gains 0 response of the properties of the	culation of Earlie Solution of Earlie Solution of Earlie Solution of Earlie Solution of Earlie Solution of Earlie Solution (negative solution) and the Earlie Solution of Earlie Solution (negative solution) and the Earlie Solution of Earlie Solution (negative solution) and the Earlie Solution of Earlie Earlie Solution of Earlie Earlie Solution of Earlie	of (65)m c and 5a ts Apr 124.66 ppendix 10.86 Appendix 206.91 ppendix 35.47 5a) 0 tive valu -99.73	only if construction only if c	Jun 124.66 ion L9 of 6.85 uation L 176.54 ion L15 35.47 0 le 5) -99.73	Jul 124.66 r L9a), a 7.41 13 or L1 166.71 or L15a) 35.47	Aug 124.66 Iso see 9.63 3a), also 164.39 0, also se 35.47 0	Sep 124.66 Table 5 12.92 See Tai 170.22 See Table 35.47 0 -99.73	Oct 124.66 16.41 ble 5 182.63 5 35.47 0 -99.73	Nov 124.66 19.15 198.28 35.47 0	Dec 124.66 20.41 213 35.47 0 -99.73	eating	(66) (67) (68) (69) (70) (71)

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	X	1.65	x	11.28	x	0.55	x	0.8] =	11.35	(75)
Northeast 0.9x	0.77	x	1.65	x	22.97	x	0.55	x	0.8	=	23.11	(75)
Northeast 0.9x	0.77	x	1.65	x	41.38	x	0.55	x	0.8	=	41.64	(75)
Northeast _{0.9x}	0.77	x	1.65	x	67.96	x	0.55	x	0.8	=	68.38	(75)
Northeast 0.9x	0.77	x	1.65	x	91.35	x	0.55	x	0.8	=	91.92	(75)
Northeast 0.9x	0.77	x	1.65	x	97.38	x	0.55	x	0.8	=	97.99	(75)
Northeast 0.9x	0.77	x	1.65	x	91.1	x	0.55	x	0.8	=	91.67	(75)
Northeast 0.9x	0.77	X	1.65	x	72.63	x	0.55	X	0.8	=	73.08	(75)
Northeast _{0.9x}	0.77	x	1.65	x	50.42	x	0.55	x	0.8	=	50.74	(75)
Northeast 0.9x	0.77	x	1.65	x	28.07	x	0.55	x	0.8	=	28.24	(75)
Northeast 0.9x	0.77	X	1.65	x	14.2	X	0.55	X	0.8	=	14.29	(75)
Northeast _{0.9x}	0.77	x	1.65	x	9.21	x	0.55	x	0.8	=	9.27	(75)
Southeast 0.9x	0.77	x	5.76	x	36.79	x	0.55	X	0.8	=	64.62	(77)
Southeast 0.9x	0.77	x	5.76	x	62.67	x	0.55	x	0.8	=	110.08	(77)
Southeast 0.9x	0.77	x	5.76	x	85.75	x	0.55	X	0.8	=	150.61	(77)
Southeast 0.9x	0.77	X	5.76	x	106.25	x	0.55	X	0.8	=	186.61	(77)
Southeast 0.9x	0.77	X	5.76	x	119.01	x	0.55	X	0.8	=	209.02	(77)
Southeast 0.9x	0.77	x	5.76	x	118.15	x	0.55	x	0.8	=	207.51	(77)
Southeast 0.9x	0.77	X	5.76	x	113.91	x	0.55	X	0.8	=	200.06	(77)
Southeast 0.9x	0.77	X	5.76	x	104.39	x	0.55	X	0.8	=	183.35	(77)
Southeast 0.9x	0.77	X	5.76	x	92.85	x	0.55	X	0.8	=	163.08	(77)
Southeast 0.9x	0.77	x	5.76	x	69.27	x	0.55	X	0.8	=	121.66	(77)
Southeast 0.9x	0.77	x	5.76	x	44.07	x	0.55	x	0.8	=	77.4	(77)
Southeast 0.9x	0.77	x	5.76	x	31.49	x	0.55	x	0.8	=	55.3	(77)
Southwest _{0.9x}	0.77	x	1.37	x	36.79]	0.55	x	0.8	=	30.74	(79)
Southwest _{0.9x}	0.77	X	4.34	x	36.79]	0.55	X	0.8	=	48.69	(79)
Southwest _{0.9x}	0.77	x	1.37	x	62.67]	0.55	x	0.8	=	52.36	(79)
Southwest _{0.9x}	0.77	X	4.34	x	62.67]	0.55	X	0.8	=	82.94	(79)
Southwest _{0.9x}	0.77	X	1.37	x	85.75]	0.55	X	0.8	=	71.64	(79)
Southwest _{0.9x}	0.77	X	4.34	x	85.75]	0.55	X	0.8	=	113.48	(79)
Southwest _{0.9x}	0.77	x	1.37	x	106.25]	0.55	x	0.8	=	88.77	(79)
Southwest _{0.9x}	0.77	x	4.34	x	106.25]	0.55	x	0.8	=	140.61	(79)
Southwest _{0.9x}	0.77	x	1.37	x	119.01]	0.55	X	0.8	=	99.43	(79)
Southwest _{0.9x}	0.77	x	4.34	x	119.01]	0.55	X	0.8	=	157.49	(79)
Southwest _{0.9x}	0.77	X	1.37	x	118.15]	0.55	X	0.8	=	98.71	(79)
Southwest _{0.9x}	0.77	X	4.34	x	118.15]	0.55	x	0.8] =	156.35	(79)
Southwest _{0.9x}	0.77	X	1.37	x	113.91]	0.55	x	0.8] =	95.17	(79)
Southwest _{0.9x}	0.77	X	4.34	x	113.91]	0.55	x	0.8] =	150.74	(79)
Southwest _{0.9x}	0.77	X	1.37	x	104.39]	0.55	x	0.8] =	87.22	(79)

Southwes	t _{0.9x} 0.77	X	4.3	34	X	10	04.39			0.55	X	8.0	=	138.15	(79)
Southwes	t _{0.9x} 0.77	X	1.3	37	X	9	2.85]		0.55	x [0.8	=	77.58	(79)
Southwes	t _{0.9x} 0.77	X	4.3	34	x	9	2.85]		0.55	x [0.8	=	122.88	(79)
Southwes	t _{0.9x} 0.77	X	1.3	37	x	6	9.27]		0.55	x [0.8	=	57.87	(79)
Southwes	t _{0.9x} 0.77	Х	4.3	34	x	6	9.27]		0.55	x [0.8	=	91.67	(79)
Southwes	t _{0.9x} 0.77	X	1.3	37	x	4	4.07]		0.55	x	0.8	=	36.82	(79)
Southwes	t _{0.9x} 0.77	X	4.3	34	x	4	4.07]		0.55	x [0.8	=	58.32	(79)
Southwes	t _{0.9x} 0.77	X	1.3	37	x	3	1.49]		0.55	x [0.8	=	26.31	(79)
Southwes	t _{0.9x} 0.77	X	4.3	34	x	3	1.49]		0.55	x	0.8	=	41.67	(79)
Solar gai	ns in watts, c	alculated	for eac	h month				(83)m	= Su	um(74)m .	(82)m				
(83)m= 1	55.41 268.49	377.37	484.37	557.86	56	30.57	537.64	481.	.79	414.27	299.44	186.83	132.55		(83)
Total gair	ns – internal a	and solar	(84)m =	= (73)m	+ (8	33)m	, watts		•			•		_	
(84)m= 5	86.04 697.06	792.34	877.36	928.49	90	09.65	872.71	822.	.82	766.58	673.94	586.86	551.76		(84)
7. Mean	internal temp	perature	(heating	season)										
	ature during h		`		′	area 1	from Tab	ole 9.	. Th′	1 (°C)				21	(85)
•	on factor for g	٠.			•			,	,	. (-)					`
	Jan Feb	Mar	Apr	May	È	Jun	Jul	Aı	ug	Sep	Oct	Nov	Dec	7	
(86)m=	1 0.99	0.97	0.92	0.8	\vdash	0.61	0.45	0.5	- 	0.74	0.94	0.99	1	╡	(86)
L Mean in	ternal temper	ature in	livina ar	 aa T1 /f/	مالد	w sta	ne 3 to 7	in T	ahle	96)		1	l	_	
_	19.87 20.06	20.33	20.64	20.87	_	0.97	21	20.9	$\overline{}$	20.93	20.63	20.19	19.84	٦	(87)
		<u> </u>		<u> </u>				<u> </u>				1 -00	1 .0.0 .	_	(-)
· —	ature during h			1	_				$\overline{}$	<u> </u>		1		7	(00)
(88)m= 1	19.96 19.97	19.97	19.98	19.98	1	9.99	19.99	20	0	19.99	19.98	19.98	19.97		(88)
Utilisatio	on factor for g	ains for ı	rest of d	welling,	h2,	m (se	e Table	9a)						_	
(89)m=	0.99 0.99	0.96	0.89	0.74	(0.53	0.35	0.3	39	0.66	0.92	0.99	1		(89)
Mean in	ternal temper	ature in	the rest	of dwell	ing	T2 (f	ollow ste	eps 3	to 7	' in Tabl	e 9c)				
_	18.47 18.75	19.14	19.58	19.86	·	9.98	19.99	19.9		19.94	19.57	18.95	18.43	7	(90)
	!	!		l .						f	LA = Livi	ng area ÷ (4	4) =	0.34	(91)
N.4	4		41			\	ΛΤ4	. /4		A) TO					
	ternal temper			î .							40.00	10.07	100	٦	(02)
` ′	18.94 19.19	19.54	19.94	20.2		0.31	20.33	20.3		20.27	19.93	19.37	18.9	_	(92)
	djustment to t			· ·	_				_		_	1 40 07	100	٦	(02)
` '	18.94 19.19	19.54	19.94	20.2	2	0.31	20.33	20.3	33	20.27	19.93	19.37	18.9		(93)
	e heating req						44 5		0.1			(7 0)			
	o the mean in sation factor fo				ned	at ste	ep 11 of	labi	e 9b), so tha	t II,m=	(76)m an	d re-ca	culate	
	Jan Feb	Mar	Apr	May		Jun	Jul	Aı	ug	Sep	Oct	Nov	Dec	٦	
<u> </u>	on factor for g			Iviay	_	oun	- Gai		<u> </u>	ООР	000	1101		_	
_	0.99 0.98	0.96	0.89	0.76		0.56	0.39	0.4	13	0.69	0.92	0.98	0.99	٦	(94)
` ′	ains, hmGm								!				<u> </u>	_	
	81.37 684.25	757.98	781.54	702.05	50	05.01	336.24	352.	.37	526.48	619.1	576.72	548.41	7	(95)
	average exte	rnal tem	perature	e from T	u abl	e 8	I	· · · ·			I	1	I	_	•
	4.3 4.9	6.5	8.9	11.7	_	14.6	16.6	16.	.4	14.1	10.6	7.1	4.2	7	(96)
	ss rate for me				Ц_							1	<u> </u>	_	•
_	370.58 1334.34				1	17.45	337.78	354.	′ 	562.08	855.92	1130.91	1362.59		(97)
· <u></u>	· · · · · ·				_				!			1		_	

Space heating requirement for each month, kWh/month = 0.024	4 x [(97)m – (9	5)m] x (4	1)m		
(98)m= 587.17 436.86 339.45 168.18 57.98 0 0	0	0	176.19	399.02 605.74		
	Tota	al per year	r (kWh/yea	r) = Sum(98) _{15,912} =	2770.59	(98)
Space heating requirement in kWh/m²/year					33.94	(99)
9b. Energy requirements – Community heating scheme						
This part is used for space heating, space cooling or water heating. Fraction of space heat from secondary/supplementary heating (T				unity scheme.	0	(301)
Fraction of space heat from community system 1 – (301) =		,		[1	(302)
The community scheme may obtain heat from several sources. The procedure a	llows for	CHP and	up to four	ا other heat sources; th	ne latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. S Fraction of heat from Community heat pump	See Appe	ndix C.		ſ		(303a)
Fraction of heat from Community heat pump (Water)				[[1	╡`
, , , ,				[[0.8	(303a)
Fraction of community heat from heat source 2 (Water)			(0	(202-) -	0.2	(303b)
Fraction of total space heat from Community heat pump			,	02) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for commun	•	ating sys	stem	[-	1	(305)
Distribution loss factor (Table 12c) for community heating system		,		[1.05	(306)
Distribution loss factor (Table 12c) for community heating system	n (Wate	er)			1.05	(306)
Space heating Annual space heating requirement				[kWh/yea 2770.59	r
Space heat from Community heat pump		(98) x (3	304a) x (30	5) x (306) =	2909.12	(307a)
Efficiency of secondary/supplementary heating system in % (from	m Table	e 4a or <i>I</i>	Appendix	E)	0	(308
Space heating requirement from secondary/supplementary systematics	em	(98) x (3	301) x 100	÷ (308) =	0	(309)
Water heating				ſ	0400.04	_
Annual water heating requirement If DHW from community scheme:					2120.61	
Water heat from CHP (Water)		(64) x (3	303a) x (30	5) x (306) =	1781.32	(310a)
Water heat from heat source 2 (Water)		(64) x (3	303a) x (30	5) x (306) =	445.33	(310b)
Electricity used for heat distribution	0.01	× [(307a)(307e) +	- (310a)(310e)] =	29.09	(313)
Electricity used for heat distribution (Water)	0.01	× [(307a)(307e) +	- (310a)(310e)] =	22.27	(313)
Cooling System Energy Efficiency Ratio					0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)		= (107)	÷ (314) =		0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from o	outside			[295.81	(330a)
warm air heating system fans					0	(330b)
pump for solar water heating				[0	(330g)
Total electricity for the above, kWh/year		=(330a)	+ (330b) +	(330g) =	295.81	(331)
			,	(0009)	200.01	(00.)

Electricity generated by PVs (Appendix M) (negative quantity) (333)-576.34 Total delivered energy for all uses (307) + (309) + (310) + (312) + (315) + (331) + (332)...(237b) =2979.37 (338)12b. CO2 Emissions – Community heating scheme Energy **Emission factor Emissions** kWh/year kg CO2/kWh kg CO2/year CO2 from other sources of space and water heating (not CHP) If there is CHP using two fuels repeat (363) to (366) for the second fuel Efficiency of heat source 1 (%) (367a) 280 CO2 associated with heat source 1 $[(307b)+(310b)] \times 100 \div (367b) \times$ (367)0.52 539.23 Electrical energy for heat distribution [(313) x](372)0.52 15.1 Water heating from separate community system CO2 from other sources of space and water heating (not CHP) If there is CHP using two fuels repeat (363) to (366) for the second fuel Efficiency of heat source 1 (%) 280 (367a) Efficiency of heat source 2 (%) If there is CHP using two fuels repeat (363) to (366) for the second fuel (367b) 100 CO2 associated with heat source 1 $[(307b)+(310b)] \times 100 \div (367b) \times$ (367)0 330.18 CO2 associated with heat source 2 $[(307b)+(310b)] \times 100 \div (367b) \times$ (368)0.52 231.13 Electrical energy for heat distribution [(313) x](372)0.52 11.56 Total CO2 associated with community systems (363)...(366) + (368)...(372)1127.19 (373)CO2 associated with space heating (secondary) (309) x (374)0 CO2 associated with water from immersion heater or instantaneous heater (312) x 0.52 (375)0 Total CO2 associated with space and water heating (373) + (374) + (375) =(376)1127.19 CO2 associated with electricity for pumps and fans within dwelling (331)) x (378)0.52 153.53 CO2 associated with electricity for lighting (332))) x (379)0.52 182.05 Energy saving/generation technologies (333) to (334) as applicable x 0.01 =Item 1 (380)0.52 -299.12 sum of (376)...(382) = Total CO2, kg/year (383)1163.64 $(383) \div (4) =$ **Dwelling CO2 Emission Rate** (384)14.25

El rating (section 14)

(385)

87.69

User Details:												
Assessor Name: Chris Hocknell Stroma Number: STRO0	16363											
	: 1.0.5.51											
Property Address: Flat-101-GREEN												
Address:												
1. Overall dwelling dimensions:												
Area(m²) Av. Height(m) Ground floor 79.31 $(1a)$ x 2.63 $(2a)$ =	Volume(m³) 208.59 (3a)											
	208.59											
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ [4]												
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$	208.59 (5)											
2. Ventilation rate: main secondary other total	m³ per hour											
heating heating												
Number of Griffing's	0 (6a)											
Number of open flues $0 + 0 + 0 = 0 \times 20 =$	0 (6b)											
Number of intermittent fans 0 × 10 =	0 (7a)											
Number of passive vents 0 x 10 =	0 (7b)											
Number of flueless gas fires 0 × 40 =	0 (7c)											
Air changes per hour												
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$ $\div (5) = 0$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)	0 (8)											
Number of storeys in the dwelling (ns)	0 (9)											
Additional infiltration [(9)-1]x0.1 =	0 (10)											
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)											
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35												
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)											
If no draught lobby, enter 0.05, else enter 0	0 (13)											
Percentage of windows and doors draught stripped	0 (14)											
Window infiltration 0.25 - [0.2 x (14) ÷ 100] =	0 (15)											
Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =	0 (16)											
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)											
If based on air permeability value, then (18) = [(17) ÷ 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 (19)											
Shelter factor (20) = 1 - [0.075 x (19)] =	0.85 (20)											
Infiltration rate incorporating shelter factor (21) = (18) x (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		•				<u> </u>	` ´	`				1	
0.16 Calculate effec	0.16	0.16	0.14	0.14 he appli	0.12 icable ca	0.12	0.12	0.13	0.14	0.14	0.15	J	
If mechanica		_	ale ioi li	ic appii	cable ca	30						0.5	(23
If exhaust air he	at pump u	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat reco	very: effic	iency in %	allowing	for in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mecha	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
(24a)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(24
b) If balance	d mecha	anical ve	entilation	without	heat red	overy (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 ho				•	•								
if (22b)m	-		· ` ·	, ,	í –	· ` `	ŕ		· ` ·	<u> </u>	T .	1	(0.4
(24c)m= 0	0	0		0	0	0	0	0	0	0	0		(24
d) If natural v if (22b)m					•				0.51				
(24d)m= 0	0	0	0	0	0	0	0	0	0.01	0	0	1	(24
Effective air	l change	rate - er	nter (24a	or (24)	b) or (24	c) or (24	d) in bo	(25)				1	
(25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26]	(25
									ı			J	
3. Heat losses	and ne Gros	•			Net Ar	200	U-val	10	AXU		k-value		λΧk
ELEMENT	area		Openin m		A,r		W/m2		(W/F	<)	kJ/m ² ·		J/K
Doors					1.99	х	1	=	1.99				(26
Windows Type	1				1.37	x1.	/[1/(1.4)+	0.04] =	1.82				(27
Nindows Type	2				0.9	x1.	/[1/(1.4)+	0.04] =	1.19				(27
Nindows Type	3				5.81	x1.	/[1/(1.4)+	0.04] =	7.7				(27
Windows Type	4				4.37	x1.	/[1/(1.4)+	0.04] =	5.79				(27
Nindows Type	5				4.16	x1.	/[1/(1.4)+	0.04] =	5.52				(27
Rooflights					3.0641	14 x1	/[1/(1.4) +	0.04] =	4.28979	6			(27
Floor					55.4	x	0.13	= i	7.202	₹ ſ			(28
Nalls Type1	70.8	4	17.98	3	52.86	5 x	0.15	<u> </u>	7.93	F i		7 <u> </u>	(29
Nalls Type2	27.9	1	1.99		25.92	2 x	0.15	-	3.89	=		7 F	(29
Roof Type1	5.84	1	3.06		2.78	x	0.13	-	0.36	=		i i	(30
Roof Type2	0.17	7	0		0.17	x	0.13	=	0.02	F i		-	(30
Γotal area of el					160.1	6							`` ``
Party wall	,				17.81	=	0		0	— [7	(32
Party floor					23.91	_				'		-	(32
Party ceiling					70.27	=						╡	(3)
for windows and it include the area					alue calcul		formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	1 3.2	(04
					· · ·		(26)(30)) + (32) =				49.29	(3:
abric heat los	S, VV/N -	- 0 (// /	Ο)				()((-)				43.23	1 (
Fabric heat los: Heat capacity (`	O)				(==):::(==)		(30) + (32	2) + (32a).	(32e) =	25420.01	(34

can be used instea	ad of a det	tailed calcu	ulation.										
Thermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix I	K						24.58	(36)
if details of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								
Total fabric hea	at loss							(33) +	(36) =			73.87	(37)
Ventilation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (25)m x (5))	_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 18.99	18.77	18.55	17.45	17.23	16.13	16.13	15.91	16.57	17.23	17.67	18.11		(38)
Heat transfer of	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m= 92.86	92.64	92.42	91.32	91.1	90	90	89.78	90.44	91.1	91.54	91.98		
Heat loss para	meter (H	HLP), W/	m²K						Average = = (39)m ÷		12 /12=	91.27	(39)
(40)m= 1.17	1.17	1.17	1.15	1.15	1.13	1.13	1.13	1.14	1.15	1.15	1.16		
Number of day	s in mor	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	
4. Water heat	ing ener	rgy requi	rement:								kWh/y	ear:	
												1	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		.45		(42)
Annual averag	e hot wa										2.38]	(43)
Reduce the annua not more that 125							to achieve	a water us	se target o	f		J	
Г. П						·						1	
Jan Hot water usage ir	Feb	Mar day for ea	Apr	May Vd m = fa	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
	97.92	94.23	90.53	86.84	83.14	83.14	86.84	90.53	94.23	97.92	101.62	1	
(44)m= 101.62	97.92	94.23	90.53	00.04	03.14	03.14	00.04		<u> </u>	<u> </u>		1108.55	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600		Total = Su oth (see Ta			1100.55	(44)
(45)m= 150.69	131.8	136	118.57	113.77	98.18	90.98	104.4	105.64	123.12	134.39	145.94]	
		<u> </u>		<u> </u>	<u>I</u>	!	<u>!</u>		Total = Su	m(45) ₁₁₂ =	! =	1453.48	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)				_	
(46)m= 22.6	19.77	20.4	17.79	17.07	14.73	13.65	15.66	15.85	18.47	20.16	21.89		(46)
Water storage		includin	a any c	olar or M	WHDG	ctorogo	within co	mo voc	col			1	(47)
Storage volum	` ,					_		ille ves	SEI		0		(47)
If community h Otherwise if no	_			_			. ,	ers) ente	er 'O' in <i>(</i>	47)			
Water storage		not wate	, (uno ii	10144001	riotaritar	10040 00)	010) 0110	31 O III (11)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day):					0]	(48)
Temperature fa	actor fro	m Table	2b								0	j	(49)
Energy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =		1	10	j	(50)
b) If manufact			-										
Hot water store	_			e 2 (kWl	h/litre/da	ay)				0.	.02]	(51)
If community h Volume factor	_		JII 4.3							4	U3	1	(52)
Temperature fa			2b								.03 6	1	(52)
											-	J	()

Energy lost from wate			(47) x (51)) x (52) x (53) =	1.	03		(54)			
Enter (50) or (54) in (•								1.	03		(55)
Water storage loss ca	Iculated fo	or each	month			((56)m = (55) × (41)r	n				
(56)m= 32.01 28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contains dedicate	ed solar stora	age, (57)n	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 32.01 28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit loss (a	nnual) fron	n Table	3							0		(58)
Primary circuit loss ca			•		` '	, ,						
(modified by factor												
(59)m= 23.26 21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss calculated	for each r	month (61)m = ((60) ÷ 36	65 × (41))m	_					
(61)m= 0 0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat required for	r water hea	ating ca	alculated	for eacl	h month	(62)m =	0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 205.97 181.73	191.28	172.07	169.05	151.67	146.25	159.67	159.14	178.39	187.88	201.22		(62)
Solar DHW input calculated	l using Apper	ndix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	on to wate	r heating)		
(add additional lines if	FGHRS a	and/or V	VWHRS	applies	, see Ap	pendix (3)					
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water hea	ater	-	-		-		-					
(64)m= 205.97 181.73	191.28	172.07	169.05	151.67	146.25	159.67	159.14	178.39	187.88	201.22		
	•					Outp	out from wa	ater heater	(annual)₁	12	2104.32	(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]												
5	noamig, i		Jiiui 0.20	, [0.00	·· (+0)	' (01)11	ıj ' U.O A	· [(4 0)iii	' (<i>31)</i> III	' (39)III]	
(65)m= 94.33 83.76		82.22	82.05	75.44	74.47	78.93	77.92	85.16	87.48	92.75]	(65)
	89.44	82.22	82.05	75.44	74.47	78.93	77.92	85.16	87.48	92.75		(65)
(65)m= 94.33 83.76 include (57)m in cal	89.44 culation of	82.22 f (65)m	82.05 only if c	75.44	74.47	78.93	77.92	85.16	87.48	92.75		(65)
(65)m= 94.33 83.76 include (57)m in cal 5. Internal gains (se	89.44 culation of	82.22 f (65)m and 5a)	82.05 only if c	75.44	74.47	78.93	77.92	85.16	87.48	92.75		(65)
include (57)m in cal 5. Internal gains (see	89.44 culation of	82.22 f (65)m and 5a)	82.05 only if cy	75.44	74.47	78.93 dwelling	77.92 or hot w	85.16 ater is fr	87.48 om com	92.75		(65)
include (57)m in cal 5. Internal gains (se	89.44 culation of E Table 5 are 5), Watts	82.22 f (65)m and 5a)	82.05 only if c	75.44 ylinder is	74.47	78.93	77.92	85.16	87.48	92.75 munity h		(65)
(65)m= 94.33 83.76 include (57)m in cal 5. Internal gains (se Metabolic gains (Table Jan Feb (66)m= 122.48 122.48	89.44 culation of e Table 5 at e 5), Watts Mar	82.22 f (65)m and 5a) s Apr 122.48	82.05 only if cy	75.44 ylinder is Jun 122.48	74.47 s in the c	78.93 dwelling Aug 122.48	77.92 or hot w Sep 122.48	85.16 ater is fr	87.48 om com	92.75 munity h		
include (57)m in cal 5. Internal gains (se Metabolic gains (Table Jan Feb (66)m= 122.48 122.48 Lighting gains (calcula	89.44 culation of e Table 5 a e 5), Watts Mar 122.48 ated in App	82.22 f (65)m and 5a) s Apr 122.48 pendix L	82.05 only if cy : May 122.48 _, equati	75.44 ylinder is Jun 122.48 on L9 or	74.47 s in the c Jul 122.48 r L9a), a	78.93 dwelling Aug 122.48 lso see	77.92 or hot w Sep 122.48 Table 5	85.16 ater is fr Oct 122.48	87.48 om com	92.75 munity h		
(65)m= 94.33 83.76 include (57)m in cal 5. Internal gains (se Metabolic gains (Table Jan Feb (66)m= 122.48 122.48 Lighting gains (calculated) (67)m= 19.43 17.26	89.44 culation of e Table 5 at e 5), Watts Mar 122.48 ated in App	82.22 f (65)m and 5a) s Apr 122.48 pendix L 10.63	82.05 only if cy May 122.48 _, equati 7.94	75.44 ylinder is Jun 122.48 on L9 or 6.71	74.47 s in the c Jul 122.48 r L9a), a 7.25	Aug 122.48 Iso see	77.92 or hot w Sep 122.48 Table 5	85.16 ater is fr Oct 122.48	87.48 om com Nov 122.48	92.75 munity h		(66)
include (57)m in cal 5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122.48 Lighting gains (calcula (67)m= 19.43 17.26 Appliances gains (calcula factor)	89.44 culation of e Table 5 at e 5), Watts Mar 122.48 ated in App 14.04 culated in App 14.04	82.22 f (65)m and 5a) s Apr 122.48 pendix L 10.63 Append	82.05 only if cy : May 122.48 _, equati 7.94 lix L, equ	Jun 122.48 on L9 on 6.71 uation L	74.47 s in the c Jul 122.48 r L9a), a 7.25 13 or L1	78.93 dwelling Aug 122.48 lso see 9.42 3a), also	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal	85.16 ater is fr Oct 122.48 16.05 ble 5	87.48 om com Nov 122.48	92.75 munity h Dec 122.48		(66) (67)
include (57)m in call finding gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122.48 Lighting gains (calcula (67)m= 19.43 17.26 Appliances gains (calcula (68)m= 217.99 220.25	89.44 Culation of E Table 5 at E 5), Watts Mar 122.48 Atted in App 14.04 Culated in App 214.55	82.22 f (65)m and 5a) s Apr 122.48 pendix L 10.63 Append 202.42	82.05 only if cy May 122.48 _, equati 7.94 dix L, equ 187.1	75.44 ylinder is Jun 122.48 on L9 or 6.71 uation L 172.7	74.47 s in the c Jul 122.48 r L9a), a 7.25 13 or L1: 163.08	78.93 dwelling Aug 122.48 lso see 9.42 3a), also 160.82	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal	85.16 ater is fr Oct 122.48 16.05 ble 5 178.66	87.48 om com Nov 122.48	92.75 munity h		(66)
include (57)m in calculation include (57)m in calculation include (57)m in calculation include (57)m in calculation include (57)m in calculation include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57	89.44 culation of e Table 5 a e 5), Watts Mar 122.48 ated in App 14.04 culated in App 214.55 ated in App	82.22 f (65)m and 5a) s Apr 122.48 pendix l 10.63 Append 202.42 pendix	82.05 only if cy May 122.48 _, equati	75.44 ylinder is Jun 122.48 on L9 or 6.71 uation L 172.7 ion L15	Jul 122.48 r L9a), a 7.25 13 or L1 163.08 or L15a)	78.93 dwelling Aug 122.48 lso see 9.42 3a), also 160.82 , also se	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal 166.52 ee Table	85.16 ater is fr Oct 122.48 16.05 ole 5 178.66 5	87.48 om com Nov 122.48 18.74	92.75 munity h Dec 122.48 19.97		(66) (67) (68)
include (57)m in calculation include (57)m in calculation include (57)m in calculation include (57)m in calculation include (57)m in calculation include (57)m in calculation include (57)m include (56)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (57)m include (58)m include (5	89.44 culation of e Table 5 a e 5), Watts Mar 122.48 ated in App 14.04 culated in A 214.55 ated in App 35.25	82.22 f (65)m and 5a) s Apr 122.48 pendix I 10.63 Append 202.42 pendix 35.25	82.05 only if cy May 122.48 _, equati 7.94 dix L, equ 187.1	75.44 ylinder is Jun 122.48 on L9 or 6.71 uation L 172.7	74.47 s in the c Jul 122.48 r L9a), a 7.25 13 or L1: 163.08	78.93 dwelling Aug 122.48 lso see 9.42 3a), also 160.82	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal	85.16 ater is fr Oct 122.48 16.05 ble 5 178.66	87.48 om com Nov 122.48	92.75 munity h Dec 122.48		(66) (67)
include (57)m in call 5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122.48 Lighting gains (calcula (67)m= 19.43 17.26 Appliances gains (calcula (68)m= 217.99 220.25 Cooking gains (calcula (69)m= 35.25 35.25 Pumps and fans gains	89.44 culation of e Table 5 at e 5), Watts Mar 122.48 ated in App 14.04 culated in App 214.55 ated in App 35.25 ated Table 5at	82.22 f (65)m and 5a) s Apr 122.48 pendix L 10.63 Append 202.42 pendix 35.25	82.05 only if control May 122.48, equati 7.94 dix L, equati 187.1 L, equati 35.25	75.44 ylinder is Jun 122.48 on L9 or 6.71 uation L 172.7 ion L15 35.25	Jul 122.48 r L9a), a 7.25 13 or L1: 163.08 or L15a) 35.25	Aug 122.48 Iso see 9.42 3a), also 160.82), also se 35.25	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal 166.52 ee Table 35.25	85.16 ater is fr Oct 122.48 16.05 ble 5 178.66 5 35.25	87.48 om com Nov 122.48 18.74	92.75 munity h Dec 122.48 19.97 208.37		(66) (67) (68) (69)
include (57)m in call 5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122.48 122.48 Lighting gains (calcula (67)m= 19.43 17.26 Appliances gains (calcula (68)m= 217.99 220.25 Cooking gains (calcula (69)m= 35.25 35.25 Pumps and fans gains (70)m= 0 0	89.44 culation of e Table 5 at e 5), Watts Mar 122.48 ated in App 14.04 culated in App 214.55 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App	82.22 f (65)m and 5a) s Apr 122.48 pendix L 10.63 Appendix 202.42 pendix 35.25 a) 0	82.05 only if cy May 122.48 , equati 7.94 dix L, equ 187.1 L, equat 35.25	75.44 ylinder is Jun 122.48 on L9 or 6.71 uation L 172.7 ion L15 35.25	Jul 122.48 r L9a), a 7.25 13 or L1 163.08 or L15a)	78.93 dwelling Aug 122.48 lso see 9.42 3a), also 160.82 , also se	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal 166.52 ee Table	85.16 ater is fr Oct 122.48 16.05 ole 5 178.66 5	87.48 om com Nov 122.48 18.74	92.75 munity h Dec 122.48 19.97		(66) (67) (68)
include (57)m in call 5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122.48 Lighting gains (calcula (67)m= 19.43 17.26 Appliances gains (calcula (68)m= 217.99 220.25 Cooking gains (calcula (69)m= 35.25 35.25 Pumps and fans gains (70)m= 0 0 Losses e.g. evaporations (1970)m= 10 Losses e.g. evaporat	89.44 culation of E Table 5 at E 5), Watts Mar 122.48 ated in App 14.04 culated in App 14.55 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25 ated in App 35.25	82.22 f (65)m and 5a) s Apr 122.48 pendix L 10.63 Append 202.42 pendix 35.25 a) 0 ve value	82.05 only if cy May 122.48 _, equati 7.94 lix L, equ 187.1 L, equat 35.25 0 es) (Tab	75.44 ylinder is Jun 122.48 on L9 or 6.71 uation L 172.7 ion L15 35.25 0 le 5)	Jul 122.48 r L9a), a 7.25 13 or L1: 163.08 or L15a) 35.25	78.93 dwelling Aug 122.48 lso see 9.42 3a), also 160.82), also se 35.25	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal 166.52 ee Table 35.25	85.16 ater is fr Oct 122.48 16.05 ble 5 178.66 5 35.25	87.48 om com Nov 122.48 18.74 193.98 35.25	92.75 munity h Dec 122.48 19.97 208.37		(66) (67) (68) (69) (70)
include (57)m in call 5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122.48 122.48 Lighting gains (calcula (67)m= 19.43 17.26 Appliances gains (calcula (68)m= 217.99 220.25 Cooking gains (calcula (69)m= 35.25 35.25 Pumps and fans gains (70)m= 0 0 Losses e.g. evaporation (71)m= -97.99 -97.99	89.44 culation of e Table 5 at e 5), Watts Mar 122.48 ated in App 14.04 culated in App 214.55 ated in App 35.25 c (Table 5at o	82.22 f (65)m and 5a) s Apr 122.48 pendix L 10.63 Appendix 202.42 pendix 35.25 a) 0	82.05 only if cy May 122.48 , equati 7.94 dix L, equ 187.1 L, equat 35.25	75.44 ylinder is Jun 122.48 on L9 or 6.71 uation L 172.7 ion L15 35.25	Jul 122.48 r L9a), a 7.25 13 or L1: 163.08 or L15a) 35.25	Aug 122.48 Iso see 9.42 3a), also 160.82), also se 35.25	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal 166.52 ee Table 35.25	85.16 ater is fr Oct 122.48 16.05 ble 5 178.66 5 35.25	87.48 om com Nov 122.48 18.74	92.75 munity h Dec 122.48 19.97 208.37		(66) (67) (68) (69)
include (57)m in call 5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122	89.44 culation of e Table 5 at e 5), Watts Mar 122.48 ated in App 14.04 culated in App 35.25 ated in App 35.25 ated in App 37.25 ated in App 37.25 ated in App 37.25 ated in App 37.25 ated in App 37.25 ated in App 37.25 ated in App 37.25 ated in App 37.25 ated in App 37.25 ated in App 37.25	82.22 f (65)m and 5a) s Apr 122.48 pendix l 10.63 Appendix 202.42 pendix 35.25 a) 0 ve value -97.99	82.05 only if cy May 122.48, equati 7.94 dix L, equat 187.1 L, equat 35.25 0 es) (Tab -97.99	75.44 ylinder is Jun 122.48 on L9 or 6.71 uation L 172.7 ion L15 35.25 0 le 5) -97.99	74.47 s in the co Jul 122.48 r L9a), a 7.25 13 or L1 163.08 or L15a) 35.25 0	78.93 dwelling Aug 122.48 lso see 9.42 3a), also 160.82), also se 35.25 0	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tall 166.52 ee Table 35.25 0 -97.99	85.16 ater is fr Oct 122.48 16.05 ble 5 178.66 5 35.25 0	87.48 om com Nov 122.48 18.74 193.98 35.25 0	92.75 munity h Dec 122.48 19.97 208.37 35.25 0		(66) (67) (68) (69) (70)
include (57)m in call 5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122	89.44 culation of e Table 5 at e 5), Watts Mar 122.48 ated in App 14.04 culated in App 35.25 ated in App 35.25 ated in App 37.25 ated in App 35.25	82.22 f (65)m and 5a) s Apr 122.48 pendix L 10.63 Append 202.42 pendix 35.25 a) 0 ve value	82.05 only if cy May 122.48 _, equati 7.94 lix L, equ 187.1 L, equat 35.25 0 es) (Tab	75.44 ylinder is Jun 122.48 on L9 of 6.71 uation L 172.7 ion L15 35.25 0 le 5) -97.99	74.47 s in the c Jul 122.48 r L9a), a 7.25 13 or L1: 163.08 or L15a) 35.25 0 -97.99	78.93 dwelling Aug 122.48 lso see 9.42 3a), also 160.82 0, also se 35.25 0 -97.99	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal 166.52 ee Table 35.25 0 -97.99	85.16 ater is fr Oct 122.48 16.05 ble 5 178.66 5 35.25 0 -97.99	87.48 om com Nov 122.48 18.74 193.98 35.25 0 -97.99	92.75 munity h Dec 122.48 19.97 208.37 35.25 0 -97.99		(66) (67) (68) (69) (70)
include (57)m in call 5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122.48 122.48 122.48 122.48 129.48 129.48 129.48 129.49 120.25 120	89.44 culation of e Table 5 at e 5), Watts Mar 122.48 ated in App 14.04 culated in App 35.25 ated in App 35.25	82.22 f (65)m and 5a) s Apr 122.48 Dendix L 10.63 Appendix 35.25 a) 0 ve value -97.99	82.05 only if cy May 122.48 _, equati 7.94 dix L, equ 187.1 L, equat 35.25 0 es) (Tab -97.99	75.44 ylinder is Jun 122.48 on L9 or 6.71 uation L 172.7 ion L15 35.25 0 le 5) -97.99	74.47 s in the c Jul 122.48 r L9a), a 7.25 13 or L1 163.08 or L15a) 35.25 0 -97.99	78.93 dwelling Aug 122.48 lso see 9.42 3a), also 160.82), also se 35.25 0 -97.99 106.09 1+ (68)m	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tale 166.52 ee Table 35.25 0 -97.99 108.22 + (69)m + (85.16 ater is fr Oct 122.48 16.05 ble 5 178.66 5 35.25 0 -97.99 114.46 70)m + (7	87.48 om com Nov 122.48 18.74 193.98 35.25 0 -97.99 121.5 1)m + (72)	92.75 munity h Dec 122.48 19.97 208.37 35.25 0 -97.99		(66) (67) (68) (69) (70) (71)
include (57)m in call 5. Internal gains (see Metabolic gains (Table Jan Feb (66)m= 122.48 122	89.44 culation of e Table 5 at e 5), Watts Mar 122.48 ated in App 14.04 culated in App 35.25 ated in App 35.25	82.22 f (65)m and 5a) s Apr 122.48 pendix l 10.63 Appendix 202.42 pendix 35.25 a) 0 ve value -97.99	82.05 only if cy May 122.48, equati 7.94 dix L, equat 187.1 L, equat 35.25 0 es) (Tab -97.99	75.44 ylinder is Jun 122.48 on L9 of 6.71 uation L 172.7 ion L15 35.25 0 le 5) -97.99	74.47 s in the c Jul 122.48 r L9a), a 7.25 13 or L1: 163.08 or L15a) 35.25 0 -97.99	78.93 dwelling Aug 122.48 lso see 9.42 3a), also 160.82 0, also se 35.25 0 -97.99	77.92 or hot w Sep 122.48 Table 5 12.64 o see Tal 166.52 ee Table 35.25 0 -97.99	85.16 ater is fr Oct 122.48 16.05 ble 5 178.66 5 35.25 0 -97.99	87.48 om com Nov 122.48 18.74 193.98 35.25 0 -97.99	92.75 munity h Dec 122.48 19.97 208.37 35.25 0 -97.99		(66) (67) (68) (69) (70)

Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com

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

Orientation:	Access Factor Table 6d	r	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast _{0.9x}	0.77	X	0.9	x	11.28	x	0.55	x	0.8	=	3.1	(75)
Northeast 0.9x	0.77	x	0.9	x	22.97	x	0.55	x	0.8	=	6.3	(75)
Northeast 0.9x	0.77	x	0.9	x	41.38	x	0.55	x	0.8	=	11.36	(75)
Northeast _{0.9x}	0.77	x	0.9	x	67.96	x	0.55	x	0.8	=	18.65	(75)
Northeast 0.9x	0.77	x	0.9	x	91.35	x	0.55	x	0.8	=	25.07	(75)
Northeast 0.9x	0.77	x	0.9	x	97.38	x	0.55	x	0.8	=	26.73	(75)
Northeast _{0.9x}	0.77	x	0.9	x	91.1	x	0.55	x	0.8	=	25	(75)
Northeast 0.9x	0.77	X	0.9	X	72.63	x	0.55	X	0.8	=	19.93	(75)
Northeast _{0.9x}	0.77	x	0.9	x	50.42	x	0.55	x	0.8	=	13.84	(75)
Northeast 0.9x	0.77	x	0.9	x	28.07	x	0.55	x	0.8	=	7.7	(75)
Northeast 0.9x	0.77	X	0.9	X	14.2	X	0.55	X	0.8	=	3.9	(75)
Northeast _{0.9x}	0.77	x	0.9	x	9.21	x	0.55	x	0.8	=	2.53	(75)
Southeast 0.9x	0.77	x	5.81	x	36.79	x	0.55	X	0.8	=	65.18	(77)
Southeast 0.9x	0.77	x	5.81	x	62.67	x	0.55	x	0.8	=	111.03	(77)
Southeast 0.9x	0.77	x	5.81	x	85.75	x	0.55	X	0.8] =	151.92	(77)
Southeast 0.9x	0.77	x	5.81	X	106.25	x	0.55	X	0.8] =	188.23	(77)
Southeast 0.9x	0.77	x	5.81	X	119.01	x	0.55	X	0.8	=	210.84	(77)
Southeast 0.9x	0.77	x	5.81	x	118.15	x	0.55	x	0.8	=	209.31	(77)
Southeast 0.9x	0.77	x	5.81	X	113.91	x	0.55	X	0.8] =	201.8	(77)
Southeast 0.9x	0.77	x	5.81	x	104.39	x	0.55	X	0.8	=	184.94	(77)
Southeast 0.9x	0.77	x	5.81	x	92.85	x	0.55	x	0.8	=	164.5	(77)
Southeast 0.9x	0.77	x	5.81	X	69.27	x	0.55	X	0.8] =	122.71	(77)
Southeast 0.9x	0.77	x	5.81	x	44.07	x	0.55	X	0.8] =	78.07	(77)
Southeast 0.9x	0.77	x	5.81	x	31.49	x	0.55	X	0.8] =	55.78	(77)
Southwest _{0.9x}	0.77	x	4.16	x	36.79]	0.55	X	0.8	=	46.67	(79)
Southwest _{0.9x}	0.77	x	4.16	x	62.67]	0.55	x	0.8	=	79.5	(79)
Southwest _{0.9x}	0.77	x	4.16	x	85.75]	0.55	X	0.8	=	108.77	(79)
Southwest _{0.9x}	0.77	x	4.16	x	106.25]	0.55	x	0.8	=	134.78	(79)
Southwest _{0.9x}	0.77	X	4.16	x	119.01]	0.55	X	0.8	=	150.96	(79)
Southwest _{0.9x}	0.77	x	4.16	x	118.15]	0.55	x	0.8	=	149.87	(79)
Southwest _{0.9x}	0.77	x	4.16	x	113.91]	0.55	x	0.8	=	144.49	(79)
Southwest _{0.9x}	0.77	x	4.16	x	104.39]	0.55	x	0.8	=	132.42	(79)
Southwest _{0.9x}	0.77	x	4.16	x	92.85]	0.55	X	0.8	=	117.78	(79)
Southwest _{0.9x}	0.77	x	4.16	x	69.27]	0.55	X	0.8	=	87.86	(79)
Southwest _{0.9x}	0.77	x	4.16	x	44.07]	0.55	X	0.8] =	55.9	(79)
Southwest _{0.9x}	0.77	X	4.16	x	31.49]	0.55	x	0.8] =	39.94	(79)
Northwest 0.9x	0.77	X	1.37	x	11.28	x	0.55	x	0.8] =	9.43	(81)
Northwest 0.9x	0.77	X	4.37	x	11.28	x	0.55	x	0.8	=	15.03	(81)
Northwest 0.9x	0.77	X	1.37	x	22.97	x	0.55	x	0.8	j =	19.19	(81)

Northwest _{0.9x}		–		٦		1 1		п г				7(04)
Northwest 0.9x	0.77	X	4.37	X	22.97	X	0.55	_	0.8	=	30.6	(81)
<u> </u>	0.77	×	1.37	X	41.38	X 1	0.55	_	0.8	=	34.57	(81)
Northwest 0.9x	0.77	×	4.37	」 ×	41.38] X]	0.55	_	0.8	=	55.14	(81)
Northwest 0.9x	0.77	×	1.37	」 ×	67.96	X 1	0.55	_ ×	0.8	=	56.78	(81)
Northwest 0.9x	0.77	×	4.37	×	67.96	X	0.55	_	0.8	=	90.55	(81)
Northwest 0.9x	0.77	×	1.37	X	91.35	X	0.55	_	0.8	=	76.32	(81)
Northwest 0.9x	0.77	×	4.37	X	91.35	X	0.55	_ ×	0.8	=	121.72	(81)
Northwest 0.9x	0.77	X	1.37	×	97.38	X	0.55	_ X	8.0	=	81.36	(81)
Northwest 0.9x	0.77	X	4.37	X	97.38	X	0.55	_ X	0.8	=	129.76	(81)
Northwest 0.9x	0.77	X	1.37	X	91.1	X	0.55	_ x [0.8	=	76.11	(81)
Northwest _{0.9x}	0.77	X	4.37	X	91.1	X	0.55	_ x _	0.8	=	121.39	(81)
Northwest _{0.9x}	0.77	X	1.37	X	72.63	X	0.55	X	8.0	=	60.68	(81)
Northwest _{0.9x}	0.77	X	4.37	X	72.63	X	0.55	X	8.0	=	96.78	(81)
Northwest _{0.9x}	0.77	X	1.37	X	50.42	X	0.55	x	0.8	=	42.13	(81)
Northwest _{0.9x}	0.77	X	4.37	X	50.42	X	0.55	x	0.8	=	67.19	(81)
Northwest _{0.9x}	0.77	X	1.37	×	28.07	X	0.55	x [0.8	=	23.45	(81)
Northwest 0.9x	0.77	X	4.37	X	28.07	X	0.55	x [0.8	=	37.4	(81)
Northwest 0.9x	0.77	X	1.37	X	14.2	X	0.55	x [0.8	=	11.86	(81)
Northwest 0.9x	0.77	X	4.37	X	14.2	x	0.55	x [0.8	=	18.92	(81)
Northwest _{0.9x}	0.77	X	1.37	x	9.21	x	0.55	x	0.8	=	7.7	(81)
Northwest _{0.9x}	0.77	X	4.37	X	9.21	X	0.55	x	0.8	=	12.28	(81)
Rooflights 0.9x	1	×	3.06	X	18.07	x	0.55	_ x [0.8	=	21.93	(82)
Rooflights 0.9x	1	x	3.06	x	37.96	х	0.55	_ x [0.8	=	46.06	(82)
Rooflights 0.9x	1	x	3.06	×	71.02	х	0.55	_ x [0.8	=	86.18	(82)
Rooflights 0.9x	1	x	3.06	×	119.98	х	0.55	x	0.8	=	145.58	(82)
Rooflights 0.9x	1	x	3.06	x	163.58	х	0.55	_ x [0.8	=	198.49	(82)
Rooflights 0.9x	1	x	3.06	x	175.24	x	0.55	_ x [0.8	<u> </u>	212.64	(82)
Rooflights 0.9x	1	x	3.06	i x	163.61	x	0.55	- x	0.8	=	198.52	(82)
Rooflights 0.9x	1	X	3.06	×	129.11	x	0.55	- x	0.8	=	156.67	(82)
Rooflights 0.9x	1	×	3.06	i x	87.66	x	0.55		0.8	-	106.37	(82)
Rooflights 0.9x	1	×	3.06	X	47.1	X	0.55		0.8	=	57.15	(82)
Rooflights 0.9x	1	×	3.06	۲ ×	22.95) x	0.55	x	0.8	=	27.85	(82)
Rooflights 0.9x	1	X	3.06	۱ x	14.62) x	0.55	_	0.8	= =	17.74	(82)
	· · · · · · · · · · · · · · · · · · ·		0.00	_		_	0.00					` ′
Solar gains in v	watts. calc	ulated	for each mor	nth		(83)m	= Sum(74)m	(82)m				
(83)m= 161.34		47.93	634.57 783.3		09.67 767.32	651		336.28	196.5	135.97		(83)
Total gains – ir	nternal and	d solar	(84)m = (73)	m + (33)m , watts						ı	
(84)m= 585.3	714.6 8	356.49	1021.56 1148	.47 1	153.6 1097.49	987	.48 858.93	705.2	590.46	548.72		(84)
7. Mean inter	nal temper	rature (heating seas	on)	•							
Temperature	•	`			area from Tal	ole 9.	Th1 (°C)				21	(85)
Utilisation fac	•	•		_		•	` '					
Jan	Feb	Mar	Apr Ma	Ť	Jun Jul	A	ug Sep	Oct	Nov	Dec		
LI			· I	- 1	1		<u>- 1 ' </u>		•		1	

(86)m=	0.99	0.99	0.96	0.86	0.69	0.49	0.36	0.42	0.68	0.93	0.99	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.86	20.07	20.39	20.74	20.93	20.99	21	21	20.95	20.65	20.19	19.82		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	19.94	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.98	0.95	0.83	0.63	0.42	0.28	0.32	0.6	0.9	0.98	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	18.44	18.75	19.2	19.68	19.9	19.97	19.97	19.97	19.94	19.59	18.92	18.39		(90)
									1	LA = Livin	g area ÷ (4	4) =	0.35	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	18.93	19.21	19.61	20.04	20.26	20.32	20.33	20.33	20.29	19.96	19.36	18.88		(92)
			ı	interna	temper	ature fro	m Table	4e, whe	re appro	priate	ı			
(93)m=	18.93	19.21	19.61	20.04	20.26	20.32	20.33	20.33	20.29	19.96	19.36	18.88		(93)
•		•	uirement		1.4.1		44	T.I.I. 0	41.	4 T : /:	70)		. 1 - 4 -	
				mperatui using Ta		ied at ste	ер 11 от	i abie 9i	o, so tna	t 11,m=(/6)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:							ı			
(94)m=	0.99	0.98	0.94	0.83	0.64	0.44	0.31	0.36	0.62	0.9	0.98	0.99		(94)
			<u> </u>	4)m x (84										(0=)
(95)m=		698.86	805.31	850.25	740.22	510.1	334.88	351.42	535.5	636.29	579.02	545.07		(95)
(96)m=	4.3	age exte	6.5	perature 8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
		_	!	l empe	!	<u> </u>	!	!		!	,	1.2		(==)
i			r	1017.64	r	514.87	335.45	352.63	559.61	852.32	1122.31	1350.62		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	579.05	420.99	302.25	120.53	29.4	0	0	0	0	160.72	391.17	599.33		_
								Tota	l per year	(kWh/year	·) = Sum(9	8) _{15,912} =	2603.45	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								32.83	(99)
9b. En	ergy rec	uiremer	nts – Cor	mmunity	heating	scheme	:							
				ating, spa							unity sch	neme.		¬
Fractio	n of spa	ice heat	from se	condary	/supplen	nentary I	neating (Table 1	1) '0' it n	one			0	(301)
Fractio	n of spa	ice heat	from co	mmunity	system	1 – (30	1) =						1	(302)
includes	boilers, h	eat pumps	s, geotherr	mal and wa	aste heat f					up to four (other heat	sources; tl		7(2020)
				ity heat									<u> </u>	(303a)
				ity heat		•							0.8	(303a)
Fractio	n of cor	nmunity	heat fro	m heat s	source 2	(Water)							0.2	(303b)
Fractio	n of tota	al space	heat fro	m Comn	nunity he	eat pump)			(3	02) x (303	a) =	1	(304a)
Factor	Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)													

			-		7
Distribution loss factor (Table 12c) for commu			<u> </u>	1.05	(306)
Distribution loss factor (Table 12c) for commu	ınity heating system (Wat	er)		1.05	(306)
Space heating			Г	kWh/year	٦
Annual space heating requirement		(09) v (204a) v	(205) v (206) -	2603.45]] ₍₂₀₇₀)
Space heat from Community heat pump	er avatam in 0/ /fram Tabl		(305) x (306) =	2733.62](307a)] ₍₂₀₀
Efficiency of secondary/supplementary heatin	`	• •	, L	0](308](300)
Space heating requirement from secondary/s	upplementary system	(98) x (301) x 1	100 ÷ (308) –	0	(309)
Water heating Annual water heating requirement			ſ	2104.32	7
If DHW from community scheme: Water heat from CHP (Water)		(64) x (303a) x	(305) x (306) =	1767.63	(310a)
Water heat from heat source 2 (Water)		(64) x (303a) x	(305) x (306) =	441.91	(310b)
Electricity used for heat distribution	0.0	1 × [(307a)(307	7e) + (310a)(310e)] =	27.34	(313)
Electricity used for heat distribution (Water)	0.0	1 × [(307a)(307	7e) + (310a)(310e)] =	22.1	(313)
Cooling System Energy Efficiency Ratio			Ī	0	(314)
Space cooling (if there is a fixed cooling syste	em, if not enter 0)	= (107) ÷ (314)) =	0	(315)
Electricity for pumps and fans within dwelling mechanical ventilation - balanced, extract or p	•	:	- [241.75	(330a)
warm air heating system fans			[0	(330b)
pump for solar water heating			[0	(330g)
Total electricity for the above, kWh/year		=(330a) + (330	(b) + (330g) =	241.75	(331)
Energy for lighting (calculated in Appendix L)			Ī	343.21	(332)
Electricity generated by PVs (Appendix M) (no	egative quantity)		<u> </u>	-576.34	(333)
Total delivered energy for all uses (307) + (30	09) + (310) + (312) + (315) + (331) + (33	32)(237b) =	2742.24	(338)
12b. CO2 Emissions – Community heating so	heme		_		
		ergy /h/year	Emission factor E	Emissions cg CO2/year	
CO2 from other sources of space and water h Efficiency of heat source 1 (%)	neating (not CHP) If there is CHP using two fue	s repeat (363) to	(366) for the second fuel	280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x	100 ÷ (367b) x	0.52 =	506.7	(367)
Electrical energy for heat distribution	[(313) x		0.52	14.19	(372)
Water heating from separate community syste	em				_
CO2 from other sources of space and water Efficiency of heat source 1 (%)	heating (not CHP) If there is CHP using two fuel	s repeat (363) to	(366) for the second fuel	280	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fue	s repeat (363) to	(366) for the second fuel	100	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x	100 ÷ (367b) x	0 =	327.64	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x	100 ÷ (367b) x	0.52 =	229.35	(368)
Electrical energy for heat distribution	[(313) x		0.52 =	11.47	(372)
					_ `

Total CO2 associated with community systems	(363)(366) + (368)(372))	=	1089.34	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater of	r instantaneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			1089.34	(376)
CO2 associated with electricity for pumps and fans	within dwelling (331)) x	0.52	=	125.47	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	178.13	(379)
Energy saving/generation technologies (333) to (334) Item 1	′ · · ·	0.52 x 0.01	= _	-299.12	(380)
Total CO2, kg/year sum of (376)	.(382) =			1093.82	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =				13.79	(384)
El rating (section 14)				88.21	(385)

		l Isar I	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	- 036 FL	Strom	_					
		Property				N			
Address :									
1. Overall dwelling dime	ensions:	_							
Ground floor				l(12) v			1 (22) -	· ` `	3) (3a)
	a)./4b)./4a)./4d)./4a)./4] •		2.7	(2a) -	130.19	(Ja)
	a)+(1b)+(1c)+(1d)+(1e)+(1	(11)	50.44	J)	1) - (0) -	(0.)		_
Dwelling volume				(3a)+(3b)+(3c)+(3c	1)+(3e)+	.(3n) =	136.19	(5)
2. Ventilation rate:	main seconda	r\/	other		total			m³ ner hou	r
N 1 6 1:	heating heating	<u> </u>	Other				40 -	III per nou	_
•		╛╘	0	╛╘	0			0	(6a)
·			0	」 <u> </u>	0			0	(6b)
Number of intermittent fa	ins				0	X	10 =	0	(7a)
Number of passive vents	;				0	X ·	10 =	0	(7b)
Number of flueless gas f	ires				0	X 4	40 =	0	(7c)
							Air ch	angos nor ha	NIIP.
lufilandina dan terbiana	fl for (60)1(6b)1(7a) ((7b) ((7a) –	_					_
	•			continue fr			÷ (5) =	0	(8)
					(0) (0)	(. •)		0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
				•	ruction			0	(11)
		o the grea	ter wall are	a (after					
	-, ,	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.5.51		(14)							
			-	. ,	-	+ (15) -			(15)
	a50 expressed in cubic metr	es ner hø					area		(16)
•	·	•	•	•	cuc or c	invelope	arca		(17)
•					is being u	sed		3.13	` ′
	ed		(20) - 1	[0 075 v /	10)1 -				(19)
	ting chalter factor				19)] –				(20)
•	•		(21) - (10) X (20) =				0.13	(21)
	 	Jul	Aua	Sep	Oct	Nov	Dec]	
	1 ' 1 ' 1	1 00	1 715					l	
 		3.8	3.7	4	4.3	4.5	4.7]	
	- 1	1	1	1	1	•	1	1	
		1 0 0 5	T 0.00		T 400	1 440	1 4 40	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		

					1		(21a) x	` ´ 	I			1	
0.16 alculate effec	0.16	0.16 change i	0.14 rate for t	0.14 he appli	0.12 cable ca	0.12	0.12	0.13	0.14	0.14	0.15]	
If mechanica		•										0.5	(23
If exhaust air he	at pump u	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat reco	very: effic	eiency in %	allowing t	for in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mecha	ınical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1 – (23c)) ÷ 100]	
4a)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(24
b) If balance	d mecha	ınical ve	entilation	without	heat red	covery (I	MV) (24k)m = (22	2b)m + (2	23b)		_	
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole he if (22b)m				•	•				.5 × (23b	o)			
4c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
d) If natural if (22b)m				•	•				0.5]			•	
4d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
Effective air	change i	rate - er	nter (24a) or (24l	o) or (24	c) or (24	d) in bo	x (25)				_	
5)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
3. Heat losses	s and he	at loss r	paramet	er:									
LEMENT	Gros area	s	Openin m	gs	Net Ar A ,ı		U-val W/m2		A X U (W/I	〈)	k-value kJ/m²·		A X k kJ/K
oors					1.99	х	1	=	1.99				(2
indows Type	1				1.37	x1	/[1/(1.4)+	0.04] =	1.82				(2
indows Type	2				4.65	x1	/[1/(1.4)+	0.04] =	6.16				(2
indows Type	3				1.54	x1	/[1/(1.4)+	0.04] =	2.04				(2
alls Type1	55.8	3	8.93		46.87	7 X	0.15	= i	7.03	=			(2
alls Type2	22.49	9	1.99		20.5	x	0.15	= i	3.08	T i			
otal area of e	lements,	, m²			78.29	•							(3
arty wall					9.64	x	0		0				(3
arty floor					50.44	1						-	(3
arty ceiling					0	=				Ī			(3
or windows and include the area						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] a	ıs given in	paragrapl	h 3.2	`
abric heat los	s, W/K =	S (A x	U)				(26)(30) + (32) =				23.93	(3
eat capacity	Cm = S(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	16553.1	(3
nermal mass	paramet	ter (TMF	⊃ = Cm ÷	- TFA) ir	n kJ/m²K	, <u>.</u>		Indica	itive Value	Medium		250	(3
r design assess n be used instea				construct	ion are no	t known pr	recisely the	e indicative	e values of	TMP in Ta	able 1f		
nermal bridge	,	•		•	•	K						10.82	(3
details of therma		are not kn	own (36) =	= 0.05 x (3	11)			(22) +	(36) -				
otal fabric he									(36) =	25)m x (5)		34.76	(3
entilation hea	+ 1000	101110											

(20)	40.05	10.44	14.20	14.05	10.52	40.52	10.00	40.00	44.05	44.54	14.00		(38)
(38)m= 12.4	12.25	12.11	11.39	11.25	10.53	10.53	10.39	10.82	11.25	11.54	11.82		(30)
Heat transfer (39)m= 47.15	47.01	1t, VV/K 46.86	46.15	46	45.29	45.29	45.15	(39)m 45.58	= (37) + (3	46.29	46.58		
(59)111 47.15	47.01	40.00	40.13	40	43.23	43.29	43.13		Average =		<u> </u>	46.11	(39)
Heat loss para	meter (l	HLP), W	/m²K						= (39)m ÷				` ′
(40)m= 0.93	0.93	0.93	0.91	0.91	0.9	0.9	0.9	0.9	0.91	0.92	0.92		_
Number of day	/s in mo	nth (Tab	le 1a)					/	Average =	Sum(40)₁	12 /12=	0.91	(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	ting ene	rgy requi	irement:								kWh/yea	ar:	
Assumed occu	inancy	N									7		(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	49 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		.7		(42)
if TFA £ 13.9 Annual average	•	ater usad	ne in litre	es ner da	ıv Vd av	erane =	(25 x N)	+ 36		7/	.65		(43)
Reduce the annua	al average	hot water	usage by	5% if the a	welling is	designed t			e target o				(40)
not more that 125		person per T	, ,	ater use, l	not and co	<u> </u>				T	T 1		
Jan Hot water usage is	Feb	Mar day for ea	Apr	May	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11		
(44)m= 82.11	79.13	70.14	73.15	70.17	07.10	07.10	70.17		Total = Su			895.77	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x E	OTm / 3600			· /	<u> </u>		` ′
(45)m= 121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		
If instantaneous w	vater heati	na at noint	of use (no	hot water	storage)	enter () in	hoves (46		Γotal = Su	m(45) ₁₁₂ =	=	1174.5	(45)
(46)m= 18.27	15.98	16.48	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(46)
Water storage		10.40	14.37	13.79	11.9	11.03	12.05	12.0	14.92	10.29	17.09		(40)
Storage volum	e (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	_			_			, ,			\			
Otherwise if no Water storage		hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
a) If manufact		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)) =		1	10		(50)
b) If manufact Hot water stor			•								.02		(51)
If community h	•			C 2 (KVV)	11/11110/00	· y /				0.	.02		(31)
Volume factor	from Ta	ble 2a								1.	.03		(52)
Temperature f	actor fro	m Table	2b							0	.6		(53)
Energy lost fro		•	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		.03		(54)
Enter (50) or (Water storage	. , .	•	for each	month			((56)m = (55) × <i>(1</i> 1):	m	1.	.03		(55)
					20.00					20.00	22.04		(56)
(56)m= 32.01 If cylinder contains	28.92 s dedicate	32.01 d solar sto	30.98 rage, (57)ı	32.01 m = (56)m	30.98 x [(50) – (32.01 H11)] ÷ (5	32.01 0), else (5	30.98 7)m = (56)	32.01 m where (30.98 H11) is fro	32.01 om Appendix	:H	(56)
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
02.01	1 20.02	1 02.01	1 00.00				1 02.01	55.50	52.01	1 00.00	<u> </u>		(==)

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 therm	ostat)
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 23.26 22.51 23.26	22.51 23.26 (59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0	0 0 (61)
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)$ m =	- (46)m + (57)m + (59)m + (61)m
(62)m= 177.05 156.43 165.18 149.31 147.21 132.83 128.79 139.63 138.86 154.76	``` ``
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution of the contr	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	ation to water meating)
(63)m= 0 0 0 0 0 0 0 0 0 0 0	0 0 (63)
Output from water heater	
(64)m= 177.05 156.43 165.18 149.31 147.21 132.83 128.79 139.63 138.86 154.76	6 162.09 173.2
Output from water heat	
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)n	
(65)m= 84.71 75.35 80.76 74.65 74.79 69.17 68.66 72.27 71.18 77.3	78.9 83.43 (65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is	from community heating
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct	Nov Dec
(66)m= 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15	85.15 85.15 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 13.31 11.82 9.61 7.28 5.44 4.59 4.96 6.45 8.66 10.99	12.83 13.68 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 148.38 149.92 146.04 137.78 127.35 117.55 111 109.46 113.34 121.6	132.03 141.83 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52	31.52 31.52 (69)
Pumps and fans gains (Table 5a)	
(70)m= 0 0 0 0 0 0 0 0 0 0	0 0 (70)
Losses e.g. evaporation (negative values) (Table 5)	
(71)m= -68.12 -6	-68.12 -68.12 (71)
	35.12
Water heating gains (Table 5) (72)m= 113.86 112.13 108.55 103.68 100.52 96.07 92.29 97.14 98.86 103.9	109.59 112.14 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m + (69)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m$	
(73)m= 324.09 322.41 312.75 297.28 281.86 266.76 256.8 261.6 269.41 285.04	302.99 316.19 (73)
6. Solar gains:	
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the application of the solar flux from Table 6a and associated equations to convert to the application of the solar flux flux forms and flux flux flux flux flux flux flux flux	
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b	FF Gains Table 6c (W)
Northeast 0.9x	0.8 = 16 (75)
Northeast 0.9x 0.77 x 1.54 x 11.28 x 0.55 x	0.8 = 5.3 (75)

Northeast 0.9-1			,		,		,						_
Northeast 0 sv	Northeast _{0.9x}	0.77	X	4.65	X	22.97	X	0.55	x	0.8	=	32.56	(75)
Northeast 0.9x	<u> </u>	0.77	X	1.54	X	22.97	X	0.55	x	0.8	=	10.78	(75)
Northeast 0.9x	<u> </u>	0.77	X	4.65	X	41.38	X	0.55	x	0.8	=	58.67	(75)
Northeast 0.0x	<u> </u>	0.77	X	1.54	X	41.38	X	0.55	X	8.0	=	19.43	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	67.96	X	0.55	x	8.0	=	96.35	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	67.96	X	0.55	x	0.8	=	31.91	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	91.35	X	0.55	x	0.8	=	129.52	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	91.35	X	0.55	x	0.8	=	42.89	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	97.38	X	0.55	х	0.8	=	138.08	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	97.38	X	0.55	x	0.8	=	45.73	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	91.1	X	0.55	x	0.8	=	129.17	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	91.1	X	0.55	x	0.8	=	42.78	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	x	72.63	X	0.55	x [0.8	=	102.98	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	72.63	X	0.55	x	0.8	=	34.1	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	50.42	X	0.55	x	0.8	=	71.49	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	x	50.42	X	0.55	x [0.8	=	23.68	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	x	28.07	X	0.55	x	0.8	=	39.8	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	28.07	X	0.55	x	0.8	=	13.18	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	x	14.2	X	0.55	x [0.8	=	20.13	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	14.2	X	0.55	x	0.8	=	6.67	(75)
Southwest0.9x	Northeast _{0.9x}	0.77	X	4.65	x	9.21	X	0.55	x	0.8	=	13.06	(75)
Southwest0.9x	Northeast _{0.9x}	0.77	X	1.54	X	9.21	X	0.55	x	0.8	=	4.33	(75)
Southwesto,9x	Southwest _{0.9x}	0.77	X	1.37	X	36.79]	0.55	x	0.8	=	30.74	(79)
Southwesto,9x	Southwest _{0.9x}	0.77	X	1.37	x	62.67]	0.55	x	0.8	=	52.36	(79)
Southwesto,9x	Southwest _{0.9x}	0.77	X	1.37	X	85.75]	0.55	x	0.8	=	71.64	(79)
Southwest0.9x	Southwest _{0.9x}	0.77	X	1.37	X	106.25]	0.55	x	0.8	= [88.77	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	x	119.01]	0.55	x	0.8	=	99.43	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	X	118.15]	0.55	x	0.8	=	98.71	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	X	113.91]	0.55	x	0.8	=	95.17	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	x	104.39]	0.55	x	0.8	=	87.22	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	X	92.85]	0.55	x	0.8	= [77.58	(79)
Southwest _{0.9x} 0.77 x 1.37 x 31.49 0.55 x 0.8 = 26.31 (79) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 (83) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest _{0.9x}	0.77	X	1.37	X	69.27]	0.55	x	0.8	=	57.87	(79)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 Total gains – internal and solar (84)m = (73)m + (83)m, watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest _{0.9x}	0.77	X	1.37	x	44.07]	0.55	x	0.8	=	36.82	(79)
(83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest _{0.9x}	0.77	X	1.37	X	31.49]	0.55	x	0.8	=	26.31	(79)
(83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)													
Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Solar gains in w	/atts, calcul	ated	for each mon	_		(83)n			•			
(84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)	` '						224	1.3 172.74	110.85	63.62	43.7		(83)
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)				` 	·		_					I	
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	(84)m= 376.12	418.12 462	2.49	514.32 553.7	5	49.28 523.92	485	.89 442.15	395.89	366.61	359.89		(84)
Utilisation factor for gains for living area, h1,m (see Table 9a)	7. Mean intern	al tempera	ture (heating seaso	on)								
	Temperature o	during heati	ng pe	eriods in the li	ving	area from Tal	ble 9	, Th1 (°C)				21	(85)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec					Ť							 I	
	Jan	Feb N	/lar	Apr Ma	y	Jun Jul	A	ug Sep	Oct	Nov	Dec		

(86)m=	0.99	0.99	0.97	0.89	0.73	0.52	0.38	0.43	0.68	0.93	0.99	0.99		(86)
Mear	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	20.2	20.33	20.55	20.81	20.95	20.99	21	21	20.98	20.78	20.45	20.18		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	20.14	20.14	20.14	20.15	20.16	20.17	20.17	20.17	20.16	20.16	20.15	20.15		(88)
Utilisa	ation fac	tor for g	ains for ı	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.99	0.98	0.96	0.86	0.68	0.46	0.31	0.35	0.61	0.9	0.98	0.99		(89)
Mear	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	19.08	19.27	19.58	19.94	20.12	20.17	20.17	20.17	20.15	19.92	19.46	19.05		(90)
									f	fLA = Livin	g area ÷ (4	1) =	0.54	(91)
Mear	interna	l temper	ature (fo	r the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	A) × T2					
(92)m=	19.69	19.85	20.11	20.41	20.57	20.62	20.62	20.62	20.6	20.39	20	19.66		(92)
			he mean		<u> </u>	r		r			1			(00)
(93)m=	19.69	19.85	20.11	20.41	20.57	20.62	20.62	20.62	20.6	20.39	20	19.66		(93)
•		•	uirement		o obtoir	and at et	on 11 of	Table 0	o co tha	t Ti m=/	76)m an	d re-calc	ulato	
			or gains	•		ieu ai sii	ър птог	I able 9	J, 80 IIIa	ı. 11,111–(i Ojili ali	u re-caic	uiale	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:		1								
(94)m=	0.99	0.98	0.96	0.87	0.7	0.49	0.35	0.39	0.65	0.91	0.98	0.99		(94)
Usefu (95)m=		410.27	, W = (94 441.69	448.39	4)m 389.1	270.65	181.92	190.22	287.23	359.31	358.94	357.09		(95)
			rnal tem			l	101.92	190.22	201.23	339.31	336.94	357.09		(93)
(96)m=		4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for me	an intern	al tempe	erature,	Lm , W =	-[(39)m :	x [(93)m	– (96)m]	ļ			
(97)m=	725.51	702.74	637.71	531.18	408.1	272.5	182.1	190.58	296.15	450.33	597.03	720.24		(97)
			ement fo			Wh/mon	th = 0.02	24 x [(97)m – (95		r			
(98)m=	262.67	196.54	145.84	59.61	14.14	0	0	0	0	67.71	171.42	270.18		—
								Tota	l per year	(kWh/year	·) = Sum(9	8) _{15,912} =	1188.11	(98)
Spac	e heatin	g require	ement in	kWh/m²	/year								23.55	(99)
9b. En	ergy red	uiremer	nts – Cor	nmunity	heating	scheme								
			ace hea from se								unity sch	neme.	0	(301)
	·			-		-		Table I	1) 0 11 11	OHE		[0	_՝ ՝
	•		from co	•	•	`	,						1	(302)
includes	boilers, h	eat pumps	s, geothern	nal and wa	aste heat f					up to four (other heat	sources; th	he latter	_
Fraction	on of hea	at from C	Commun	ity heat _l	oump								1	(303a)
Fraction	on of hea	at from C	Commun	ity heat _l	oump (V	Vater)							0.8	(303a)
Fraction	on of cor	nmunity	heat fro	m heat s	ource 2	(Water)							0.2	(303b)
Fractio	on of tota	al space	heat fro	m Comn	nunity he	eat pump)			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and	charging	method	(Table	4c(3)) fo	r commu	unity hea	iting sys	tem			1	(305)

Distribution loss factor (Table 12c) for commu	ınity heating system		Г	1.05	(306)
Distribution loss factor (Table 12c) for commu)	L T	1.05	(306)
Space heating	mily froduing by blom (vialor)	,	L	kWh/year	١
Annual space heating requirement			Г	1188.11	7
Space heat from Community heat pump	((98) x (304a) x	(305) x (306) =	1247.51	(307a)
Efficiency of secondary/supplementary heating	ng system in % (from Table	4a or Appen	dix E)	0	(308
Space heating requirement from secondary/s	upplementary system	(98) x (301) x 1	00 ÷ (308) =	0	(309)
Water heating Annual water heating requirement			[1825.34]
If DHW from community scheme: Water heat from CHP (Water)		(64) x (303a) x	(305) x (306) =	1533.28	(310a)
Water heat from heat source 2 (Water)		(64) x (303a) x	(305) x (306) =	383.32	(310b)
Electricity used for heat distribution	0.01 ×	[(307a)(307	e) + (310a)(310e)] =	12.48	(313)
Electricity used for heat distribution (Water)	0.01 ×	[(307a)(307	e) + (310a)(310e)] =	19.17	(313)
Cooling System Energy Efficiency Ratio			Ī	0	(314)
Space cooling (if there is a fixed cooling syste	em, if not enter 0)	= (107) ÷ (314)	=	0	(315)
Electricity for pumps and fans within dwelling mechanical ventilation - balanced, extract or			[157.84	(330a)
warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	:	=(330a) + (330l	o) + (330g) =	157.84	(331)
Energy for lighting (calculated in Appendix L)				234.98	(332)
Electricity generated by PVs (Appendix M) (n	egative quantity)			-576.34	(333)
Total delivered energy for all uses (307) + (30	09) + (310) + (312) + (315) +	- (331) + (33	(2)(237b) =	1063.99	(338)
12b. CO2 Emissions – Community heating so					
	Ener kWh	gy /year	Emission factor I kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water he Efficiency of heat source 1 (%)	neating (not CHP) If there is CHP using two fuels r	repeat (363) to	(366) for the second fuel	280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 10	00 ÷ (367b) x	0.52	231.23	(367)
Electrical energy for heat distribution	[(313) x		0.52	6.47	(372)
Water heating from separate community syst	em				
CO2 from other sources of space and water Efficiency of heat source 1 (%)	heating (not CHP) If there is CHP using two fuels r	repeat (363) to	(366) for the second fuel	280	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels r	repeat (363) to	(366) for the second fuel	100	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 10	00 ÷ (367b) x	0 =	284.21	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 10	00 ÷ (367b) x	0.52 =	198.94	(368)
Electrical energy for heat distribution	[(313) x		0.52	9.95	(372)

Total CO2 associated with community systems	(363)(366) + (368)(372)		=	730.81	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or insta	antaneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			730.81	(376)
CO2 associated with electricity for pumps and fans within	dwelling (331)) x	0.52	=	81.92	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.95	(379)
Energy saving/generation technologies (333) to (334) as a ltem 1	• •	0.52 x 0.01	= _	-299.12	(380)
Total CO2, kg/year sum of (376)(382)	=			635.56	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =				12.6	(384)
El rating (section 14)				91.08	(385)

Sasessor Name: Chris Hocknell Stroma Number: STRO016363 Software Version: Version: 1.0.5.51			l lser I)etails: _						
Address: 1. Overall dwelling dimensions: Area(m*)			<u> </u>	Strom	_					
Area(m²)			Property				EN			
Aramomination Aramominatio	Address :									
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1e)+(1h) e)+(1e)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1e)+(1e)+(1e)+(1e)+(1e)+(1e)+(1e)+(1e	1. Overall dwelling dime	ensions:	_							
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)	Ground floor				l(12) v			7(22) -		<u> </u>
Dwelling volume		a) ((4b) ((4a) ((4a) ((4a) ((4a) ((4a) ((4a) ((4a) ((4a) ((4] •	4	2.1	(2a) -	191.01	(Ja)
Number of chimneys	•	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	71.04	J) - (0) - (0	1) - (0) -	(0.)		_
Number of chimneys	Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	191.81	(5)
Number of chimneys	2. Ventilation rate:	main soconda	r\/	othor		total			m³ nor hou	ır
Number of open flues		heating heating	<u> </u>	Other	- F	iotai		40	iii periliou	_
Number of intermittent fans	•		╛╘	0	╛╘	0			0	(6a)
Number of passive vents	Number of open flues	0 + 0	+	0	_ = _	0	X :	20 =	0	(6b)
Number of flueless gas fires	Number of intermittent fa	nns				0	X	10 =	0	(7a)
Air changes per hour	Number of passive vents	3				0	X	10 =	0	(7b)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7c) = 0	Number of flueless gas f	ires			Ī	0	x 4	40 =	0	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7c) = 0					_					_
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns)					_			Air ch	nanges per ho	our —
Number of storeys in the dwelling (ns)		•			oontinuo fr			÷ (5) =	0	(8)
Additional infiltration			tu to (17),	Oli lei Wise (continue n	OIII (9) 10	(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 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (14) + 100] = 0 Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 0.85 (20) 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	·	3 ([(9)	-1]x0.1 =		_
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)	Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	ry consti	ruction			0	(11)
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 Window infiltration Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20) 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			o the grea	ter wall are	a (after					
Percentage of windows and doors draught stripped O	-	-	.1 (seal	ed), else	enter 0				0	(12)
Window infiltration 0.25 - [0.2 x (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 3 (17) If based on air permeability value, then (18) = [(17) + 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 2 (19) Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.13 (21) Infiltration rate modified for monthly wind speed 3 0.13 (21) Monthly average wind speed from Table 7 4 4.3 4.3 4.3 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4 4 4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	If no draught lobby, en	ter 0.05, else enter 0							0	(13)
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 If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (21) = (18) × (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	Percentage of window	s and doors draught stripped							0	(14)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 × (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (21) = (18) × (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				-	. ,	-			0	(15)
If based on air permeability value, then $(18) = [(17) \div 20] \div (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ 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 $(22a)m = (22)m \div 4$									0	=
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85 (20)$ 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 $(22a)m = (22)m \div 4$	•	·	•	•	•	etre of e	envelope	area		╡``
Number of sides sheltered	•	•				is beina u	sed		0.15	(18)
Infiltration rate incorporating shelter factor 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				g					2	(19)
Infiltration rate modified for monthly wind speed Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Shelter factor			(20) = 1 -	[0.075 x (19)] =			0.85	(20)
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 3.7 4 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate incorpora	ting shelter factor		(21) = (18	s) x (20) =				0.13	(21)
Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.7 4 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate modified t	- 					1		1	
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4	Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind Factor (22a)m = (22)m ÷ 4	 	 		1			•		1	
	(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
	Wind Factor (22a)m = (2	2)m ÷ 4								
		'	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					
0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effect		•	ate for t	he appli	cable ca	se						·	
If mechanica			endix N (2	3h) = (23a	a) x Fmv (e	equation (N5)) othe	rwise (23h	n) = (23a)			0.5	(238
If balanced with									, (20a)			0.5	(23k
a) If balance		-	•	_					2h\m + ('	22h) v [:	1 (22a)	77.35	(230
(24a)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	+ 100] 	(24a
b) If balance	LL						<u> </u>	1			0.20		(
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole h													•
,	n < 0.5 × (•	•				.5 × (23b)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
d) If natural	ventilatior	n or wh	ole hous	e positiv	ve input	ventilati	on from	loft				l	
if (22b)n	n = 1, ther	n (24d)	m = (22l	o)m othe	erwise (2	24d)m =	0.5 + [(2	22b)m² x	0.5]			-	
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air	change ra	ate - en	iter (24a) or (24k	o) or (24	c) or (24	d) in bo	x (25)				-	
(25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(25)
3. Heat losse	s and hea	at loss p	paramet	er:									
ELEMENT	Gross area (ı	;	Openin	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	()	k-value kJ/m²·l		A X k kJ/K
Doors	(-	,			1.99		1		1.99	'			(26)
Windows Type	e 1				1.37		/[1/(1.4)+	0.04] =	1.82				(27)
Windows Type					0.9	_	/[1/(1.4)+		1.19				(27)
Windows Type					5.79	〓 .	/[1/(1.4)+		7.68				(27)
Windows Type					2.19	= .	/[1/(1.4)+		2.9	=			(27)
Walls Type1	75.26		15.7	3	59.53	=			8.93	=			(29)
Walls Type2	27.91	_	1.99	=		=	0.15	_		믁 ¦		╡	(29)
Total area of e		 m²	1.98		25.92	=	0.15		3.89				
	iements,	111			103.1	=							(31)
Party floor					10.99	=	0	=	0	<u> </u>		╡	(32)
Party floor					71.04	=				Ĺ		╡	(32a
Party ceiling					71.04			1/8/4/11 1-).0041-				(32)
* for windows and ** include the area						atea using	g tormula 1	1/[(1/U-vail	ie)+0.04] a	s given in	paragrapn	1 3.2	
				,			(26)(30) + (32) =				35.66	(33)
Fabric heat los									(0.0)	2) + (32a)	(32e) =	23186.5	(34)
Fabric heat los		(xk)						((28).	(30) + (32	-) · (OLU).	(-)	20100.0	
	Cm = S(A	•	P = Cm ÷	- TFA) ir	n kJ/m²K	,			(30) + (32 itive Value:		(-)	250	(35)
Fabric heat los Heat capacity	Cm = S(A paramete sments wher	er (TMF	tails of the	•			recisely the	Indica	itive Value:	Medium			==
Fabric heat los Heat capacity Thermal mass For design assess	Cm = S(A paramete sments wher ad of a detail	er (TMF re the der iled calcu	tails of the ılation.	construct	ion are no	t known pi	recisely the	Indica	itive Value:	Medium		250	(35)
Fabric heat los Heat capacity Thermal mass For design assess can be used instead	Cm = S(A paramete sments when ad of a detail es : S (L x	er (TMF re the der iled calcu (Y) calc	tails of the ulation. culated (construct	ion are not opendix I	t known pi	recisely the	Indica	itive Value:	Medium			==

Ventila	tion hea	it loss ca	alculated	l monthly	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	17.46	17.26	17.05	16.05	15.84	14.84	14.84	14.63	15.24	15.84	16.25	16.65		(38)
Heat tra	ansfer c	oefficier	nt, W/K	-	-	-	-		(39)m	= (37) + (3	38)m	-		
(39)m=	65.88	65.68	65.47	64.47	64.26	63.26	63.26	63.05	63.66	64.26	64.67	65.07		
		4 (1	II D) \\\\	/ 21 <i>C</i>				•		•	Sum(39) ₁	12 /12=	64.42	(39)
(40)m=	0.93	0.92	HLP), W/	0.91	0.9	0.89	0.89	0.89	0.9	= (39)m ÷	0.91	0.92		
(40)111–	0.93	0.92	0.92	0.91	0.9	0.09	0.09	0.09			Sum(40) ₁ .		0.91	(40)
Numbe	r of day	s in mor	nth (Tabl	le 1a)					,	- Tverage	Juiii(40)1.	12 / 12-	0.91	(.0)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
_	-			-	-	-	-	-	-		-	-		
4. Wa	ter heat	ing ener	gy requi	irement:								kWh/ye	ear:	
Λ		1	\ I											(40)
		pancy, l). N = 1		[1 - exp	(-0.0003	349 x (TF	-A -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13.		27		(42)
	A £ 13.9				(0.000			/_/]	(,			
								(25 x N)				.14		(43)
			not water person per					to achieve	a water us	se target o	Ť			
[-			· ·			·	Ι Δ	Can	0-4	Nav	Daa		
Hot wate	Jan r usage in	Feb	Mar day for ea	Apr	May Vd m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	96.95	93.43	89.9	86.38	82.85	79.32	79.32	82.85	86.38	89.9	93.43	96.95		
(44)111-	90.93	33.43	09.9	00.30	02.03	19.32	19.52	02.03	<u> </u>		m(44) ₁₁₂ =		1057.67	(44)
Energy c	ontent of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600			ables 1b, 1		1007.07	(/
(45)m=	143.78	125.75	129.76	113.13	108.55	93.67	86.8	99.6	100.79	117.47	128.22	139.24		
				• .		, ,				Total = Su	m(45) ₁₁₂ =		1386.77	(45)
r	-	ater heatir	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)					
(46)m=	21.57 storage	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.89		(46)
	Ū		includin	na anv sa	olar or M	/WHRS	storane	within sa	ame ves	امء		0		(47)
_		` ,	nd no ta	•			_		arric ves	301		U		(47)
	-	_			_			ombi boil	ers) ente	er '0' in (47)			
	storage			`					,	`	,			
a) If m	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature fa	actor fro	m Table	2b								0		(49)
0,			storage					(48) x (49)) =		1	10		(50)
,			eclared o	•										
		_	factor fr ee section		e 2 (KVV	n/litre/da	ay)				0.	02		(51)
	-	from Tal		011 4.3							1	03		(52)
			m Table	2b								.6		(53)
•			storage		ear			(47) x (51)) x (52) x (53) =		03		(54)
		54) in (5	_	,y				(· ·) / (• ·)	, (=) ^ (/		03		(55)
	. , .	, ,	culated f	for each	month			((56)m = (55) × (41)	m				, ,
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
(30)111-	02.01	20.02	02.01	1 00.00	52.01	1 00.00	1 02.01	1 52.01	1 00.00	52.01	1 00.00	02.01		(30)

If cylinder contai	ns dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (1	111)] + (30	0), 0.00 (0	<i>i</i>)iii – (30)	iii wiieie (H11) IS Tro	m Append	lix H	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circu	it loss (ar	nual) fro	m Table	 e 3							0		(58)
Primary circu	`	,			59)m = (58) ÷ 36	65 × (41)	m				•	
(modified b	y factor f	rom Tabl	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss c	alculated	for each	month (61)m = ((60) ÷ 36	35 × (41))m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat red	quired for	water he	eating ca	alculated	for each	า month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 199.05	175.68	185.04	166.62	163.83	147.16	142.08	154.88	154.29	172.74	181.72	194.52		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negativ	e quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add addition	al lines if	FGHRS	and/or \	VWHRS	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= 199.05	175.68	185.04	166.62	163.83	147.16	142.08	154.88	154.29	172.74	181.72	194.52		
	•						Outp	out from w	ater heate	r (annual)₁	12	2037.61	(64)
Heat gains fro	om water	heating,	kWh/mo	onth 0.25	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m]	
(65)m= 92.03	81.75	87.37	80.41	80.31	73.94	73.08	77.34	76.31	83.28	85.43	90.52		(65)
include (57)m in cal	culation o	of (65)m	only if c	ylinder is	in the c	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal o	•										•		
Metabolic gai	· ·												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.56	+	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56		(66)
Lighting gains	s (calcula	ted in Ar	pendix	L. eguati	on L9 or	 · L9a). а	lso see	Table 5				ı	
(67)m= 17.8	15.81	12.86	9.74	7.28	6.14	6.64	i		44.74	17.17	18.3		(67)
Appliances g	ains (calc	ulated in	Annone				8.63	11.58	14.71	17.17			(67)
(68)m= 199.71	- ` 		Append	dix L, equ	uation L		ļ	<u> </u>	<u> </u>	17.17		•	(67)
	201.78	196.56	185.44	dix L, equ	uation L ²		ļ	<u> </u>	<u> </u>	177.71	190.9	']	(68)
Cooking gain			185.44	171.41	158.22	13 or L1: 149.41	3a), also 147.34	see Ta 152.56	ble 5 163.68	<u> </u>	190.9		, ,
Cooking gain (69)m= 34.36	s (calcula	ted in A	185.44	171.41	158.22 ion L15	13 or L1: 149.41	3a), also 147.34), also se	see Ta 152.56 ee Table	ble 5 163.68	177.71	190.9	 	, ,
(69)m= 34.36	s (calcula 34.36	ted in A ₁	185.44 opendix 34.36	171.41 L, equat	158.22	13 or L13 149.41 or L15a)	3a), also 147.34	see Ta 152.56	ble 5 163.68	<u> </u>		 	(68)
	s (calcula 34.36	ted in A ₁	185.44 opendix 34.36	171.41 L, equat	158.22 ion L15	13 or L13 149.41 or L15a)	3a), also 147.34), also se	see Ta 152.56 ee Table	ble 5 163.68	177.71		 	(68)
(69)m= 34.36 Pumps and fa (70)m= 0	s (calcula 34.36 ans gains 0	ted in A _l 34.36 (Table 5	185.44 opendix 34.36 5a)	171.41 L, equat 34.36	158.22 ion L15 34.36	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69)
(69)m= 34.36 Pumps and fa	s (calcula 34.36 ans gains 0	ted in A _l 34.36 (Table 5	185.44 opendix 34.36 5a)	171.41 L, equat 34.36	158.22 ion L15 34.36	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e	s (calcula 34.36 ans gains 0 vaporatio	34.36 (Table 5 0 on (negat	185.44 opendix 34.36 oa) o tive valu	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5)	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69) (70)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (T	34.36 (Table 5 0 on (negat	185.44 opendix 34.36 oa) o tive valu	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5)	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69) (70)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (T	117.43	185.44 opendix 34.36 5a) 0 tive valu -90.84	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5) -90.84	13 or L1; 149.41 or L15a) 34.36 0	3a), also 147.34), also se 34.36 0 -90.84	see Ta 152.56 ee Table 34.36 0 -90.84	ble 5 163.68 5 34.36 0 -90.84	177.71 34.36 0 -90.84	34.36 0 -90.84		(68) (69) (70) (71)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating (72)m= 123.69	s (calcula 34.36 ans gains 0 vaporation -90.84 g gains (Tal.66 121.66	117.43	185.44 opendix 34.36 5a) 0 tive valu -90.84	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5) -90.84	13 or L13 149.41 or L15a) 34.36 0 -90.84	3a), also 147.34), also se 34.36 0 -90.84	34.36 0 see Table 34.36 0 -90.84	ble 5 163.68 5 34.36 0 -90.84	177.71 34.36 0 -90.84	34.36 0 -90.84		(68) (69) (70) (71)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating (72)m= 123.69 Total internal	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (Tal.66 121.66 1 gains =	117.43	185.44 opendix 34.36 5a) 0 ciive valu -90.84	171.41 L, equat 34.36 0 es) (Tab -90.84	158.22 ion L15 34.36 0 le 5) -90.84	13 or L1; 149.41 or L15a) 34.36 0 -90.84 98.23 m + (67)m	3a), also 147.34), also se 34.36 0 -90.84 103.95	o see Ta 152.56 ee Table 34.36 0 -90.84 105.98 + (69)m +	ble 5 163.68 5 34.36 0 -90.84 111.93 (70)m + (7	177.71 34.36 0 -90.84 118.65 1)m + (72	34.36 0 -90.84 121.67		(68) (69) (70) (71) (72)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating (72)m= 123.69 Total interna (73)m= 398.28	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (1 121.66 ll gains = 396.32 as:	14.36 (Table 5 0 on (negation -90.84 able 5) 117.43	185.44 opendix 34.36 5a) 0 cive valu -90.84 111.68	171.41 L, equat 34.36 0 es) (Tab -90.84 107.95	158.22 ion L15 34.36 0 le 5) -90.84 102.7 (66) 324.13	13 or L1: 149.41 or L15a) 34.36 0 -90.84 98.23 m + (67)m 311.34	3a), also 147.34), also se 34.36 0 -90.84 103.95 1+(68)m+ 316.98	0 see Ta 152.56 ee Table 34.36 0 -90.84 105.98 + (69)m + (6	ble 5 163.68 5 34.36 0 -90.84 111.93 (70)m + (7 347.38	177.71 34.36 0 -90.84 118.65 1)m + (72 370.59	34.36 0 -90.84 121.67 m 387.93		(68) (69) (70) (71) (72)

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

Northoast a ou		1		1		1		l		1		7(75)
Northeast 0.9x	0.77	X	0.9	X	11.28	X	0.55	X	0.8] = 1	3.1	(75)
Northeast 0.9x	0.77	X	0.9	X	22.97	X	0.55	X	0.8] = 1	6.3	(75)
Northeast 0.9x	0.77	X	0.9	X	41.38	X	0.55	X	0.8] =	11.36	(75)
Northeast _{0.9x}	0.77	X	0.9	X	67.96	X	0.55	X	0.8] =	18.65	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.35	X	0.55	X	0.8	=	25.07	(75)
Northeast _{0.9x}	0.77	X	0.9	X	97.38	X	0.55	X	0.8] =	26.73	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.1	X	0.55	X	0.8	=	25	(75)
Northeast _{0.9x}	0.77	X	0.9	X	72.63	X	0.55	X	0.8	=	19.93	(75)
Northeast _{0.9x}	0.77	X	0.9	X	50.42	X	0.55	X	0.8	=	13.84	(75)
Northeast _{0.9x}	0.77	X	0.9	X	28.07	X	0.55	X	0.8	=	7.7	(75)
Northeast _{0.9x}	0.77	X	0.9	X	14.2	X	0.55	X	0.8	=	3.9	(75)
Northeast _{0.9x}	0.77	X	0.9	X	9.21	X	0.55	X	0.8	=	2.53	(75)
Southeast _{0.9x}	0.77	X	5.79	X	36.79	X	0.55	X	0.8	=	64.96	(77)
Southeast _{0.9x}	0.77	X	5.79	X	62.67	X	0.55	X	0.8	=	110.65	(77)
Southeast _{0.9x}	0.77	X	5.79	X	85.75	X	0.55	X	0.8	=	151.4	(77)
Southeast _{0.9x}	0.77	X	5.79	X	106.25	X	0.55	x	0.8	=	187.59	(77)
Southeast _{0.9x}	0.77	X	5.79	X	119.01	X	0.55	x	0.8	=	210.11	(77)
Southeast 0.9x	0.77	X	5.79	X	118.15	x	0.55	x	0.8	=	208.59	(77)
Southeast _{0.9x}	0.77	X	5.79	x	113.91	x	0.55	x	0.8] =	201.11	(77)
Southeast _{0.9x}	0.77	X	5.79	X	104.39	x	0.55	X	0.8] =	184.3	(77)
Southeast _{0.9x}	0.77	X	5.79	x	92.85	x	0.55	X	0.8] =	163.93	(77)
Southeast _{0.9x}	0.77	x	5.79	x	69.27	x	0.55	x	0.8] =	122.29	(77)
Southeast _{0.9x}	0.77	x	5.79	x	44.07	x	0.55	x	0.8] =	77.81	(77)
Southeast _{0.9x}	0.77	X	5.79	x	31.49	x	0.55	x	0.8] =	55.59	(77)
Northwest _{0.9x}	0.77	X	1.37	x	11.28	x	0.55	x	0.8] =	23.57	(81)
Northwest _{0.9x}	0.77	X	2.19	x	11.28	x	0.55	x	0.8] =	7.53	(81)
Northwest _{0.9x}	0.77	x	1.37	x	22.97	x	0.55	x	0.8	j =	47.97	(81)
Northwest 0.9x	0.77	x	2.19	x	22.97	x	0.55	x	0.8	j =	15.34	(81)
Northwest _{0.9x}	0.77	x	1.37	x	41.38	x	0.55	x	0.8] =	86.43	(81)
Northwest 0.9x	0.77	x	2.19	x	41.38	x	0.55	x	0.8	j =	27.63	(81)
Northwest _{0.9x}	0.77	x	1.37	x	67.96	x	0.55	x	0.8	j =	141.94	(81)
Northwest _{0.9x}	0.77	x	2.19	x	67.96	х	0.55	x	0.8	j =	45.38	(81)
Northwest 0.9x	0.77	x	1.37	x	91.35	x	0.55	х	0.8	j =	190.79	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.35	x	0.55	х	0.8	j =	61	(81)
Northwest _{0.9x}	0.77	x	1.37	x	97.38	х	0.55	х	0.8	j =	203.41	(81)
Northwest _{0.9x}	0.77	x	2.19	x	97.38	x	0.55	x	0.8	j =	65.03	(81)
Northwest _{0.9x}	0.77	x	1.37	x	91.1	x	0.55	x	0.8	j =	190.28	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.1	x	0.55	x	0.8	i =	60.84	(81)
Northwest _{0.9x}	0.77	X	1.37	X	72.63	X	0.55	x	0.8] =	151.7	(81)
Northwest _{0.9x}	0.77	X	2.19	X	72.63	X	0.55	x	0.8] =	48.5	(81)
Northwest _{0.9x}	0.77	X	1.37	X	50.42	X	0.55	X	0.8] =	105.31	(81)
_		1		1		1		I		1		_ ' '

Northwest 0.9x	0.77	x	2.1	9	X	50.42] x [0.55	X	0.8	=	33.67	(81)
Northwest 0.9x	0.77	x	1.3	57	x	28.07] x [0.55	x [0.8	=	58.62	(81)
Northwest 0.9x	0.77	X	2.1	9	X	28.07] x [0.55	x	0.8	=	18.74	(81)
Northwest 0.9x	0.77	X	1.3	57	x	14.2] x [0.55	x [0.8	=	29.65	(81)
Northwest 0.9x	0.77	х	2.1	9	x	14.2	_ x [0.55	x [0.8	=	9.48	(81)
Northwest 0.9x	0.77	х	1.3	37	x	9.21	x	0.55	x	0.8	=	19.25	(81)
Northwest 0.9x	0.77	Х	2.1	9	x	9.21	×	0.55	x	0.8	=	6.15	(81)
Solar gains ir	watts, ca	alculated	for eacl	n month	_	-	(83)m	= Sum(74)m	(82)m				
(83)m= 99.16	180.26	276.81	393.55	486.97	503.76	477.22	404.4	316.75	207.36	120.84	83.52		(83)
Total gains –	internal a	and solar	(84)m =	(73)m	+ (83)m	, watts						•	
(84)m= 497.43	576.58	660.73	757.48	830.68	827.88	788.57	721.4	643.94	554.74	491.43	471.45		(84)
7. Mean inte	rnal temp	perature	(heating	season)								
Temperature	e during h	neating p	eriods ir	the livi	ng area	from Tal	ble 9,	Th1 (°C)				21	(85)
Utilisation fa	ctor for g	ains for l	iving are	ea, h1,m	(see T	able 9a)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.96	0.87	0.69	0.49	0.35	0.4	0.66	0.93	0.99	1		(86)
Mean intern	al temper	ature in	living are	ea T1 (fo	ollow ste	eps 3 to 7	7 in Ta	able 9c)	•	•	•	•	
(87)m= 20.17		20.57	20.83	20.97	21	21	21	20.98	20.79	20.43	20.14		(87)
Temperature	during h	L	oriodo ir	root of	dwallin	g from To	hlo 0	Th2 (°C)		ļ.			
(88)m= 20.14		20.15	20.16	20.16	20.18	20.18	20.1		20.16	20.16	20.15		(88)
` ′		<u> </u>			<u> </u>			20.17	20.10	20.10	20.10		()
Utilisation fa	 	r			r `	1		1 0 50	Ι	1 000	Ι ,	1	(89)
(89)m= 0.99	0.98	0.95	0.84	0.64	0.42	0.29	0.33	0.59	0.9	0.98	1		(09)
Mean intern	al temper	1	the rest		ng T2 (1	eps 3		le 9c)			Ī	
(90)m= 19.04	19.27	19.61	19.98	20.13	20.17	20.18	20.1		19.93	19.43	19		(90)
									fLA = Livir	ng area ÷ (4) =	0.39	(91)
Mean_intern	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1 -	- fLA) × T2					
(92)m= 19.47	19.68	19.98	20.31	20.46	20.49	20.49	20.5	20.48	20.26	19.81	19.44		(92)
Apply adjust	ment to t	he mean	internal	temper	ature fr	om Table	4e, v	here appr	opriate		1	•	
(93)m= 19.47		19.98	20.31	20.46	20.49	20.49	20.5	20.48	20.26	19.81	19.44		(93)
8. Space he													
Set Ti to the the utilisatio					ed at s	tep 11 of	Table	9b, so tha	at Ti,m=((76)m an	d re-cald	culate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
Utilisation fa			•	iviay	J	1 oui	<u> </u>	<u>9 Ocp</u>	1 001	1107	Dec		
(94)m= 0.99	0.98	0.95	0.85	0.66	0.45	0.31	0.36	0.62	0.9	0.98	0.99		(94)
Useful gains	, hmGm	, W = (94	1)m x (84	4)m	!	·	!			!			
(95)m= 493.59	566.06	627.34	641.02	544.77	371.21	246.18	257.9	396.79	500.92	482.58	468.7		(95)
Monthly ave	rage 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 ra	te for me			erature,	Lm , W	=[(39)m	x [(93)m– (96)m]			•	
(97)m= 999.52		882.77	735.55	562.63	372.67	246.3	258.2		620.8	822.23	991.82		(97)
Space heati		r						-i	í - `	τ΄	1	Ī	
(98)m= 376.41	271.86	190.04	68.06	13.29	0	0	0	0	89.19	244.55	389.2		

	Total per year (kWh/year) = Sum(98) _{15,912} =	1642.61	(98)
Space heating requirement in kWh/m²/year	[]	23.12	` ☐ ₍₉₉₎
9b. Energy requirements – Community heating scheme			
This part is used for space heating, space cooling or water heating			
Fraction of space heat from secondary/supplementary heating (Tab	ole 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
The community scheme may obtain heat from several sources. The procedure allow includes boilers, heat pumps, geothermal and waste heat from power stations. See	•	e latter	
Fraction of heat from Community heat pump	··	1	(303a)
Fraction of heat from Community heat pump (Water)		0.8	(303a)
Fraction of community heat from heat source 2 (Water)		0.2	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community	heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Distribution loss factor (Table 12c) for community heating system (V	Vater)	1.05	(306)
Space heating	_	kWh/year	_ , _
Annual space heating requirement		1642.61	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1724.74	(307a)
Efficiency of secondary/supplementary heating system in % (from T	able 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating	Г	2027.04	7
Annual water heating requirement If DHW from community scheme:	L	2037.61	_
Water heat from CHP (Water)	(64) x (303a) x (305) x (306) =	1711.59	(310a)
Water heat from heat source 2 (Water)	(64) x (303a) x (305) x (306) =	427.9	(310b)
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	17.25	(313)
Electricity used for heat distribution (Water)	0.01 × [(307a)(307e) + (310a)(310e)] =	21.39	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from out	side	222.31	(330a)
warm air heating system fans		0	」 (330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	222.31	(331)
Energy for lighting (calculated in Appendix L)		314.43	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	<u> </u>	-576.34	(333)
Total delivered energy for all uses $(307) + (309) + (310) + (312) + (312)$	ـــــــــــــــــــــــــــــــــــــ	1685.13	(338)
(, , , , , , , , , , , , , , , , , , , ,		」 ` ′

12b. CO2 Emissions – Community heating	scheme				
		Energy kWh/year	Emission factor kg CO2/kWh	r Emissions kg CO2/year	
CO2 from other sources of space and wate Efficiency of heat source 1 (%)		two fuels repeat (363) to	(366) for the second fu	el 280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	= 319.69	(367)
Electrical energy for heat distribution	[((313) x	0.52	= 8.95	(372)
Water heating from separate community sy	stem				
CO2 from other sources of space and wat Efficiency of heat source 1 (%)		two fuels repeat (363) to	(366) for the second fu	zel 280	(367a)
Efficiency of heat source 2 (%)	If there is CHP using	two fuels repeat (363) to	(366) for the second fu	100	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0	= 317.26	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	= 222.08	(368)
Electrical energy for heat distribution	[1	(313) x	0.52	= 11.1	(372)
Total CO2 associated with community syste	ems (363)(366) + (368)(37	2)	= 879.08	(373)
CO2 associated with space heating (second	dary) (309) x	0	= 0	(374)
CO2 associated with water from immersion	heater or instantanee	ous heater (312) x	0.52	= 0	(375)
Total CO2 associated with space and wate	r heating (373) + (374) + (375) =		879.08	(376)
CO2 associated with electricity for pumps a	nd fans within dwellir	ng (331)) x	0.52	= 115.38	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	163.19	(379)
Energy saving/generation technologies (33 Item 1	3) to (334) as applica	ble	0.52 x 0.01 =	-299.12	(380)
Total CO2, kg/year	m of (376)(382) =			858.53	(383)
Dwelling CO2 Emission Rate (38	(3) ÷ (4) =			12.09	(384)
El rating (section 14)				90.09	(385)

User Details:	
	TRO016363
	ersion: 1.0.5.51
Property Address: Flat-202-GREEN	
Address:	
1. Overall dwelling dimensions:	
Ground floor	Volume(m³) = 136.19 (3a)
55.11 ()	130.19
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ $\underbrace{50.44}$ (4)	
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+(3n)	= 136.19 (5)
2. Ventilation rate: main secondary other total	m³ per hour
heating heating	
Trumber of children	0 (6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 =$	0 (6b)
Number of intermittent fans 0 × 10 =	0 (7a)
Number of passive vents 0 x 10 =	0 (7b)
Number of flueless gas fires 0 x 40 =	0 (7c)
Δ	ir changes per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$ $\div (5) = 0$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)	0 (8)
Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration [(9)-1]x0.	1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35	
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$	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	a 3 (17)
If based on air permeability value, then (18) = [(17) ÷ 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 (19)
Shelter factor $(20) = 1 - [0.075 \times (19)] =$	0.85 (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 D)ec
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	
	18

_	ation rate				r	i í	r` ´	` ´ 		0.14		7	
0.16 Calculate effec	0.16 ctive air c	0.16 change i	0.14 ate for t	0.14 he appli	0.12 cable ca	0.12 se	0.12	0.13	0.14	0.14	0.15]	
If mechanica		-										0.5	(23
If exhaust air he	at pump us	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recov	/ery: effici	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mecha	nical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)) ÷ 100]	
24a)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(24
b) If balance	d mecha	nical ve	ntilation	without	heat red	covery (I	ИV) (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 extr ı < 0.5 ×			•	•				.5 × (23b)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	ventilation n = 1, the			•	•				0.5]		•	•	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
Effective air	change r	ate - er	iter (24a) or (24k	o) or (24	c) or (24	d) in bo	x (25)	_		-	-	
25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
3. Heat losses	s and hea	at loss r	paramete	er:									
LEMENT	Gross area (s	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	〈)	k-value kJ/m²·		A X k kJ/K
oors	,				1.99	X	1	=	1.99	,			(2
Vindows Type	1				1.37	x1	/[1/(1.4)+	0.04] =	1.82				(2
/indows Type	2				4.65	x1	/[1/(1.4)+	0.04] =	6.16				(2
/indows Type	3				1.54	x1	/[1/(1.4)+	0.04] =	2.04				(2
/alls Type1	55.8		8.93		46.87	7 X	0.15	─	7.03			$\neg \vdash$	(2
/alls Type2	22.49	=	1.99		20.5	X	0.15	-	3.08	7 7		i ii	(2
otal area of e					78.29	9							(3
arty wall					9.64	x	0		0	п г		\neg	(3
arty floor					50.44							-	(3
arty ceiling					50.44	_						╡┝	(3
for windows and include the area					alue calcul		formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragrapl	 n 3.2	(`
abric heat los							(26)(30)) + (32) =				23.93	(3
eat capacity	2m = S(<i>F</i>	Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	18066.3	3 (3
hermal mass	paramet	er (TMF	P = Cm ÷	· TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(3
or design assess an be used instea				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridge	s : S (L)	x Y) cal	culated ı	using Ap	pendix l	<						10.71	(3
details of therma		ire not kn	own (36) =	0.05 x (3	1)				(0.0)				
otal fabric hea	at loss							(33) +	(36) =			34.64	(3
entilation hea									= 0.33 × (

(38)m= 12.4	12.25	12.11	11.39	11.25	10.53	10.53	10.39	10.82	11.25	11.54	11.82		(38)
. ,			11.55	11.25	10.55	10.55	10.59				11.02		(00)
(39)m= 47.04	46.89	46.75	46.04	45.89	45.18	45.18	45.03	45.46	45.89	46.18	46.47		
(00)										Sum(39) ₁	<u> </u>	46	(39)
Heat loss para	meter (l	HLP), W	m²K		Г	Г	1	(40)m	= (39)m ÷	(4)	_		
(40)m= 0.93	0.93	0.93	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.92		7(40)
Number of day	s in mo	nth (Tab	le 1a)					,	4verage =	Sum(40)₁	12 /12=	0.91	(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 hea	ting ene	rgy requi	irement:								kWh/yea	ar:	
Assumed occu	ıpancv.	N								1	.7		(42)
if TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.				()
if TFA £ 13.5 Annual average	,	ater usad	ae in litre	es per da	av Vd.av	erage =	(25 x N)	+ 36		74	.65		(43)
Reduce the annua	al average	hot water	usage by	5% if the a	welling is	designed t			se target o				(- /
not more that 125	, ,	,	, ,			<u> </u>							
Jan Hot water usage i	Feb	Mar dav for ea	Apr ach month	May Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m= 82.11	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11		
(11)	70.10	70.11	70.10	70.11	07.10	07.10	70.11			m(44) ₁₁₂ =		895.77	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	OTm / 3600	kWh/mon	th (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		_
If instantaneous v	vater heati	na at point	of use (no	hot water	· storage).	enter 0 in	boxes (46		Γotal = Su	m(45) ₁₁₂ =	= <u>L</u>	1174.5	(45)
(46)m= 18.27	15.98	16.48	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(46)
Water storage		1		1			1 .2.00	0		10.20			()
Storage volum	ne (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	_			•			, ,	\t-	· · 'O' i · · /	47)			
Otherwise if no Water storage		not wate	er (unis ir	iciudes i	nstantar	ieous co	ווסם ומוזונ	ers) ente	er o in (47)			
a) If manufact		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)) =		1	10		(50)
b) If manufactHot water stor			•								.02		(51)
If community h	•			`		,					.02		(-)
Volume factor			0.1							1.	.03		(52)
Temperature f							(4-)		>	0	0.6		(53)
Energy lost fro Enter (50) or		-	, KVVh/ye	ear			(47) x (51)) x (52) x (53) =		.03		(54) (55)
Water storage	. , .	•	for each	month			((56)m = (55) × (41)r	m		.03		(33)
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain												ίΗ	X 7
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
			!		!	!							

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 therm	ostat)											
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 23.26 22.51 23.26	22.51 23.26 (59)											
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m												
(61)m= 0 0 0 0 0 0 0 0 0 0 0	0 0 (61)											
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)$ m =	- (46)m + (57)m + (59)m + (61)m											
(62)m= 177.05 156.43 165.18 149.31 147.21 132.83 128.79 139.63 138.86 154.76	``` ``											
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution of the contr												
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	ation to water meating)											
(63)m= 0 0 0 0 0 0 0 0 0 0 0	0 0 (63)											
Output from water heater												
(64)m= 177.05 156.43 165.18 149.31 147.21 132.83 128.79 139.63 138.86 154.76	6 162.09 173.2											
Output from water heat												
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)n]												
(65)m= 84.71 75.35 80.76 74.65 74.79 69.17 68.66 72.27 71.18 77.3	78.9 83.43 (65)											
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is	from community heating											
5. Internal gains (see Table 5 and 5a):												
Metabolic gains (Table 5), Watts												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct	Nov Dec											
(66)m= 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15	85.15 85.15 (66)											
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m= 13.31 11.82 9.61 7.28 5.44 4.59 4.96 6.45 8.66 10.99	12.83 13.68 (67)											
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m= 148.38 149.92 146.04 137.78 127.35 117.55 111 109.46 113.34 121.6	132.03 141.83 (68)											
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m= 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52	31.52 31.52 (69)											
Pumps and fans gains (Table 5a)												
(70)m= 0 0 0 0 0 0 0 0 0 0	0 0 (70)											
Losses e.g. evaporation (negative values) (Table 5)												
(71)m= -68.12 -6	-68.12 -68.12 (71)											
	35.12											
Water heating gains (Table 5) (72)m= 113.86 112.13 108.55 103.68 100.52 96.07 92.29 97.14 98.86 103.9	109.59 112.14 (72)											
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m + (69)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m$												
(73)m= 324.09 322.41 312.75 297.28 281.86 266.76 256.8 261.6 269.41 285.04	302.99 316.19 (73)											
6. Solar gains:												
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the application of the solar flux from Table 6a and associated equations to convert to the application of the solar flux flux forms.												
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b	FF Gains Table 6c (W)											
Northeast 0.9x	0.8 = 16 (75)											
Northeast 0.9x 0.77 x 1.54 x 11.28 x 0.55 x	0.8 = 5.3 (75)											

Northeast 0.9-1			,		,		,						_
Northeast 0 sv	Northeast _{0.9x}	0.77	X	4.65	X	22.97	X	0.55	x	0.8	=	32.56	(75)
Northeast 0.9x	<u> </u>	0.77	X	1.54	X	22.97	X	0.55	x	0.8	=	10.78	(75)
Northeast 0.9x	<u> </u>	0.77	X	4.65	X	41.38	X	0.55	x	0.8	=	58.67	(75)
Northeast 0.0x	<u> </u>	0.77	X	1.54	X	41.38	X	0.55	X	8.0	=	19.43	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	67.96	X	0.55	X	8.0	=	96.35	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	67.96	X	0.55	x	0.8	=	31.91	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	91.35	X	0.55	x	0.8	=	129.52	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	91.35	X	0.55	x	0.8	=	42.89	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	97.38	X	0.55	х	0.8	=	138.08	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	97.38	X	0.55	x	0.8	=	45.73	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	91.1	X	0.55	x	0.8	=	129.17	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	91.1	X	0.55	x	0.8	=	42.78	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	x	72.63	X	0.55	x [0.8	=	102.98	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	72.63	X	0.55	x	0.8	=	34.1	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	50.42	X	0.55	x	0.8	=	71.49	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	x	50.42	X	0.55	x [0.8	=	23.68	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	x	28.07	X	0.55	x	0.8	=	39.8	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	28.07	X	0.55	x	0.8	=	13.18	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	x	14.2	X	0.55	x [0.8	=	20.13	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	14.2	X	0.55	x	0.8	=	6.67	(75)
Southwest0.9x	Northeast _{0.9x}	0.77	X	4.65	x	9.21	X	0.55	x	0.8	=	13.06	(75)
Southwest0.9x	Northeast _{0.9x}	0.77	X	1.54	X	9.21	X	0.55	x	0.8	=	4.33	(75)
Southwesto,9x	Southwest _{0.9x}	0.77	X	1.37	X	36.79]	0.55	x	0.8	=	30.74	(79)
Southwesto,9x	Southwest _{0.9x}	0.77	X	1.37	x	62.67]	0.55	x	0.8	=	52.36	(79)
Southwesto,9x	Southwest _{0.9x}	0.77	X	1.37	X	85.75]	0.55	x	0.8	=	71.64	(79)
Southwest0.9x	Southwest _{0.9x}	0.77	X	1.37	X	106.25]	0.55	x	0.8	= [88.77	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	x	119.01]	0.55	x	0.8	=	99.43	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	X	118.15]	0.55	x	0.8	=	98.71	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	X	113.91]	0.55	x	0.8	=	95.17	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	x	104.39]	0.55	x	0.8	=	87.22	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	X	92.85]	0.55	x	0.8	= [77.58	(79)
Southwest _{0.9x} 0.77 x 1.37 x 31.49 0.55 x 0.8 = 26.31 (79) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 (83) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest _{0.9x}	0.77	X	1.37	X	69.27]	0.55	x	0.8	=	57.87	(79)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 Total gains – internal and solar (84)m = (73)m + (83)m, watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest _{0.9x}	0.77	X	1.37	x	44.07]	0.55	x	0.8	=	36.82	(79)
(83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest _{0.9x}	0.77	X	1.37	X	31.49]	0.55	x	0.8	=	26.31	(79)
(83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)													
Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Solar gains in w	/atts, calcul	ated	for each mon	_		(83)n			•			
(84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)	` '						224	1.3 172.74	110.85	63.62	43.7		(83)
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)				` 	·		_					I	
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	(84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 (84)												
Utilisation factor for gains for living area, h1,m (see Table 9a)	7. Mean intern	al tempera	ture (heating seaso	on)								
	Temperature o	during heati	ng pe	eriods in the li	ving	area from Tal	ble 9	, Th1 (°C)				21	(85)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec					Ť							 I	
	Jan	Feb N	/lar	Apr Ma	y	Jun Jul	A	ug Sep	Oct	Nov	Dec		

(86)m=	0.99	0.99	0.97	0.89	0.73	0.52	0.38	0.43	0.68	0.93	0.99	0.99		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)					
(87)m=	20.2	20.34	20.55	20.81	20.95	20.99	21	21	20.98	20.78	20.45	20.18		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	20.14	20.14	20.14	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.15	20.15		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	ee Table	9a)						
(89)m=	0.99	0.98	0.96	0.86	0.67	0.46	0.31	0.35	0.61	0.9	0.98	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	19.08	19.28	19.59	19.94	20.12	20.17	20.17	20.17	20.15	19.92	19.46	19.06		(90)
									1	LA = Livin	g area ÷ (4) =	0.54	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	19.69	19.85	20.11	20.41	20.57	20.62	20.62	20.62	20.6	20.39	20	19.67		(92)
Apply	adjustn	nent to t	he mear	interna	l temper	ature fro	m Table	4e, whe	re appro	priate				
(93)m=	19.69	19.85	20.11	20.41	20.57	20.62	20.62	20.62	20.6	20.39	20	19.67		(93)
		•	uirement				44 6	T			70)			
				mperatu using Ta		ned at ste	ep 11 of	Table 9	o, so tha	t II,m=(/6)m an	d re-calc	culate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:		•								
(94)m=	0.99	0.98	0.95	0.87	0.7	0.49	0.35	0.39	0.65	0.91	0.98	0.99		(94)
	<u> </u>		<u>`</u>	4)m x (8	 	l								(0=)
(95)m=		410.25	441.6	448.06	388.48	270.06	181.51	189.79	286.72	359.13	358.91	357.09		(95)
(96)m=	4.3	4.9	6.5	perature 8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			<u> </u>		<u> </u>	Lm , W =		!		!				()
(97)m=	723.99	701.26	636.36	530.01	407.18	271.86	181.68	190.14	295.47	449.35	595.75	718.71		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	261.55	195.56	144.9	59	13.91	0	0	0	0	67.13	170.53	269.05		
								Tota	l per year	(kWh/year	·) = Sum(9	8) _{15,912} =	1181.63	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								23.43	(99)
9b. En	ergy rec	uiremer	nts – Cor	mmunity	heating	scheme	;							
						ing or wa					unity sch	neme.		¬
Fractio	n of spa	ice heat	from se	condary	/supplen	nentary l	heating (Table 1	1) '0' if n	one			0	(301)
Fractio	n of spa	ice heat	from co	mmunity	system (1 – (30	1) =						1	(302)
includes	boilers, h	eat pumps	s, geotherr	mal and wa	aste heat f	rces. The p from power				up to four (other heat	sources; tl		7(202-)
				ity heat									1	(303a)
				ity heat		,							0.8	(303a)
Fractio	Fraction of community heat from heat source 2 (Water) 0.2 (303b)													
Fractio	n of tota	al space	heat fro	m Comn	nunity he	eat pump)			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and	charging	method	l (Table	4c(3)) fo	r commu	unity hea	iting sys	tem			1	(305)

Distribution loss factor (Table 12c) for commu	ınity heating system		Г	1.05	(306)
Distribution loss factor (Table 12c) for commu)	L T	1.05](306)
Space heating	anity floating bystem (vvater	,	L	kWh/year	١
Annual space heating requirement			Г	1181.63	7
Space heat from Community heat pump		(98) x (304a) x	(305) x (306) =	1240.71	(307a)
Efficiency of secondary/supplementary heating	ng system in % (from Table	4a or Appen	dix E)	0	(308
Space heating requirement from secondary/s	supplementary system	(98) x (301) x 1	00 ÷ (308) =	0	(309)
Water heating Annual water heating requirement			[1825.34]
If DHW from community scheme: Water heat from CHP (Water)		(64) x (303a) x	(305) x (306) =	1533.28	(310a)
Water heat from heat source 2 (Water)		(64) x (303a) x	(305) x (306) =	383.32	(310b)
Electricity used for heat distribution	0.01 ×	: [(307a)(307	e) + (310a)(310e)] =	12.41	(313)
Electricity used for heat distribution (Water)	0.01 ×	: [(307a)(307	e) + (310a)(310e)] =	19.17	(313)
Cooling System Energy Efficiency Ratio				0	(314)
Space cooling (if there is a fixed cooling syste	em, if not enter 0)	= (107) ÷ (314)	=	0	(315)
Electricity for pumps and fans within dwelling mechanical ventilation - balanced, extract or			[157.84	(330a)
warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year		=(330a) + (330l	b) + (330g) =	157.84	(331)
Energy for lighting (calculated in Appendix L)				234.98	(332)
Electricity generated by PVs (Appendix M) (n	egative quantity)			-576.34	(333)
Total delivered energy for all uses (307) + (30	09) + (310) + (312) + (315) +	+ (331) + (33	32)(237b) =	1057.19	(338)
12b. CO2 Emissions – Community heating so					
	Ener kWh	gy /year	Emission factor E kg CO2/kWh	Emissions (g CO2/year	
CO2 from other sources of space and water the Efficiency of heat source 1 (%)	neating (not CHP) If there is CHP using two fuels r	repeat (363) to	(366) for the second fuel	280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 10	00 ÷ (367b) x	0.52 =	229.98	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	6.44	(372)
Water heating from separate community syst	em				
CO2 from other sources of space and water Efficiency of heat source 1 (%)	heating (not CHP) If there is CHP using two fuels r	repeat (363) to	(366) for the second fuel	280	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels r	repeat (363) to	(366) for the second fuel	100	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 10	00 ÷ (367b) x	0 =	284.21	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 10	00 ÷ (367b) x	0.52	198.94	(368)
Electrical energy for heat distribution	[(313) x		0.52	9.95	(372)

Total CO2 associated with community system	ns (363)(366) + (368)(372	2)	= [729.51	(373)
CO2 associated with space heating (secondary	ary) (309) x	0	= [0	(374)
CO2 associated with water from immersion h	eater or instantaneous heater (312) x	0.52	= [0	(375)
Total CO2 associated with space and water h	neating (373) + (374) + (375) =			729.51	(376)
CO2 associated with electricity for pumps and	d fans within dwelling (331)) x	0.52	= [81.92	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	= [121.95	(379)
Energy saving/generation technologies (333) Item 1	· ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	0.52 x 0.01 =		-299.12	(380)
Total CO2, kg/year	of (376)(382) =			634.26	(383)
Dwelling CO2 Emission Rate (383)	÷ (4) =			12.57	(384)
El rating (section 14)				91.09	(385)

Sasessor Name: Chris Hocknell Stroma Number: STR0016363 Software Version: Version: 1.0.5.51			l lser I)etails: _						
## Address : 1. Overall dwelling dimensions:		_	<u> </u>	Strom	_					
## Acade Section Control Contr	Software Name.		Property				ΞN	VEISIC	л. т.о.э.эт	
Arealmon Francis Fra	Address :		roporty	7 (44) 555	. r iai 00	7 0112				
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1e)+(1h) e)+(1e)+(1h) Total floor area TFA = (1a)+(1b)+(1e)+(1e)+(1e)+(1e)+(1e)+(1e)+(1e)+(1e	1. Overall dwelling dime	ensions:								
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n) T1,04 (4) T2,04 (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 191.81 (5) (5) (5) (70) (7)	0 15				1			٦		<u> </u>
Dwelling volume				71.04	(1a) x		2.7	(2a) =	191.81	(3a)
2. Ventilation rate: main heating heating heating heating	Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	71.04	(4)					
Number of chimneys	Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	191.81	(5)
Number of chimneys	2. Ventilation rate:									
Number of open flues			ry	other		total			m³ per hou	ır
Number of intermittent fans	Number of chimneys	0 + 0] + [0] = [0	X	40 =	0	(6a)
Number of passive vents	Number of open flues	0 + 0] + [0	= [0	x :	20 =	0	(6b)
Number of flueless gas fires 0	Number of intermittent fa	ins				0	X	10 =	0	(7a)
Air changes per hour	Number of passive vents	3			Ī	0	x	10 =	0	(7b)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	Number of flueless gas f	ires			Ī	0	x -	40 =	0	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					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 If no draught lobby, enter 0.05, else enter 0 Percentage of windows and doors draught stripped Window infiltration 0.25 - [0.2 × (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 3 (17) If based on air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered 2 (19) Shelter factor (20) = 1 - [0.075 × (19)] = 0.85 (20) 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								Air ch	nanges per ho	our
Number of storeys in the dwelling (ns) Additional infiltration (g)-1)x0.1 = 0 (10) (10)		•						÷ (5) =	0	(8)
Additional infiltration			ed to (17),	otherwise (continue fr	om (9) to	(16)			— (0)
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	· · · · · · · · · · · · · · · · · · ·	ne awaiing (na)					[(9)	-1]x0.1 =		_
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)	Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	ry constr	ruction	Σ()	•		=
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 Window infiltration Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 If based on air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20) 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			o the grea	ter wall are	a (after					
If no draught lobby, enter 0.05, else enter 0).1 (seal	ed), else	enter 0				0	(12)
Window infiltration 0.25 - [0.2 x (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 3 (17) If based on air permeability value, then (18) = [(17) + 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 2 (19) Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.13 (21) Infiltration rate modified for monthly wind speed 3 0.13 (21) Monthly average wind speed from Table 7 4 4.3 4.3 4.3 4.3 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4 4 4 4.3 3.8 3.7 4 4.3 4.5 4.7	•		`	,,						=
Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = O (16) Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = $[(17) + 20] + (8)$, otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - $[0.075 \times (19)] =$ O (18) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - $[0.075 \times (19)] =$ O (18) O (19) O (19) O (19) O (19) O (19) O (10) D (10) Air permeability value, then (18) = $[(17) + 20] + (8)$, otherwise (18) = (16) O (18) O (19)	Percentage of window	s and doors draught stripped							0	(14)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20) Infiltration rate incorporating shelter factor (21) = (18) x (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	Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
If based on air permeability value, then $(18) = [(17) + 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] =$ $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ 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 $(22a)m = (22)m \div 4$									0	(16)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used Number of sides sheltered Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85 (20)$ 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 $(22a)m = (22)m \div 4$	•	·	•	•	•	etre of e	envelope	area		╡``
Number of sides sheltered	•	•				is heina u	sed		0.15	(18)
Infiltration rate incorporating shelter factor			ne or a ac	gree an pe	measinty	io being a	50 0		2	(19)
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	Shelter factor			(20) = 1 -	[0.075 x (19)] =				→ ' '
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 3.7 4 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate incorpora	ting shelter factor		(21) = (18) x (20) =				0.13	(21)
Monthly average wind speed from Table 7 (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.7 4 4.3 4.5 4.7 Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate modified f	for monthly wind speed					•		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	Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind Factor (22a)m = (22)m ÷ 4	 		_		1				1	
	(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
	Wind Factor (22a)m = (2	2)m ÷ 4								
			0.95	0.92	11	1.08	1.12	1.18]	

Adjusted infiltra	ation rate ((allowi	ng for sh	nelter an	ıd wind s	speed) =	: (21a) x	(22a)m					
0.16	1 1	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effect		•	ate for t	he appli	cable ca	ise			•				
If mechanica			endix N (2	(3h) = (23;	a) × Fmv (6	eguation (N5)) othe	rwise (23h	n) = (23a)			0.5	(23a
If balanced with									(===;			0.5	==
a) If balance		-	-	_					2h\m + (23P) × [1 (23c)	77.35 ÷ 1001	(230
(24a)m= 0.28		0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	100]	(24a
b) If balance				<u> </u>			<u> </u>	1	ļ		0.20		•
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole h	ouse extra n < 0.5 × (2			•	•				5 × (23h))	!	l	
(24c)m = 0	0	0	0	0	0	0	0	0	0	0	0		(240
d) If natural	ventilation	or wh	ole hous	ke positi	ve input	ventilati	on from	I loft	<u>!</u>	<u>!</u>	ļ.		
,	n = 1, then			•	•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air	change ra	ite - en	iter (24a) or (24h	o) or (24	c) or (24	ld) in bo	x (25)				_	
(25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(25)
3. Heat losses	s and heat	t loss r	paramete	er:									
ELEMENT	Gross area (m		Openin m	ıgs	Net Ar A ,r		U-val W/m2		A X U (W/I	K)	k-value kJ/m²·l		A X k kJ/K
Doors	,	,			1.99		1	=	1.99	$\stackrel{\prime}{\Box}$			(26)
Windows Type	: 1				1.37	x1	/[1/(1.4)+	0.04] =	1.82	Ħ			(27)
Windows Type	2				0.9	x1	/[1/(1.4)+	0.04] =	1.19				(27)
Windows Type	3				5.79	x1	/[1/(1.4)+	0.04] =	7.68	=			(27)
Windows Type	4				2.19	x1	/[1/(1.4)+	0.04] =	2.9	Ħ			(27)
Walls Type1	75.26	\neg	15.73	3	59.53	=	0.15		8.93	=			(29)
Walls Type2	27.91	=	1.99	=	25.92	=	0.15	_	3.89	=		-	(29)
Total area of e		 n²			103.1	_	00		0.00				(31)
Party wall	,				10.99	=	0		0				(32)
Party floor					71.04	=						╡	(32
Party ceiling					71.04	_							(32)
* for windows and	roof window:	s. use e	ffective wi	ndow U-va			a formula 1	1/[(1/U-valu	ue)+0.041 a	L as aiven in	paragraph		(02)
** include the area							,		,	J	, .		
Fabric heat los	s, W/K = 5	3 (A x	U)				(26)(30) + (32) =				35.66	(33)
Heat capacity	Cm = S(A	xk)						((28).	(30) + (32	2) + (32a).	(32e) =	23186.5	(34)
Thermal mass	parameter	r (TMF	' = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assess can be used instead				construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
The support levides	es : S (L x	Y) cald	culated ι	using Ap	pendix I	K						12.73	(36)
mermai bridge	`												
if details of therma Total fabric hea	al bridging are	e not kn	own (36) =	= 0.05 x (3	11)			(00)	· (36) =			48.39	(37)

Ventila	tion hea	it loss ca	alculated	l monthly	y				(38)m	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	17.46	17.26	17.05	16.05	15.84	14.84	14.84	14.63	15.24	15.84	16.25	16.65		(38)
Heat tr	ansfer c	oefficier	nt, W/K	•	•	•	•	•	(39)m	= (37) + (38)m	•	'	
(39)m=	65.85	65.65	65.45	64.44	64.24	63.23	63.23	63.03	63.63	64.24	64.64	65.04		
Heat lo	ss para	meter (H		/m²K				•		Average = = (39)m ÷	Sum(39) ₁	12 /12=	64.39	(39)
(40)m=	0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.9	0.9	0.91	0.92		
Numbe	er of day	s in moi	nth (Tab	le 1a)		•			,	Average =	Sum(40) ₁	12 /12=	0.91	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
'				•	•			•	•		•	•	·	
4. Wa	iter heat	ing enei	rgy requi	irement:								kWh/ye	ear:	
Assum	ed occu	pancy, l	N								2	.27		(42)
if TF		9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.			l	,
								(25 x N)				3.14		(43)
			hot water person per					to achieve	a water us	se target o	f			
	Jan	Feb	Mar			Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea	Apr ach month	May Vd,m = fa				Sep	Oct	INOV	Dec		
(44)m=	96.95	93.43	89.9	86.38	82.85	79.32	79.32	82.85	86.38	89.9	93.43	96.95		
(1 1)	00.00	00.10	00.0	00.00	02.00	10.02	70.02	02.00	<u> </u>		m(44) ₁₁₂ =		1057.67	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	OTm / 3600			. ,			 ` ′
(45)m=	143.78	125.75	129.76	113.13	108.55	93.67	86.8	99.6	100.79	117.47	128.22	139.24		
lf instant	taneous w	ater heati	na at naint	of use (no	hot water	r storage)	enter O in	boxes (46		Γotal = Su	m(45) ₁₁₂ =	=	1386.77	(45)
1				·				` '	. , ,	47.00	10.00	00.00	1	(46)
(46)m= Water	21.57 storage	18.86 loss:	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.89		(46)
	_) includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	nunity h	eating a	ınd no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
			hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
	storage			6 4		(1.3.8./)	. /						ı	
•			eclared l		or is kno	wn (kvvr	1/day):					0		(48)
			m Table					(40) (40)				0		(49)
			storage eclared o	-		or is not		(48) x (49)) =		1	10		(50)
•			factor fr	-							0.	.02		(51)
If comr	munity h	eating s	ee secti	on 4.3										
		from Ta									1.	.03		(52)
•			m Table									.6		(53)
• • • • • • • • • • • • • • • • • • • •			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		.03		(54)
	. ,	54) in (5	•					(/50)	FE) (11)		1.	.03		(55)
1			culated f			ı		((56)m = (•	 	ı	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)

If cylinder contai	ns dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (1	111)] + (30	0), 0.00 (0	<i>i</i>)iii – (30)	iii wiieie (H11) IS Tro	m Append	lix H	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circu	it loss (ar	nual) fro	m Table	 e 3							0		(58)
Primary circu	`	,			59)m = (58) ÷ 36	65 × (41)	m				•	
(modified b	y factor f	rom Tabl	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss c	alculated	for each	month (61)m = ((60) ÷ 36	35 × (41))m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat red	quired for	water he	eating ca	alculated	for each	า month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 199.05	175.68	185.04	166.62	163.83	147.16	142.08	154.88	154.29	172.74	181.72	194.52		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negativ	e quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add addition	al lines if	FGHRS	and/or \	VWHRS	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= 199.05	175.68	185.04	166.62	163.83	147.16	142.08	154.88	154.29	172.74	181.72	194.52		
	•						Outp	out from w	ater heate	r (annual)₁	12	2037.61	(64)
Heat gains fro	om water	heating,	kWh/mo	onth 0.25	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m]	
(65)m= 92.03	81.75	87.37	80.41	80.31	73.94	73.08	77.34	76.31	83.28	85.43	90.52		(65)
include (57)m in cal	culation o	of (65)m	only if c	ylinder is	in the c	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal o	•										•		
Metabolic gai	· ·												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.56	+	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56		(66)
Lighting gains	s (calcula	ted in Ar	pendix	L. eguati	on L9 or	 · L9a). a	lso see	Table 5				ı	
(67)m= 17.8	15.81	12.86	9.74	7.28	6.14	6.64	i		44.74	17.17	18.3		(67)
Appliances g	ains (calc	ulated in	Annone				8.63	11.58	14.71	17.17			(67)
(68)m= 199.71	- ` 		Append	dix L, equ	uation L		ļ	<u> </u>	<u> </u>	17.17		•	(67)
	201.78	196.56	185.44	dix L, equ	uation L ²		ļ	<u> </u>	<u> </u>	177.71	190.9	']	(68)
Cooking gain			185.44	171.41	158.22	13 or L1: 149.41	3a), also 147.34	see Ta 152.56	ble 5 163.68	<u> </u>	190.9		, ,
Cooking gain (69)m= 34.36	s (calcula	ted in A	185.44	171.41	158.22 ion L15	13 or L1: 149.41	3a), also 147.34), also se	see Ta 152.56 ee Table	ble 5 163.68	177.71	190.9	 	, ,
(69)m= 34.36	s (calcula 34.36	ted in A ₁	185.44 opendix 34.36	171.41 L, equat	158.22	13 or L13 149.41 or L15a)	3a), also 147.34	see Ta 152.56	ble 5 163.68	<u> </u>		 	(68)
	s (calcula 34.36	ted in A ₁	185.44 opendix 34.36	171.41 L, equat	158.22 ion L15	13 or L13 149.41 or L15a)	3a), also 147.34), also se	see Ta 152.56 ee Table	ble 5 163.68	177.71		 	(68)
(69)m= 34.36 Pumps and fa (70)m= 0	s (calcula 34.36 ans gains 0	ted in A _l 34.36 (Table 5	185.44 opendix 34.36 5a)	171.41 L, equat 34.36	158.22 ion L15 34.36	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69)
(69)m= 34.36 Pumps and fa	s (calcula 34.36 ans gains 0	ted in A _l 34.36 (Table 5	185.44 opendix 34.36 5a)	171.41 L, equat 34.36	158.22 ion L15 34.36	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e	s (calcula 34.36 ans gains 0 vaporatio	34.36 (Table 5 0 on (negat	185.44 opendix 34.36 oa) o tive valu	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5)	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69) (70)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (T	34.36 (Table 5 0 on (negat	185.44 opendix 34.36 oa) o tive valu	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5)	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69) (70)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (T	117.43	185.44 opendix 34.36 5a) 0 tive valu -90.84	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5) -90.84	13 or L1; 149.41 or L15a) 34.36 0	3a), also 147.34), also se 34.36 0 -90.84	34.36 0 see Table 34.36 0 -90.84	ble 5 163.68 5 34.36 0 -90.84	177.71 34.36 0 -90.84	34.36 0 -90.84		(68) (69) (70) (71)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating (72)m= 123.69	s (calcula 34.36 ans gains 0 vaporation -90.84 g gains (Tal.66 121.66	117.43	185.44 opendix 34.36 5a) 0 tive valu -90.84	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5) -90.84	13 or L13 149.41 or L15a) 34.36 0 -90.84	3a), also 147.34), also se 34.36 0 -90.84	34.36 0 see Table 34.36 0 -90.84	ble 5 163.68 5 34.36 0 -90.84	177.71 34.36 0 -90.84	34.36 0 -90.84		(68) (69) (70) (71)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating (72)m= 123.69 Total internal	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (Tal.66 121.66 1 gains =	117.43	185.44 opendix 34.36 5a) 0 ciive valu -90.84	171.41 L, equat 34.36 0 es) (Tab -90.84	158.22 ion L15 34.36 0 le 5) -90.84	13 or L1; 149.41 or L15a) 34.36 0 -90.84 98.23 m + (67)m	3a), also 147.34), also se 34.36 0 -90.84 103.95	o see Ta 152.56 ee Table 34.36 0 -90.84 105.98 + (69)m +	ble 5 163.68 5 34.36 0 -90.84 111.93 (70)m + (7	177.71 34.36 0 -90.84 118.65 1)m + (72	34.36 0 -90.84 121.67		(68) (69) (70) (71) (72)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating (72)m= 123.69 Total interna (73)m= 398.28	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (1 121.66 ll gains = 396.32 as:	14.36 (Table 5 0 on (negation -90.84 able 5) 117.43	185.44 opendix 34.36 5a) 0 cive valu -90.84 111.68	171.41 L, equat 34.36 0 es) (Tab -90.84 107.95	158.22 ion L15 34.36 0 le 5) -90.84 102.7 (66) 324.13	13 or L1: 149.41 or L15a) 34.36 0 -90.84 98.23 m + (67)m 311.34	3a), also 147.34), also se 34.36 0 -90.84 103.95 1+(68)m+ 316.98	0 see Ta 152.56 ee Table 34.36 0 -90.84 105.98 + (69)m + (6	ble 5 163.68 5 34.36 0 -90.84 111.93 (70)m + (7 347.38	177.71 34.36 0 -90.84 118.65 1)m + (72 370.59	34.36 0 -90.84 121.67 m 387.93		(68) (69) (70) (71) (72)

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

Northoast a ou		1		1		1		l		1		7(75)
Northeast 0.9x	0.77	X	0.9	X	11.28	X	0.55	X	0.8] = 1	3.1	(75)
Northeast 0.9x	0.77	X	0.9	X	22.97	X	0.55	X	0.8] = 1	6.3	(75)
Northeast 0.9x	0.77	X	0.9	X	41.38	X	0.55	X	0.8] =	11.36	(75)
Northeast _{0.9x}	0.77	X	0.9	X	67.96	X	0.55	X	0.8] =	18.65	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.35	X	0.55	X	0.8	=	25.07	(75)
Northeast _{0.9x}	0.77	X	0.9	X	97.38	X	0.55	X	0.8] =	26.73	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.1	X	0.55	X	0.8	=	25	(75)
Northeast _{0.9x}	0.77	X	0.9	X	72.63	X	0.55	X	0.8	=	19.93	(75)
Northeast _{0.9x}	0.77	X	0.9	X	50.42	X	0.55	X	0.8	=	13.84	(75)
Northeast _{0.9x}	0.77	X	0.9	X	28.07	X	0.55	X	0.8	=	7.7	(75)
Northeast _{0.9x}	0.77	X	0.9	X	14.2	X	0.55	X	0.8	=	3.9	(75)
Northeast _{0.9x}	0.77	X	0.9	X	9.21	X	0.55	X	0.8	=	2.53	(75)
Southeast _{0.9x}	0.77	X	5.79	X	36.79	X	0.55	X	0.8	=	64.96	(77)
Southeast _{0.9x}	0.77	X	5.79	X	62.67	X	0.55	X	0.8	=	110.65	(77)
Southeast _{0.9x}	0.77	X	5.79	X	85.75	X	0.55	X	0.8	=	151.4	(77)
Southeast _{0.9x}	0.77	X	5.79	X	106.25	X	0.55	x	0.8	=	187.59	(77)
Southeast _{0.9x}	0.77	X	5.79	X	119.01	X	0.55	x	0.8	=	210.11	(77)
Southeast 0.9x	0.77	X	5.79	X	118.15	x	0.55	x	0.8	=	208.59	(77)
Southeast _{0.9x}	0.77	X	5.79	x	113.91	x	0.55	x	0.8] =	201.11	(77)
Southeast _{0.9x}	0.77	X	5.79	X	104.39	x	0.55	X	0.8] =	184.3	(77)
Southeast _{0.9x}	0.77	X	5.79	x	92.85	x	0.55	X	0.8] =	163.93	(77)
Southeast _{0.9x}	0.77	x	5.79	x	69.27	x	0.55	x	0.8] =	122.29	(77)
Southeast _{0.9x}	0.77	x	5.79	x	44.07	x	0.55	x	0.8] =	77.81	(77)
Southeast _{0.9x}	0.77	X	5.79	x	31.49	x	0.55	x	0.8] =	55.59	(77)
Northwest _{0.9x}	0.77	X	1.37	x	11.28	x	0.55	x	0.8] =	23.57	(81)
Northwest _{0.9x}	0.77	X	2.19	x	11.28	x	0.55	x	0.8] =	7.53	(81)
Northwest _{0.9x}	0.77	x	1.37	x	22.97	x	0.55	x	0.8	j =	47.97	(81)
Northwest 0.9x	0.77	x	2.19	x	22.97	x	0.55	x	0.8	j =	15.34	(81)
Northwest _{0.9x}	0.77	x	1.37	x	41.38	x	0.55	x	0.8] =	86.43	(81)
Northwest 0.9x	0.77	x	2.19	x	41.38	x	0.55	x	0.8	j =	27.63	(81)
Northwest _{0.9x}	0.77	x	1.37	x	67.96	x	0.55	x	0.8	j =	141.94	(81)
Northwest _{0.9x}	0.77	x	2.19	x	67.96	х	0.55	x	0.8	j =	45.38	(81)
Northwest 0.9x	0.77	x	1.37	x	91.35	x	0.55	х	0.8	j =	190.79	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.35	x	0.55	х	0.8	j =	61	(81)
Northwest _{0.9x}	0.77	x	1.37	x	97.38	х	0.55	х	0.8	j =	203.41	(81)
Northwest _{0.9x}	0.77	x	2.19	x	97.38	x	0.55	x	0.8	j =	65.03	(81)
Northwest _{0.9x}	0.77	x	1.37	x	91.1	x	0.55	x	0.8	j =	190.28	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.1	x	0.55	x	0.8	i =	60.84	(81)
Northwest _{0.9x}	0.77	X	1.37	X	72.63	X	0.55	x	0.8] =	151.7	(81)
Northwest _{0.9x}	0.77	X	2.19	X	72.63	X	0.55	x	0.8] =	48.5	(81)
Northwest _{0.9x}	0.77	X	1.37	X	50.42	X	0.55	X	0.8] =	105.31	(81)
_		1		1		1		I		1		_ ' '

Northwest 0.9x	0.77	x	2.1	9	X	50.42	_ x [0.55	х	8.0	=	33.67	(81)
Northwest 0.9x	0.77	x	1.3	37	x	28.07	x		0.55	x	0.8	=	58.62	(81)
Northwest 0.9x	0.77	x	2.1	9	x	28.07	_ x [0.55	x	0.8	=	18.74	(81)
Northwest 0.9x	0.77	x	1.3	37	x	14.2	x [0.55	x	0.8	=	29.65	(81)
Northwest 0.9x	0.77	X	2.1	9	x	14.2	x		0.55	x	0.8	=	9.48	(81)
Northwest 0.9x	0.77	×	1.3	37	x	9.21	×		0.55	x	0.8		19.25	(81)
Northwest 0.9x	0.77	X	2.1	9	х 🗔	9.21	x		0.55	x	0.8	=	6.15	(81)
Solar gains in	n watts, ca	alculated	l for eacl	h month			(83)m	= Sı	um(74)m .	(82)m				
(83)m= 99.16	180.26	276.81	393.55	486.97	503.76	477.22	404.	.43	316.75	207.36	120.84	83.52		(83)
Total gains –	internal a	and solar	(84)m =	(73)m	+ (83)n	n , watts						_	•	
(84)m= 497.43	3 576.58	660.73	757.48	830.68	827.88	788.57	721.	.41	643.94	554.74	491.43	471.45		(84)
7. Mean inte	ernal temp	perature	(heating	season)									
Temperatur	e during h	neating p	eriods ir	n the livii	ng area	from Ta	ble 9,	Th	1 (°C)				21	(85)
Utilisation fa	actor for g	ains for l	living are	ea, h1,m	(see T	able 9a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.96	0.87	0.69	0.49	0.35	0.4	4	0.66	0.93	0.99	1		(86)
Mean intern	al temper	ature in	living are	ea T1 (fo	ollow st	ens 3 to	7 in T	able	e 9c)					
(87)m= 20.17		20.57	20.83	20.97	21	21	21		20.98	20.79	20.43	20.14		(87)
	-		!d!.		-l 11:	f	-1-1- 0		-0 (%0)		!	l		
Temperatur (88)m= 20.14		20.15	20.16	20.16	20.18	20.18	20.	Ė	12 (°C) 20.17	20.16	20.16	20.15		(88)
` ′	-					ļ		10	20.17	20.10	20.10	20.15		(00)
Utilisation fa		1			· `	1	T	. 1			T		İ	(00)
(89)m= 0.99	0.98	0.95	0.84	0.64	0.42	0.29	0.3	3	0.59	0.9	0.98	1		(89)
Mean intern	al temper	ature in	the rest	of dwelli	ng T2	(follow ste	eps 3	to 7	7 in Tabl	e 9c)			•	
(90)m= 19.04	19.27	19.62	19.98	20.13	20.17	20.18	20.1	18	20.16	19.93	19.43	19		(90)
									f	LA = Livir	ng area ÷ (4	4) =	0.39	(91)
Mean intern	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1 -	– fL	A) × T2					
(92)m= 19.47	19.68	19.98	20.31	20.46	20.49	20.49	20.	.5	20.48	20.26	19.82	19.44		(92)
Apply adjus	tment to t	he mean	internal	temper	ature fi	om Table	4e, v	whe	re appro	priate				
(93)m= 19.47	19.68	19.98	20.31	20.46	20.49	20.49	20.	.5	20.48	20.26	19.82	19.44		(93)
8. Space he	eating requ	uirement												
Set Ti to the					ed at s	tep 11 of	Table	e 9b	o, so tha	t Ti,m=(76)m an	d re-cald	culate	
the utilisatio	1				1	Lul	Ι		0	0-4	Nan			
Jan Utilisation fa		Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(94)m= 0.99	0.98	0.95	0.85	0.66	0.45	0.31	0.3	16	0.62	0.9	0.98	0.99		(94)
Useful gains					0.40	0.01	0.0		0.02	0.0	0.00	0.00		(= -)
(95)m= 493.59		627.32	640.93	544.61	371.07	246.09	257.	.83	396.66	500.87	482.57	468.69		(95)
Monthly ave					<u> </u>	1	1					L	1	• •
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.	.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	ite for me	an intern	al tempe	erature,	Lm , W	'=[(39)m	x [(93	 3)m-	– (96)m]	1	ı	ı	
(97)m= 999.17	_	882.46	735.27	562.42	372.52		258.	_	405.67	620.58	821.93	991.47		(97)
Space heat	ing require	ement fo	r each n	nonth, k	Nh/mo	nth = 0.02	24 x [(97)	m – (95)m] x (4	1)m		•	
(98)m= 376.1	271.64	189.83	67.93	13.25	0	0	0		0	89.06	244.34	388.94		

	Total per year (kWh/year) = Sum(98) _{15,912} =	1641.14	(98)
Space heating requirement in kWh/m²/year	Ī	23.1	(99)
9b. Energy requirements – Community heating scheme			
This part is used for space heating, space cooling or water heating Fraction of space heat from secondary/supplementary heating (Tal		0	(301)
Fraction of space heat from community system 1 – (301) =	, 	1	」 [302]
The community scheme may obtain heat from several sources. The procedure allow	L ws for CHP and up to four other heat sources; the	e latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See Fraction of heat from Community heat pump	Appendix C.	1	(303a)
Fraction of heat from Community heat pump (Water)		0.8	(303a)
Fraction of community heat from heat source 2 (Water)	Ī	0.2	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community	y heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Distribution loss factor (Table 12c) for community heating system (Water)	1.05	(306)
Space heating		kWh/year	
Annual space heating requirement		1641.14	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1723.2	(307a)
Efficiency of secondary/supplementary heating system in % (from	Table 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement	Г	2037.61	٦
If DHW from community scheme:	L	2007.01	_
Water heat from CHP (Water)	(64) x (303a) x (305) x (306) =	1711.59	(310a)
Water heat from heat source 2 (Water)	(64) x (303a) x (305) x (306) =	427.9	(310b)
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	17.23	(313)
Electricity used for heat distribution (Water)	0.01 × [(307a)(307e) + (310a)(310e)] =	21.39	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from our	tside T	222.31	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	222.31	(331)
Energy for lighting (calculated in Appendix L)	ļ	314.43	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	Ţ	-576.34	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + ((315) + (331) + (332)(237b) =	1683.59	(338)

12b. CO2 Emissions – Community heating	g scheme				
		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and wat Efficiency of heat source 1 (%)		g two fuels repeat (363) to	o (366) for the second fu	el 280	(367a)
CO2 associated with heat source 1	[(307b)+	(310b)] x 100 ÷ (367b) x	0.52	= 319.41	(367)
Electrical energy for heat distribution		[(313) x	0.52	= 8.94	(372)
Water heating from separate community s	ystem				
CO2 from other sources of space and water Efficiency of heat source 1 (%)) g two fuels repeat (363) to	o (366) for the second fu	el 280	(367a)
Efficiency of heat source 2 (%)	If there is CHP using	g two fuels repeat (363) to	o (366) for the second fu	el 100	(367b)
CO2 associated with heat source 1	[(307b)+	(310b)] x 100 ÷ (367b) x	0	= 317.26	(367)
CO2 associated with heat source 2	[(307b)+	(310b)] x 100 ÷ (367b) x	0.52	= 222.08	(368)
Electrical energy for heat distribution		[(313) x	0.52	= 11.1	(372)
Total CO2 associated with community sys	tems	(363)(366) + (368)(37	72)	878.79	(373)
CO2 associated with space heating (seco	ndary)	(309) x	0	= 0	(374)
CO2 associated with water from immersion	n heater or instantane	eous heater (312) x	0.52	= 0	(375)
Total CO2 associated with space and wat	er heating	(373) + (374) + (375) =		878.79	(376)
CO2 associated with electricity for pumps	and fans within dwelli	ng (331)) x	0.52	= 115.38	(378)
CO2 associated with electricity for lighting		(332))) x	0.52	= 163.19	(379)
Energy saving/generation technologies (3 Item 1	33) to (334) as applica	able	0.52 x 0.01 =	-299.12	(380)
Total CO2, kg/year	um of (376)(382) =			858.23	(383)
Dwelling CO2 Emission Rate	883) ÷ (4) =			12.08	(384)
El rating (section 14)				90.09	(385)

		l Isar I	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	- 036 FL	Strom Softwa					016363 on: 1.0.5.51	
	F	Property	Address	: Flat-30	2-GREE	EN			
Address :									
Overall dwelling dime	ensions:	Δro	a(m²)		Δν Ηο	ight(m)		Volume(m ³	3)
Ground floor				(1a) x		2.7	(2a) =	136.19) (3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1			(4)			」 ` ′		
Dwelling volume	=, (, (, (,(.	,	50.44	J)+(3c)+(3c	d)+(3e)+	(3n) =	120.40	7(5)
				(64)*(65) · (00) · (00	a) · (00) ·	(011)	136.19	(5)
2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	ır
Number of chimneys	heating heating beauting heating	_ _ + _	0	7 = [0	x -	40 =	0	(6a)
Number of open flues	0 + 0	╣ + ├	0	」	0	x	20 =	0	(6b)
Number of intermittent fa			U	J <u>L</u>			10 =		╡``
				L	0		10 =	0	(7a)
Number of passive vents				Ļ	0		40 =	0	(7b)
Number of flueless gas f	ires				0	X 4	40 =	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a)+(7b)+	(7c) =	Г	0		÷ (5) =	0	(8)
If a pressurisation test has b	een carried out or is intended, procee	ed to (17),	otherwise o	continue fr	om (9) to				
Number of storeys in t	he dwelling (ns)							0	(9)
Additional infiltration	OF for atoal or timber frame a	r 0 25 fo	r maaan	m, const	ruotion	[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o resent, use the value corresponding t			•	uction			0	(11)
deducting areas of opening	ngs); if equal user 0.35								_
•	floor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0 s and doors draught stripped							0	(13)
Window infiltration	s and doors draught simpped		0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(14)
Infiltration rate			(8) + (10)	+ (11) + (1	- 12) + (13) ·	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic metro	es per ho	our per s	quare m	etre of e	envelope	area	3	(17)
If based on air permeabi	lity value, then (18) = [(17) ÷ 20]+	(8), otherw	rise (18) = ((16)				0.15	(18)
	es if a pressurisation test has been do	ne or a de	gree air pe	rmeability	is being u	sed			_
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0 075 x (1	19)1 =			2	(19)
Infiltration rate incorpora	ting shelter factor		(21) = (18		.0/]			0.85	(20)
Infiltration rate modified f	•		(= -) (, (==,				0.13	(21)
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind sp	1 ' 1 ' 1		<u> </u>	· ·	•		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		
W. 15 ((05) (5	0) 4	•	•	•	•	•	•	•	
Wind Factor (22a)m = $(2^{23})^{m}$		0.05	T 0.00		1 100	1 40	4.40	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		

_	ation rate				r	i í	r` ´	` ´ 		0.44		7	
0.16 Calculate effec	0.16 ctive air c	0.16 change i	0.14 ate for t	0.14 he appli	0.12 cable ca	0.12 se	0.12	0.13	0.14	0.14	0.15]	
If mechanica		-										0.5	(23
If exhaust air he	at pump us	sing Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat recov	/ery: effici	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				77.35	(23
a) If balance	d mecha	nical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2	2b)m + (2	23b) × [1 – (23c)) ÷ 100]	
24a)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(24
b) If balance	d mecha	nical ve	ntilation	without	heat red	covery (I	ИV) (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 extr ı < 0.5 ×			•	•				.5 × (23b)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural v	ventilation n = 1, the			•	•				0.5]		•	•	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
Effective air	change r	ate - er	iter (24a) or (24k	o) or (24	c) or (24	d) in bo	x (25)	_		-	-	
25)m= 0.28	0.27	0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
3. Heat losses	s and hea	at loss r	paramete	er:									
LEMENT	Gross area (s	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/ł	〈)	k-value kJ/m²·		A X k kJ/K
oors	,				1.99	X	1	=	1.99	,			(2
Vindows Type	1				1.37	x1	/[1/(1.4)+	0.04] =	1.82				(2
/indows Type	2				4.65	x1	/[1/(1.4)+	0.04] =	6.16				(2
/indows Type	3				1.54	x1	/[1/(1.4)+	0.04] =	2.04				(2
/alls Type1	55.8		8.93		46.87	7 X	0.15	─	7.03			$\neg \vdash$	(2
/alls Type2	22.49	=	1.99		20.5	X	0.15	-	3.08	7 7		i ii	(2
otal area of e					78.29	9							(3
arty wall					9.64	x	0		0	п г		\neg	(3
arty floor					50.44							-	(3
arty ceiling					50.44	_						╡┝	(3
for windows and include the area					alue calcul		formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragrapl	 n 3.2	(`
abric heat los							(26)(30)) + (32) =				23.93	(3
eat capacity	2m = S(<i>F</i>	Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	18066.3	3 (3
hermal mass	paramet	er (TMF	P = Cm ÷	· TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(3
or design assess an be used instea				construct	ion are no	t known pi	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridge	s : S (L)	x Y) cal	culated ı	using Ap	pendix l	<						10.71	(3
details of therma		ire not kn	own (36) =	0.05 x (3	1)				(0.0)				
otal fabric hea	at loss							(33) +	(36) =			34.64	(3
entilation hea									= 0.33 × (

(38)m= 12.4	12.25	12.11	11.39	11.25	10.53	10.53	10.39	10.82	11.25	11.54	11.82		(38)
. ,			11.55	11.25	10.55	10.55	10.59				11.02		(00)
Heat transfer (39)m= 47.04	46.89	46.75	46.04	45.89	45.18	45.18	45.03	45.46	45.89	46.18	46.47		
(00)										Sum(39) ₁	<u> </u>	46	(39)
Heat loss para	meter (l	HLP), W	m²K		Г	Г	1	(40)m	= (39)m ÷	(4)	_		_
(40)m= 0.93	0.93	0.93	0.91	0.91	0.9	0.9	0.89	0.9	0.91	0.92	0.92		7(40)
Number of day	s in mo	nth (Tab	le 1a)					,	4verage =	Sum(40)₁	12 /12=	0.91	(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 hea	ting ene	rgy requi	irement:								kWh/yea	ar:	
Assumed occu	ıpancv.	N								1	.7		(42)
if TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.				()
if TFA £ 13.5 Annual average	,	ater usad	ge in litre	es per da	av Vd.av	erage =	(25 x N)	+ 36		74	.65		(43)
Reduce the annua	al average	hot water	usage by	5% if the a	welling is	designed t			se target o				(- /
not more that 125	, ,	,	, ,			<u> </u>							
Jan Hot water usage i	Feb	Mar dav for ea	Apr ach month	May Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m= 82.11	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11		
(11)	70.10	70.11	70.10	70.11	07.10	07.10	70.11			m(44) ₁₁₂ =		895.77	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	OTm / 3600	kWh/mon	th (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		_
If instantaneous v	vater heati	na at point	of use (no	hot water	· storage).	enter 0 in	boxes (46		Γotal = Su	m(45) ₁₁₂ =	= <u>L</u>	1174.5	(45)
(46)m= 18.27	15.98	16.48	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(46)
Water storage		1		1			1 .2.00	0		10.20			()
Storage volum	ne (litres)) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	_			•			, ,	\t-	· · 'O' i · · /	47)			
Otherwise if no Water storage		not wate	er (unis ir	iciudes i	nstantar	ieous co	ווסם ומוזונ	ers) ente	er o in (47)			
a) If manufact		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)) =		1	10		(50)
b) If manufactHot water stor			•								.02		(51)
If community h	•			`		,					.02		(-)
Volume factor			0.1							1.	.03		(52)
Temperature f							(4-)		>	0	0.6		(53)
Energy lost fro Enter (50) or		-	, KVVh/ye	ear			(47) x (51)) x (52) x (53) =	-	.03		(54) (55)
Water storage	. , .	•	for each	month			((56)m = (55) × (41)r	m		.03		(33)
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain												ίΗ	X 7
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
			!		!	!							

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 therm	ostat)
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 23.26 22.51 23.26	22.51 23.26 (59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0 0	0 0 (61)
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)$ m =	- (46)m + (57)m + (59)m + (61)m
(62)m= 177.05 156.43 165.18 149.31 147.21 132.83 128.79 139.63 138.86 154.76	``` ``
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution of the contr	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	ation to water meating)
(63)m= 0 0 0 0 0 0 0 0 0 0 0	0 0 (63)
Output from water heater	
(64)m= 177.05 156.43 165.18 149.31 147.21 132.83 128.79 139.63 138.86 154.76	6 162.09 173.2
Output from water heat	
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)n	
(65)m= 84.71 75.35 80.76 74.65 74.79 69.17 68.66 72.27 71.18 77.3	78.9 83.43 (65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is	from community heating
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct	Nov Dec
(66)m= 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15	85.15 85.15 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 13.31 11.82 9.61 7.28 5.44 4.59 4.96 6.45 8.66 10.99	12.83 13.68 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 148.38 149.92 146.04 137.78 127.35 117.55 111 109.46 113.34 121.6	132.03 141.83 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52	31.52 31.52 (69)
Pumps and fans gains (Table 5a)	
(70)m= 0 0 0 0 0 0 0 0 0 0	0 0 (70)
Losses e.g. evaporation (negative values) (Table 5)	
(71)m= -68.12 -6	-68.12 -68.12 (71)
	35.12
Water heating gains (Table 5) (72)m= 113.86 112.13 108.55 103.68 100.52 96.07 92.29 97.14 98.86 103.9	109.59 112.14 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m + (69)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m + (60)m$	
(73)m= 324.09 322.41 312.75 297.28 281.86 266.76 256.8 261.6 269.41 285.04	302.99 316.19 (73)
6. Solar gains:	
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the application of the solar flux from Table 6a and associated equations to convert to the application of the solar flux flux forms.	
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b	FF Gains Table 6c (W)
Northeast 0.9x	0.8 = 16 (75)
Northeast 0.9x 0.77 x 1.54 x 11.28 x 0.55 x	0.8 = 5.3 (75)

Northeast 0.9-1			,		,		,						_
Northeast 0 sv	Northeast _{0.9x}	0.77	X	4.65	X	22.97	X	0.55	x	0.8	=	32.56	(75)
Northeast 0.9x	<u> </u>	0.77	X	1.54	X	22.97	X	0.55	x	0.8	=	10.78	(75)
Northeast 0.9x	<u> </u>	0.77	X	4.65	X	41.38	X	0.55	x	0.8	=	58.67	(75)
Northeast 0.0x	<u> </u>	0.77	X	1.54	X	41.38	X	0.55	X	8.0	=	19.43	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	67.96	X	0.55	x	8.0	=	96.35	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	67.96	X	0.55	x	0.8	=	31.91	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	91.35	X	0.55	x	0.8	=	129.52	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	91.35	X	0.55	x	0.8	=	42.89	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	97.38	X	0.55	х	0.8	=	138.08	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	97.38	X	0.55	x	0.8	=	45.73	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	91.1	X	0.55	x	0.8	=	129.17	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	91.1	X	0.55	x	0.8	=	42.78	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	x	72.63	X	0.55	x [0.8	=	102.98	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	72.63	X	0.55	x	0.8	=	34.1	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	X	50.42	X	0.55	x	0.8	=	71.49	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	x	50.42	X	0.55	x [0.8	=	23.68	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	x	28.07	X	0.55	x	0.8	=	39.8	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	28.07	X	0.55	x	0.8	=	13.18	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	4.65	x	14.2	X	0.55	x [0.8	=	20.13	(75)
Northeast 0.9x	Northeast _{0.9x}	0.77	X	1.54	X	14.2	X	0.55	x	0.8	=	6.67	(75)
Southwest0.9x	Northeast _{0.9x}	0.77	X	4.65	x	9.21	X	0.55	x	0.8	=	13.06	(75)
Southwest0.9x	Northeast _{0.9x}	0.77	X	1.54	X	9.21	X	0.55	x	0.8	=	4.33	(75)
Southwesto,9x	Southwest _{0.9x}	0.77	X	1.37	X	36.79]	0.55	x	0.8	=	30.74	(79)
Southwesto,9x	Southwest _{0.9x}	0.77	X	1.37	x	62.67]	0.55	x	0.8	=	52.36	(79)
Southwesto,9x	Southwest _{0.9x}	0.77	X	1.37	X	85.75]	0.55	x	0.8	=	71.64	(79)
Southwest0.9x	Southwest _{0.9x}	0.77	X	1.37	X	106.25]	0.55	x	0.8	= [88.77	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	x	119.01]	0.55	x	0.8	=	99.43	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	X	118.15]	0.55	x	0.8	=	98.71	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	X	113.91]	0.55	x	0.8	=	95.17	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	x	104.39]	0.55	x	0.8	=	87.22	(79)
Southwesto.9x	Southwest _{0.9x}	0.77	X	1.37	X	92.85]	0.55	x	0.8	= [77.58	(79)
Southwest _{0.9x} 0.77 x 1.37 x 31.49 0.55 x 0.8 = 26.31 (79) Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 (83) Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest _{0.9x}	0.77	X	1.37	X	69.27]	0.55	x	0.8	=	57.87	(79)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m (83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 Total gains – internal and solar (84)m = (73)m + (83)m, watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest _{0.9x}	0.77	X	1.37	x	44.07]	0.55	x	0.8	=	36.82	(79)
(83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)	Southwest _{0.9x}	0.77	X	1.37	X	31.49]	0.55	x	0.8	=	26.31	(79)
(83)m= 52.04 95.71 149.75 217.03 271.84 282.52 267.12 224.3 172.74 110.85 63.62 43.7 Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)													
Total gains – internal and solar (84)m = (73)m + (83)m , watts (84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 (84) 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	Solar gains in w	/atts, calcul	ated	for each mon	_		(83)n			•			
(84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89 7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a)	` '						224	1.3 172.74	110.85	63.62	43.7		(83)
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)				` 	·		_					I	
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85) Utilisation factor for gains for living area, h1,m (see Table 9a)	(84)m= 376.12	418.12 462	2.49	514.32 553.7	5	49.28 523.92	485	.89 442.15	395.89	366.61	359.89		(84)
Utilisation factor for gains for living area, h1,m (see Table 9a)	7. Mean intern	al tempera	ture (heating seaso	on)								
	Temperature o	during heati	ng pe	eriods in the li	ving	area from Tal	ble 9	, Th1 (°C)				21	(85)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec					Ť							 I	
	Jan	Feb N	/lar	Apr Ma	y	Jun Jul	A	ug Sep	Oct	Nov	Dec		

(86)m=	0.99	0.99	0.97	0.89	0.73	0.52	0.38	0.43	0.68	0.93	0.99	0.99		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)					
(87)m=	20.2	20.34	20.55	20.81	20.95	20.99	21	21	20.98	20.78	20.45	20.18		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	20.14	20.14	20.14	20.16	20.16	20.17	20.17	20.17	20.17	20.16	20.15	20.15		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	ee Table	9a)						
(89)m=	0.99	0.98	0.96	0.86	0.67	0.46	0.31	0.35	0.61	0.9	0.98	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	19.08	19.28	19.59	19.94	20.12	20.17	20.17	20.17	20.15	19.92	19.46	19.06		(90)
									1	LA = Livin	g area ÷ (4) =	0.54	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	19.69	19.85	20.11	20.41	20.57	20.62	20.62	20.62	20.6	20.39	20	19.67		(92)
Apply	adjustn	nent to t	he mear	interna	l temper	ature fro	m Table	4e, whe	re appro	priate				
(93)m=	19.69	19.85	20.11	20.41	20.57	20.62	20.62	20.62	20.6	20.39	20	19.67		(93)
		•	uirement				44 6	T			70)			
				mperatu using Ta		ned at ste	ep 11 of	Table 9	o, so tha	t II,m=(/6)m an	d re-calc	culate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:		•								
(94)m=	0.99	0.98	0.95	0.87	0.7	0.49	0.35	0.39	0.65	0.91	0.98	0.99		(94)
	<u> </u>		<u>`</u>	4)m x (8	 	l								(0=)
(95)m=		410.25	441.6	448.06	388.48	270.06	181.51	189.79	286.72	359.13	358.91	357.09		(95)
(96)m=	4.3	4.9	6.5	perature 8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			<u> </u>		<u> </u>	Lm , W =		!		!				()
(97)m=	723.99	701.26	636.36	530.01	407.18	271.86	181.68	190.14	295.47	449.35	595.75	718.71		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m=	261.55	195.56	144.9	59	13.91	0	0	0	0	67.13	170.53	269.05		
								Tota	l per year	(kWh/year	·) = Sum(9	8) _{15,912} =	1181.63	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								23.43	(99)
9b. En	ergy rec	uiremer	nts – Cor	mmunity	heating	scheme	;							
						ing or wa					unity sch	neme.		¬
Fractio	n of spa	ice heat	from se	condary	/supplen	nentary l	heating (Table 1	1) '0' if n	one			0	(301)
Fractio	n of spa	ce heat	from co	mmunity	system (1 – (30	1) =						1	(302)
includes	boilers, h	eat pumps	s, geotherr	mal and wa	aste heat f	rces. The p from power				up to four (other heat	sources; tl		7(202-)
				ity heat									1	(303a)
				ity heat		,							0.8	(303a)
Fractio	n of cor	nmunity	heat fro	m heat s	source 2	(Water)							0.2	(303b)
Fractio	n of tota	al space	heat fro	m Comn	nunity he	eat pump)			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and	charging	method	l (Table	4c(3)) fo	r commu	unity hea	iting sys	tem			1	(305)

Distribution loss factor (Table 12c) for commu	ınity heating system		Г	1.05	(306)
Distribution loss factor (Table 12c) for commu)	L T	1.05](306)
Space heating	anity floating bystem (vvater	,	L	kWh/year	١
Annual space heating requirement			Г	1181.63	7
Space heat from Community heat pump		(98) x (304a) x	(305) x (306) =	1240.71	(307a)
Efficiency of secondary/supplementary heating	ng system in % (from Table	4a or Appen	dix E)	0	(308
Space heating requirement from secondary/s	supplementary system	(98) x (301) x 1	00 ÷ (308) =	0	(309)
Water heating Annual water heating requirement			[1825.34]
If DHW from community scheme: Water heat from CHP (Water)		(64) x (303a) x	(305) x (306) =	1533.28	(310a)
Water heat from heat source 2 (Water)		(64) x (303a) x	(305) x (306) =	383.32	(310b)
Electricity used for heat distribution	0.01 ×	: [(307a)(307	e) + (310a)(310e)] =	12.41	(313)
Electricity used for heat distribution (Water)	0.01 ×	: [(307a)(307	e) + (310a)(310e)] =	19.17	(313)
Cooling System Energy Efficiency Ratio				0	(314)
Space cooling (if there is a fixed cooling syste	em, if not enter 0)	= (107) ÷ (314)	=	0	(315)
Electricity for pumps and fans within dwelling mechanical ventilation - balanced, extract or			[157.84	(330a)
warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year		=(330a) + (330l	b) + (330g) =	157.84	(331)
Energy for lighting (calculated in Appendix L)				234.98	(332)
Electricity generated by PVs (Appendix M) (n	egative quantity)			-576.34	(333)
Total delivered energy for all uses (307) + (30	09) + (310) + (312) + (315) +	+ (331) + (33	32)(237b) =	1057.19	(338)
12b. CO2 Emissions – Community heating so					
	Ener kWh	gy /year	Emission factor E kg CO2/kWh	Emissions (g CO2/year	
CO2 from other sources of space and water the Efficiency of heat source 1 (%)	neating (not CHP) If there is CHP using two fuels r	repeat (363) to	(366) for the second fuel	280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 10	00 ÷ (367b) x	0.52 =	229.98	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	6.44	(372)
Water heating from separate community syst	em				
CO2 from other sources of space and water Efficiency of heat source 1 (%)	heating (not CHP) If there is CHP using two fuels r	repeat (363) to	(366) for the second fuel	280	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels r	repeat (363) to	(366) for the second fuel	100	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 10	00 ÷ (367b) x	0 =	284.21	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 10	00 ÷ (367b) x	0.52	198.94	(368)
Electrical energy for heat distribution	[(313) x		0.52	9.95	(372)

Total CO2 associated with community system	ns (363)(366) + (368)(372	2)	= [729.51	(373)
CO2 associated with space heating (secondary	ary) (309) x	0	= [0	(374)
CO2 associated with water from immersion h	eater or instantaneous heater (312) x	0.52	= [0	(375)
Total CO2 associated with space and water h	neating (373) + (374) + (375) =			729.51	(376)
CO2 associated with electricity for pumps and	d fans within dwelling (331)) x	0.52	= [81.92	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	= [121.95	(379)
Energy saving/generation technologies (333) Item 1	· ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	0.52 x 0.01 =		-299.12	(380)
Total CO2, kg/year	of (376)(382) =			634.26	(383)
Dwelling CO2 Emission Rate (383)	÷ (4) =			12.57	(384)
El rating (section 14)				91.09	(385)

		l Isar I	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	<u> </u>	Strom Softwa	_				016363 on: 1.0.5.51	
Software Name.		Property	Address			N	Versic	ni. 1.0.3.31	
Address :									
1. Overall dwelling dimer	nsions:								
Ground floor			a(m²)	(4-)		ight(m)	7(0-) -	Volume(m³	_
	N. (41 N. (4			(1a) x	2	2.7	(2a) =	191.81	(3a)
•	n)+(1b)+(1c)+(1d)+(1e)+(1	n)	71.04	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	191.81	(5)
2. Ventilation rate:	main seconda	P\$3.4	other		total			m³ nor hou	
	heating heating	<u> </u>	other	, –	เบเสเ			m³ per hou	_
Number of chimneys	0 + 0	_ +	0	<u> </u>	0		40 =	0	(6a)
Number of open flues	0 + 0	+	0] = [0	X :	20 =	0	(6b)
Number of intermittent far	ns				0	X	10 =	0	(7a)
Number of passive vents					0	X	10 =	0	(7b)
Number of flueless gas fir	es			Ī	0	X 4	40 =	0	(7c)
				_					
		_ 、	- \	_				nanges per ho	_
•	rs, flues and fans = (6a)+(6b)+(een carried out or is intended, procee			continue fr	0		÷ (5) =	0	(8)
Number of storeys in th		iu io (11),	ourer wise t	onunae n	om (9) to ((10)		0	(9)
Additional infiltration	5 ()					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.5	25 for steel or timber frame o	r 0.35 fo	r masoni	y constr	uction			0	(11)
if both types of wall are pre deducting areas of opening	esent, use the value corresponding t gs): if equal user 0.35	o the grea	ter wall are	a (after					
	oor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, ent	er 0.05, else enter 0							0	(13)
Percentage of windows	and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	, ,	-			0	(15)
Infiltration rate	50		(8) + (10)					0	(16)
•	q50, expressed in cubic metro ty value, then $(18) = [(17) \div 20] +$	•	•	•	etre of e	envelope	area	3	$=$ $\begin{pmatrix} (17) \\ (40) \end{pmatrix}$
· ·	s if a pressurisation test has been do				is being u	sed		0.15	(18)
Number of sides sheltered			,	,	J			2	(19)
Shelter factor			(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporati	•		(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified for	- 1 	1	1		1		1	1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	- 	1	1 .			<u> </u>	1 .	1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
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 (allo	wing for sl	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
0.16	0.16 0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effec	_	e rate for t	he appli	cable ca	se			!				
	al ventilation: eat pump using Ap	nendiy N (2	23h) = (23a	a) x Emy (4	equation (N5)) othe	nwise (23h	n) = (23a)			0.5	(23a)
	heat recovery: ef							, (20a)			0.5	(23b)
	ed mechanical		_					2h\m + /	23P) ^ [-	1 (22a)	77.35 ÷ 1001	(23c)
(24a)m= 0.28	0.27 0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26	+ 100j	(24a)
` ′	ed mechanical		<u> </u>			<u> </u>	1	ļ		0.20		(= : =)
(24b)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24b)
	ouse extract v		n nositiv	/e innut	ventilatio	on from	nutside					, ,
,	n < 0.5 × (23b)		•	•				.5 × (23b	o)			
(24c)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24c)
,	ventilation or w n = 1, then (24			•				0.5]			•	
(24d)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change rate -	enter (24a) or (24b	o) or (24	c) or (24	ld) in bo	x (25)	•	•	•	•	
(25)m= 0.28	0.27 0.27	0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(25)
3 Heat losse	s and heat loss	s paramet	er.									
ELEMENT	Gross area (m²)	Openin m	ıgs	Net Ar A ,r		U-val W/m2		A X U (W/I		k-value		A X k kJ/K
Doors	()			1.99		1	=	1.99	$\stackrel{\prime}{\Box}$			(26)
Windows Type	e 1			1.37	x1	/[1/(1.4)+	0.04] =	1.82	=			(27)
Windows Type	2			0.9	x1	/[1/(1.4)+	0.04] =	1.19	冒			(27)
Windows Type	3			5.79	x1	/[1/(1.4)+	0.04] =	7.68	=			(27)
Windows Type	e 4			2.19	x1	/[1/(1.4)+	0.04] =	2.9	一			(27)
Walls Type1	75.26	15.7	3	59.53	3 X	0.15	=	8.93				(29)
Walls Type2	27.91	1.99		25.92	2 x	0.15	_	3.89	F i			(29)
Roof	75.26	0	=	75.26	5 X	0.13		9.78	≓ i			(30)
Total area of e	lements, m²			178.4	.3							(31)
Party wall				10.99) x	0	=	0				(32)
Party floor				71.04	_							(32a)
* for windows and ** include the area					lated using	g formula 1	1/[(1/U-valu	ue)+0.04] a	as given in	paragraph	3.2	``
Fabric heat los	ss, W/K = S (A	x U)				(26)(30) + (32) =				45.45	(33)
Heat capacity	Cm = S(A x k))					((28).	(30) + (32	2) + (32a).	(32e) =	21732.64	(34)
Thermal mass	parameter (TN	/IP = Cm -	+ TFA) ir	n kJ/m²K			Indica	ative Value	: Medium		250	(35)
For design assess can be used instead			construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L x Y) c	alculated	using Ap	pendix l	K						31.57	(36)
if details of therma		known (36) =	= 0.05 x (3	1)			(0.5)	(0.6)				
Total fabric he	at loss						(33) +	(36) =			77.02	(37)

Ventila	ition hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × ((25)m x (5))		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	17.46	17.26	17.05	16.05	15.84	14.84	14.84	14.63	15.24	15.84	16.25	16.65		(38)
Heat tr	ansfer o	coefficier	nt, W/K				!	!	(39)m	= (37) + (37)	38)m	!		
(39)m=	94.48	94.28	94.07	93.07	92.86	91.85	91.85	91.65	92.26	92.86	93.27	93.67		
Heat lo	oss para	meter (H	HLP), W/	m²K				•		Average = = (39)m ÷	Sum(39) ₁ .	12 /12=	93.01	(39)
(40)m=	1.33	1.33	1.32	1.31	1.31	1.29	1.29	1.29	1.3	1.31	1.31	1.32		
Numbe	er of day	s in moi	nth (Tab	le 1a)			I	l		Average =	Sum(40) ₁	12 /12=	1.31	(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>I</u>		
4. Wa	ater heat	ting ener	rgy requi	rement:								kWh/ye	ear:	
												,		
	$\Delta > 13.0$		N + 1.76 x	[1 - exn	(- 0 0003	849 v (TF	-Δ -13 Θ	1211 + 0 (1013 x (Γ F Δ - 13		27		(42)
	A £ 13.9		· 1.70 X	ι σχρ	(0.0000	/10 X (11	71 10.0	<i>)</i> 2)] · O.) X 010 X (1171 10.	.0)			
			ater usag									3.14		(43)
		-	hot water person per			-	-	to achieve	a water us	se target o	f			
not more											T	I _ I		
11-44	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
not wate			day for ea			·		· <i>′</i>		1	,			
(44)m=	96.95	93.43	89.9	86.38	82.85	79.32	79.32	82.85	86.38	89.9	93.43	96.95		_
Energy (content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		1057.67	(44)
(45)m=	143.78	125.75	129.76	113.13	108.55	93.67	86.8	99.6	100.79	117.47	128.22	139.24		
If instant	taneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	1386.77	(45)
(46)m=	21.57	18.86	19.46	16.97	16.28	14.05	13.02	14.94	15.12	17.62	19.23	20.89		(46)
Water	storage	loss:												
Storag	e volum	e (litres)) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	-	_	ınd no ta		_			. ,						
			hot wate	er (this in	ıcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	storage		oolorod l	ooo foot	or io kno	(k\\/k	2/dov/):							(40)
•			eclared l) 15 KHO	WII (KVVI	i/uay).					0		(48)
			m Table					(10) (10				0		(49)
			storage eclared o	-		or is not		(48) x (49) =		1	10		(50)
•			factor fr	-							0	.02		(51)
		_	ee secti		_ (- 7 /					.02		(0.)
Volum	e factor	from Ta	ble 2a								1.	.03		(52)
Tempe	erature f	actor fro	m Table	2b							0	.6		(53)
Energy	/ lost fro	m water	storage	, kWh/ye	ear			(47) x (51) x (52) x (53) =	1.	.03		(54)
Enter	(50) or ((54) in (5	55)								1.	.03		(55)
Water	storage	loss cal	culated 1	or each	month			((56)m = (55) × (41)	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
V - 7			1		L		I		1	L				•

If cylinder contai	ns dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (1	111)] + (30	0), 0.00 (0	<i>i</i>)iii – (30)	iii wiieie (H11) IS Tro	m Append	lix H	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circu	it loss (ar	nual) fro	m Table	 e 3							0		(58)
Primary circu	`	,			59)m = (58) ÷ 36	65 × (41)	m				•	
(modified b	y factor f	rom Tabl	le H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss c	alculated	for each	month (61)m = ((60) ÷ 36	35 × (41))m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total heat red	quired for	water he	eating ca	alculated	for each	า month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 199.05	175.68	185.04	166.62	163.83	147.16	142.08	154.88	154.29	172.74	181.72	194.52		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negativ	e quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add addition	al lines if	FGHRS	and/or \	VWHRS	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= 199.05	175.68	185.04	166.62	163.83	147.16	142.08	154.88	154.29	172.74	181.72	194.52		
	•						Outp	out from w	ater heate	r (annual)₁	12	2037.61	(64)
Heat gains fro	om water	heating,	kWh/mo	onth 0.25	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m]	
(65)m= 92.03	81.75	87.37	80.41	80.31	73.94	73.08	77.34	76.31	83.28	85.43	90.52		(65)
include (57)m in cal	culation o	of (65)m	only if c	ylinder is	in the c	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Internal o	•										•		
Metabolic gai	· ·												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.56	+	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56	113.56		(66)
Lighting gains	s (calcula	ted in Ar	pendix	L. eguati	on L9 or	 · L9a). a	lso see	Table 5				ı	
(67)m= 17.8	15.81	12.86	9.74	7.28	6.14	6.64	i		44.74	17.17	18.3		(67)
Appliances g	ains (calc	ulated in	Annone				8.63	11.58	14.71	17.17			(67)
(68)m= 199.71	- ` 		Append	dix L, equ	uation L		ļ	<u> </u>	<u> </u>	17.17		•	(67)
	201.78	196.56	185.44	dix L, equ	uation L ²		ļ	<u> </u>	<u> </u>	177.71	190.9	']	(68)
Cooking gain			185.44	171.41	158.22	13 or L1: 149.41	3a), also 147.34	see Ta 152.56	ble 5 163.68	<u> </u>	190.9		, ,
Cooking gain (69)m= 34.36	s (calcula	ted in A	185.44	171.41	158.22 ion L15	13 or L1: 149.41	3a), also 147.34), also se	see Ta 152.56 ee Table	ble 5 163.68	177.71	190.9	 	, ,
(69)m= 34.36	s (calcula 34.36	ted in A ₁	185.44 opendix 34.36	171.41 L, equat	158.22	13 or L13 149.41 or L15a)	3a), also 147.34	see Ta 152.56	ble 5 163.68	<u> </u>		 	(68)
	s (calcula 34.36	ted in A ₁	185.44 opendix 34.36	171.41 L, equat	158.22 ion L15	13 or L13 149.41 or L15a)	3a), also 147.34), also se	see Ta 152.56 ee Table	ble 5 163.68	177.71		 	(68)
(69)m= 34.36 Pumps and fa (70)m= 0	s (calcula 34.36 ans gains 0	ted in A _l 34.36 (Table 5	185.44 opendix 34.36 5a)	171.41 L, equat 34.36	158.22 ion L15 34.36	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69)
(69)m= 34.36 Pumps and fa	s (calcula 34.36 ans gains 0	ted in A _l 34.36 (Table 5	185.44 opendix 34.36 5a)	171.41 L, equat 34.36	158.22 ion L15 34.36	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e	s (calcula 34.36 ans gains 0 vaporatio	34.36 (Table 5 0 on (negat	185.44 opendix 34.36 oa) o tive valu	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5)	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69) (70)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (T	34.36 (Table 5 0 on (negat	185.44 opendix 34.36 oa) o tive valu	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5)	13 or L1; 149.41 or L15a) 34.36	3a), also 147.34), also se 34.36	see Ta 152.56 ee Table 34.36	ble 5 163.68 5 34.36	177.71 34.36	34.36		(68) (69) (70)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (T	117.43	185.44 opendix 34.36 5a) 0 tive valu -90.84	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5) -90.84	13 or L1; 149.41 or L15a) 34.36 0	3a), also 147.34), also se 34.36 0 -90.84	see Ta 152.56 ee Table 34.36 0 -90.84	ble 5 163.68 5 34.36 0 -90.84	177.71 34.36 0 -90.84	34.36 0 -90.84		(68) (69) (70) (71)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating (72)m= 123.69	s (calcula 34.36 ans gains 0 vaporation -90.84 g gains (Tal.66 121.66	117.43	185.44 opendix 34.36 5a) 0 tive valu -90.84	171.41 L, equat 34.36 0 es) (Tab	158.22 ion L15 34.36 0 le 5) -90.84	13 or L13 149.41 or L15a) 34.36 0 -90.84	3a), also 147.34), also se 34.36 0 -90.84	see Ta 152.56 ee Table 34.36 0 -90.84	ble 5 163.68 5 34.36 0 -90.84	177.71 34.36 0 -90.84	34.36 0 -90.84		(68) (69) (70) (71)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating (72)m= 123.69 Total internal	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (Tal.66 121.66 1 gains =	117.43	185.44 opendix 34.36 5a) 0 ciive valu -90.84	171.41 L, equat 34.36 0 es) (Tab -90.84	158.22 ion L15 34.36 0 le 5) -90.84	13 or L1; 149.41 or L15a) 34.36 0 -90.84 98.23 m + (67)m	3a), also 147.34), also se 34.36 0 -90.84 103.95	o see Ta 152.56 ee Table 34.36 0 -90.84 105.98 + (69)m +	ble 5 163.68 5 34.36 0 -90.84 111.93 (70)m + (7	177.71 34.36 0 -90.84 118.65 1)m + (72	34.36 0 -90.84 121.67		(68) (69) (70) (71) (72)
(69)m= 34.36 Pumps and fa (70)m= 0 Losses e.g. e (71)m= -90.84 Water heating (72)m= 123.69 Total interna (73)m= 398.28	s (calcula 34.36 ans gains 0 vaporatio -90.84 g gains (1 121.66 ll gains = 396.32 as:	14.36 (Table 5 0 on (negation -90.84 able 5) 117.43	185.44 opendix 34.36 5a) 0 cive valu -90.84 111.68	171.41 L, equat 34.36 0 es) (Tab -90.84 107.95	158.22 ion L15 34.36 0 le 5) -90.84 102.7 (66) 324.13	13 or L1: 149.41 or L15a) 34.36 0 -90.84 98.23 m + (67)m 311.34	3a), also 147.34), also se 34.36 0 -90.84 103.95 1+(68)m+ 316.98	0 see Ta 152.56 ee Table 34.36 0 -90.84 105.98 + (69)m + (6	ble 5 163.68 5 34.36 0 -90.84 111.93 (70)m + (7 347.38	177.71 34.36 0 -90.84 118.65 1)m + (72 370.59	34.36 0 -90.84 121.67 m 387.93		(68) (69) (70) (71) (72)

Table 6b

Table 6c

Table 6a

m²

Table 6d

(W)

Northoast a ou		1		1		1		l		1		7(75)
Northeast 0.9x	0.77	X	0.9	X	11.28	X	0.55	X	0.8] = 1	3.1	(75)
Northeast 0.9x	0.77	X	0.9	X	22.97	X	0.55	X	0.8] = 1	6.3	(75)
Northeast 0.9x	0.77	X	0.9	X	41.38	X	0.55	X	0.8] =	11.36	(75)
Northeast _{0.9x}	0.77	X	0.9	X	67.96	X	0.55	X	0.8] =	18.65	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.35	X	0.55	X	0.8	=	25.07	(75)
Northeast _{0.9x}	0.77	X	0.9	X	97.38	X	0.55	X	0.8] =	26.73	(75)
Northeast _{0.9x}	0.77	X	0.9	X	91.1	X	0.55	X	0.8	=	25	(75)
Northeast _{0.9x}	0.77	X	0.9	X	72.63	X	0.55	X	0.8	=	19.93	(75)
Northeast _{0.9x}	0.77	X	0.9	X	50.42	X	0.55	X	0.8	=	13.84	(75)
Northeast _{0.9x}	0.77	X	0.9	X	28.07	X	0.55	X	0.8	=	7.7	(75)
Northeast _{0.9x}	0.77	X	0.9	X	14.2	X	0.55	X	0.8	=	3.9	(75)
Northeast _{0.9x}	0.77	X	0.9	X	9.21	X	0.55	X	0.8	=	2.53	(75)
Southeast _{0.9x}	0.77	X	5.79	X	36.79	X	0.55	X	0.8	=	64.96	(77)
Southeast _{0.9x}	0.77	X	5.79	X	62.67	X	0.55	X	0.8	=	110.65	(77)
Southeast _{0.9x}	0.77	X	5.79	X	85.75	X	0.55	X	0.8	=	151.4	(77)
Southeast _{0.9x}	0.77	X	5.79	X	106.25	X	0.55	x	0.8	=	187.59	(77)
Southeast _{0.9x}	0.77	X	5.79	X	119.01	X	0.55	x	0.8	=	210.11	(77)
Southeast 0.9x	0.77	X	5.79	X	118.15	x	0.55	x	0.8	=	208.59	(77)
Southeast _{0.9x}	0.77	X	5.79	x	113.91	x	0.55	x	0.8] =	201.11	(77)
Southeast _{0.9x}	0.77	X	5.79	X	104.39	x	0.55	X	0.8] =	184.3	(77)
Southeast _{0.9x}	0.77	X	5.79	x	92.85	x	0.55	X	0.8] =	163.93	(77)
Southeast _{0.9x}	0.77	x	5.79	x	69.27	x	0.55	x	0.8] =	122.29	(77)
Southeast _{0.9x}	0.77	x	5.79	x	44.07	x	0.55	x	0.8] =	77.81	(77)
Southeast _{0.9x}	0.77	X	5.79	x	31.49	x	0.55	x	0.8] =	55.59	(77)
Northwest _{0.9x}	0.77	x	1.37	x	11.28	x	0.55	x	0.8] =	23.57	(81)
Northwest _{0.9x}	0.77	X	2.19	x	11.28	x	0.55	x	0.8] =	7.53	(81)
Northwest _{0.9x}	0.77	x	1.37	x	22.97	x	0.55	x	0.8	j =	47.97	(81)
Northwest 0.9x	0.77	x	2.19	x	22.97	x	0.55	x	0.8	j =	15.34	(81)
Northwest _{0.9x}	0.77	x	1.37	x	41.38	x	0.55	x	0.8	Ī =	86.43	(81)
Northwest 0.9x	0.77	x	2.19	x	41.38	x	0.55	x	0.8	j =	27.63	(81)
Northwest _{0.9x}	0.77	x	1.37	x	67.96	x	0.55	x	0.8	j =	141.94	(81)
Northwest _{0.9x}	0.77	x	2.19	x	67.96	х	0.55	x	0.8	j =	45.38	(81)
Northwest 0.9x	0.77	x	1.37	x	91.35	x	0.55	х	0.8	j =	190.79	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.35	x	0.55	х	0.8	j =	61	(81)
Northwest _{0.9x}	0.77	x	1.37	x	97.38	х	0.55	х	0.8	j =	203.41	(81)
Northwest _{0.9x}	0.77	x	2.19	x	97.38	x	0.55	x	0.8	j =	65.03	(81)
Northwest _{0.9x}	0.77	x	1.37	x	91.1	x	0.55	x	0.8	j =	190.28	(81)
Northwest _{0.9x}	0.77	x	2.19	x	91.1	x	0.55	x	0.8	i =	60.84	(81)
Northwest _{0.9x}	0.77	X	1.37	X	72.63	X	0.55	x	0.8] =	151.7	(81)
Northwest _{0.9x}	0.77	X	2.19	X	72.63	X	0.55	x	0.8] =	48.5	(81)
Northwest _{0.9x}	0.77	X	1.37	X	50.42	X	0.55	X	0.8] =	105.31	(81)
_		1		1		1		I		1		_ ' '

Northwest 0.9x	0.77	X	2.1	9	X	50.42] x [0.55	x	0.8	=	33.67	(81)
Northwest 0.9x	0.77	x	1.3	57	x	28.07] x [0.55	x	0.8	=	58.62	(81)
Northwest 0.9x	0.77	X	2.1	9	x	28.07] x [0.55	x	0.8	=	18.74	(81)
Northwest 0.9x	0.77	X	1.3	57	x	14.2] x [0.55	x [0.8	=	29.65	(81)
Northwest 0.9x	0.77	X	2.1	9	x	14.2	_ x [0.55	x	0.8	=	9.48	(81)
Northwest _{0.9x}	0.77	Х	1.3	37	x	9.21	×		0.55	х	0.8	=	19.25	(81)
Northwest 0.9x	0.77	X	2.1	9	x	9.21	×		0.55	x	0.8	=	6.15	(81)
_														
Solar gains in	watts, ca	alculated	for eacl	n month	_		(83)m	= Su	ım(74)m .	(82)m	_	-		
(83)m= 99.16	180.26	276.81	393.55	486.97	503.76	477.22	404.	43	316.75	207.36	120.84	83.52		(83)
Total gains – i	internal a	ınd solar	(84)m =	(73)m	+ (83)m	ı , watts					,		•	
(84)m= 497.43	576.58	660.73	757.48	830.68	827.88	788.57	721.	.41	643.94	554.74	491.43	471.45		(84)
7. Mean inter	rnal temp	erature	(heating	season)									
Temperature	during h	eating p	eriods ir	the livi	ng area	from Tal	ble 9,	Th1	l (°C)				21	(85)
Utilisation fac	ctor for g	ains for l	iving are	ea, h1,m	(see T	able 9a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	Jg	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.98	0.94	0.84	0.66	0.5	0.5	6	0.82	0.96	0.99	1		(86)
Mean interna	al temper	ature in	living are	ea T1 (fo	ollow st	eps 3 to 7	7 in T	able	9c)		•		•	
(87)m= 19.61	19.79	20.08	20.47	20.78	20.95	20.99	20.9	-	20.86	20.45	19.96	19.58		(87)
Temperature	during b	ooting n	oriode ir	roct of	dwollin	a from Ta	hlo 0	Th	2 (°C)		<u> </u>	l		
(88)m= 19.82	19.82	19.82	19.83	19.84	19.85	19.85	19.8		19.84	19.84	19.83	19.83		(88)
` ′	ļ				<u> </u>	<u> </u>			10.01	10.01	10.00	10.00		()
Utilisation fac					·	1	T	<u>.</u> Т	0.70	0.05	T 0.00		1	(89)
(89)m= 0.99	0.99	0.97	0.92	0.78	0.56	0.38	0.4	3	0.73	0.95	0.99	1		(09)
Mean interna	al temper		the rest		ng T2 (<u> </u>	eps 3	to 7	in Tabl	e 9c)			Ī	
(90)m= 18	18.25	18.68	19.23	19.63	19.81	19.84	19.8	34	19.73	19.21	18.51	17.96		(90)
									f	LA = Livir	ng area ÷ (4	4) =	0.39	(91)
Mean_interna	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1 -	– fL/	۹) × T2					
(92)m= 18.62	18.84	19.22	19.7	20.08	20.25	20.28	20.2	28	20.17	19.69	19.07	18.59		(92)
Apply adjustr	ment to the	ne mean	internal	temper	ature fr	om Table	4e, ۱	whe	re appro	priate		ı	•	
(93)m= 18.62	18.84	19.22	19.7	20.08	20.25	20.28	20.2	28	20.17	19.69	19.07	18.59		(93)
8. Space hea														
Set Ti to the the utilisation					ed at s	tep 11 of	Table	e 9b	, so tha	t Ti,m=(76)m an	d re-cald	culate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ıa	Sep	Oct	Nov	Dec		
Utilisation fac			•	iviay	Juli	1 oui		<u> 19 </u>	ОСР	001	1407	Dec		
(94)m= 0.99	0.99	0.97	0.91	0.79	0.6	0.42	0.4	8	0.76	0.94	0.99	0.99		(94)
Useful gains,	, hmGm ,	W = (94	1)m x (84	4)m	ļ	1	!					!		
(95)m= 493.87	568.49	639.42	692.13	657.54	494.4	334.41	348.	.52	488.42	523.39	484.65	468.76		(95)
Monthly aver	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 rat	e for mea			erature,	Lm , W	=[(39)m	x [(93	3)m-	(96)m]			•	
` '	1314.67	1196.52		777.75	519.04		355.		559.69	843.84	1116.58	1347.6		(97)
Space heating						1		Ť		- `		ı	Ī	
(98)m= 639.24	501.43	414.48	225.67	89.44	0	0	0		0	238.41	454.99	653.86		

	Total per year (kWh/year) = Sum(98) _{15,912} =	3217.52	(98)
Space heating requirement in kWh/m²/year		45.29	」(**)
9b. Energy requirements – Community heating scheme			`
This part is used for space heating, space cooling or water heating			_
Fraction of space heat from secondary/supplementary heating (Tab	ole 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
The community scheme may obtain heat from several sources. The procedure allow includes boilers, heat pumps, geothermal and waste heat from power stations. See	•	e latter	
Fraction of heat from Community heat pump		1	(303a)
Fraction of heat from Community heat pump (Water)		0.8	(303a)
Fraction of community heat from heat source 2 (Water)		0.2	(303b)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community	1	(305)	
Distribution loss factor (Table 12c) for community heating system	1.05	(306)	
Distribution loss factor (Table 12c) for community heating system (V	1.05	(306)	
Space heating	_	kWh/year	_
Annual space heating requirement		3217.52	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	3378.4	(307a)
Efficiency of secondary/supplementary heating system in % (from 1	0	(308	
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement	Г	2037.61	٦
If DHW from community scheme:	L	2007.01	_
Water heat from CHP (Water)	(64) x (303a) x (305) x (306) =	1711.59	(310a)
Water heat from heat source 2 (Water)	(64) x (303a) x (305) x (306) =	427.9	(310b)
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	33.78	(313)
Electricity used for heat distribution (Water)	0.01 × [(307a)(307e) + (310a)(310e)] =	21.39	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from out	side	222.31	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating	Γ	0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	222.31	(331)
Energy for lighting (calculated in Appendix L)	Γ	314.43	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	Γ	-576.34	(333)
Total delivered energy for all uses (307) + (309) + (310) + (312) + (312)	315) + (331) + (332)(237b) =	3338.79	(338)

12b. CO2 Emissions – Community heati	ng scheme				
		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water Efficiency of heat source 1 (%)) ng two fuels repeat (363) to	(366) for the second fue	el 280	(367a)
CO2 associated with heat source 1	[(307b)	+(310b)] x 100 ÷ (367b) x	0.52	626.21	(367)
Electrical energy for heat distribution		[(313) x	0.52	17.53	(372)
Water heating from separate community	system				
CO2 from other sources of space and v Efficiency of heat source 1 (%)		P) ng two fuels repeat (363) to	(366) for the second fue	el 280	(367a)
Efficiency of heat source 2 (%)	If there is CHP usi	ng two fuels repeat (363) to	(366) for the second fue	el 100	(367b)
CO2 associated with heat source 1	[(307b)	+(310b)] x 100 ÷ (367b) x	0	317.26	(367)
CO2 associated with heat source 2	[(307b)	+(310b)] x 100 ÷ (367b) x	0.52	222.08	(368)
Electrical energy for heat distribution		[(313) x	0.52	= 11.1	(372)
Total CO2 associated with community sy	rstems	(363)(366) + (368)(372	2)	1194.18	(373)
CO2 associated with space heating (sec	ondary)	(309) x	0	= 0	(374)
CO2 associated with water from immers	on heater or instantar	neous heater (312) x	0.52	= 0	(375)
Total CO2 associated with space and wa	ater heating	(373) + (374) + (375) =		1194.18	(376)
CO2 associated with electricity for pump	s and fans within dwe	lling (331)) x	0.52	115.38	(378)
CO2 associated with electricity for lighting	g	(332))) x	0.52	163.19	(379)
Energy saving/generation technologies (Item 1	333) to (334) as appli	cable	0.52 x 0.01 =	-299.12	(380)
Total CO2, kg/year	sum of (376)(382) =			1173.63	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			16.52	(384)
El rating (section 14)				86.45	(385)

		llsarJ	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	- 036 11	Strom Softwa	_				016363 on: 1.0.5.51	
	F	Property	Address	Flat-40	2-GREE	EN			
Address :									
1. Overall dwelling dime	ensions:	Δ	a/wa2\		Asz IIa	: au la 4/200\		Valeum a/m²	81
Ground floor			a(m²) 50.44	(1a) x		ight(m) 2.7	(2a) =	Volume(m ³	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1			(4)				100.10	(==,/
•	a)·(1b)·(1c)·(1a)·(1c)·(1	'''/	50.44)+(3c)+(3c	d)+(3e)+	(3n) =		7,5
Dwelling volume				(38) (35	71(30)1(30	4) ((00)	(011) –	136.19	(5)
2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	ır
Number of chimneys	heating heating beauting heating	П + Г	0	7 = [0	x	40 =	0	(6a)
Number of open flues	0 + 0	_	0]	0	x	20 =	0	(6b)
Number of intermittent fa		_ L		┙┢			10 =		╡``
				Ļ	0		10 =	0	(7a)
Number of passive vents				Ļ	0			0	(7b)
Number of flueless gas f	ires				0	X 4	40 =	0	(7c)
Air changes per hour									
Infiltration due to chimne	eys, flues and fans = (6a)+(6b)+(7a)+(7b)+	(7c) =	Γ	0		÷ (5) =	0	(8)
If a pressurisation test has b	peen carried out or is intended, procee	ed to (17),	otherwise o	ontinue fr	om (9) to				
Number of storeys in t	he dwelling (ns)							0	(9)
Additional infiltration	0.25 for steel or timber frame o	r 0 35 fo	r maconi	v constr	ruction	[(9)	-1]x0.1 =	0	= (10)
	resent, use the value corresponding t			•	uction			0	(11)
deducting areas of openi	- ' '		1) 1						_
•	floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	rs and doors draught stripped							0	(13)
Window infiltration	o una acoro araagin omppea		0.25 - [0.2	x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic metre	es per h	our per s	quare m	etre of e	envelope	area	3	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$							0.15	(18)
Air permeability value applie Number of sides sheltere	es if a pressurisation test has been do od	ne or a de	gree air pe	rmeability	is being u	sed			7(10)
Shelter factor	su		(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(19) (20)
Infiltration rate incorpora	ting shelter factor		(21) = (18) x (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 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 = (2	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]	
								ı	

0.16	tion rate (allo		0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15]	
Calculate effect			1	1		1 0.12	0.10	0.11	0.11	0.10] 	
If mechanical	ventilation:										0.5	(23
If exhaust air hea	at pump using A	ppendix N, (2	23b) = (23a	a) × Fmv (equation (l	N5)) , othe	rwise (23b	o) = (23a)			0.5	(23
If balanced with	heat recovery: e	efficiency in %	allowing t	for in-use f	actor (fron	n Table 4h	ı) =				77.35	(23
a) If balanced		_			- ` ` 	- 	í `	 		- ` 	; ÷ 100]	
24a)m= 0.28	0.27 0.27		0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(24
b) If balanced			1	1	covery (ľ	- ^ ` 	í `	 	- 	1	1	
24b)m= 0	0 0	0	0	0	0	0	0	0	0	0	j	(24
c) If whole ho	ouse extract v < 0.5 × (23b		•	•				5 v (22h	.)			
24c)m= 0	0.5 × (230	0 0	C) = (231 1 0		0	0 - (22)	1 0	0	0	0	1	(24
d) If natural v											l	(_
,	= 1, then (24		•	•				0.5]				
24d)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24
Effective air of	hange rate -	enter (24a	a) or (24l	b) or (24	c) or (24	d) in bo	x (25)	•		•	•	
25)m= 0.28	0.27 0.27	7 0.25	0.25	0.23	0.23	0.23	0.24	0.25	0.26	0.26		(2
3. Heat losses	and heat los	ss naramet	er									
LEMENT	Gross	Openir		Net Ar	ea	U-val	ue	AXU		k-value	e <i>F</i>	ΑΧk
	area (m²)	•	n²	ı, A	m²	W/m2	2K	(W/I	<)	kJ/m²·l	K k	√J/K
oors				1.99	X	1	=	1.99				(2
/indows Type	1			1.37	_X 1	/[1/(1.4)+	0.04] =	1.82				(2
/indows Type	2			4.65	_x 1	/[1/(1.4)+	0.04] =	6.16				(2
/indows Type	3			1.54	. x1	/[1/(1.4)+	0.04] =	2.04				(2
/alls Type1	55.8	8.93	3	46.87	7 x	0.15	=	7.03				(2
/alls Type2	22.49	1.99	9	20.5	X	0.15	=	3.08				(2
loof	50.44	0		50.44	4 x	0.13	<u> </u>	6.56			\exists	(3
otal area of el	ements, m²			128.7	3							(3
arty wall				9.64	x	0	=	0			7 [(3
arty floor				50.44	4						i —	(3
for windows and r	oof windows, u	se effective w	indow U-v	alue calcui	lated using	formula 1	/[(1/U-valu	ue)+0.04] a	ıs given in	paragraph	1 3.2	
include the areas			lls and par	titions		(22)	\ (0.0\					
abric heat loss	•	•				(26)(30	, , ,				30.49	(3
eat capacity C	•	•						(30) + (32	, , ,	(32e) =	17007.06	(3
hermal mass _l	,		,					itive Value:		-1-1-45	250	(3
or design assessr an be used instea			e construct	ion are no	t known pi	ecisely the	e inaicative	e values of	IMP IN 18	able 11		
	s : S (L x Y)	calculated	using Ap	pendix	K						24.32	(3
nermal bridge			•								<u> </u>	
nermal bridge: details of thermal	bridging are no	t known (36)	= 0.05 x (3	31)								
_		t known (36)	= 0.05 x (3	31)			(33) +	- (36) =			54.81	(3

	1	l								l	· · · · · ·		(00)
(38)m= 12.4	12.25	12.11	11.39	11.25	10.53	10.53	10.39	10.82	11.25	11.54	11.82		(38)
Heat transfer				00.00	05.04	05.04	05.0	· · · ·	= (37) + (3				
(39)m= 67.21	67.06	66.92	66.2	66.06	65.34	65.34	65.2	65.63	66.06	66.35	66.63	00.47	(39)
Heat loss par	ameter (l	HLP), W	/m²K						= (39)m ÷	Sum(39) ₁ .	12 /12=	66.17	(39)
(40)m= 1.33	1.33	1.33	1.31	1.31	1.3	1.3	1.29	1.3	1.31	1.32	1.32		_
Number of da	ıys in mo	nth (Tab	le 1a)					/	Average =	Sum(40) ₁	12 /12=	1.31	(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 hea	ating ene	rgy requ	irement:								kWh/ye	ear:	
Assumed occ	unanev	N											(42)
if TFA > 13	.9, N = 1		[1 - exp	(-0.0003	49 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		.7		(42)
Annual avera	,	ater usaç	ge in litre	es per da	ıy Vd,av	erage =	(25 x N)	+ 36		74	.65		(43)
Reduce the annu	-				-	-	ò achieve	a water us	se target o	f			
not more that 12	- 	,											
Jan Hat water was a	Feb	Mar	Apr	May	Jun	Jul Table 18 Y	Aug	Sep	Oct	Nov	Dec		
Hot water usage	, '		ı			ı	. /				T 1		
(44)m= 82.11	79.13	76.14	73.15	70.17	67.18	67.18	70.17	73.15	76.14	79.13	82.11		7
Energy content of	of hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x D)Tm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	895.77	(44)
(45)m= 121.77	106.5	109.9	95.81	91.94	79.33	73.51	84.36	85.37	99.49	108.6	117.93		
If instantaneous	water heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46,		Γotal = Su	m(45) ₁₁₂ =	= [1174.5	(45)
(46)m= 18.27	15.98	16.48	14.37	13.79	11.9	11.03	12.65	12.8	14.92	16.29	17.69		(46)
Water storage					-								, ,
Storage volur	ne (litres) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community	•			•			, ,						
Otherwise if r		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufact		aclarad l	nee fact	ar ie kna	wn (k\N/h	n/dav/).							(48)
Temperature				JI 13 KI10	vvii (i.vvi	i/day).					0		(49)
Energy lost fr				aar			(48) x (49)	١ =			0		
b) If manufac		_	-		or is not		(40) X (40)	_		1	10		(50)
Hot water sto			•							0.	02		(51)
If community	_		on 4.3										
Volume factor			O.							—	.03		(52)
Temperature										0	.6		(53)
Energy lost fr		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		.03		(54)
Enter (50) or	. , .	•	for ooob	month			//EG\m = /	EE) ~ (44).		1.	.03		(55)
Water storage					0.5.5.5		((56)m = ((50)
(56)m= 32.01 If cylinder contain	28.92	32.01	30.98	32.01 m = (56)m	30.98	32.01 H11)1 ÷ (5	32.01	30.98 7)m = (56)	32.01	30.98	32.01	v H	(56)
												A 11	, :
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)

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 therm	ostat)
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 23.26 23.26 23.26 22.51 23.26	22.51 23.26 (59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	
(61)m= 0 0 0 0 0 0 0 0 0 0	0 0 (61)
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)$ m +	- (46)m + (57)m + (59)m + (61)m
(62)m= 177.05 156.43 165.18 149.31 147.21 132.83 128.79 139.63 138.86 154.76	
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribu	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	additio water meating)
(63)m= 0 0 0 0 0 0 0 0 0 0 0	0 0 (63)
Output from water heater	
(64)m= 177.05 156.43 165.18 149.31 147.21 132.83 128.79 139.63 138.86 154.76	162.09 173.2
Output from water heat	
· · · · · · · · · · · · · · · · · · ·	, ,
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m	
(65)m= 84.71 75.35 80.76 74.65 74.79 69.17 68.66 72.27 71.18 77.3	78.9 83.43 (65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is	from community heating
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct	Nov Dec
(66)m= 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15 85.15	85.15 85.15 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 13.31 11.82 9.61 7.28 5.44 4.59 4.96 6.45 8.66 10.99	12.83 13.68 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 148.38 149.92 146.04 137.78 127.35 117.55 111 109.46 113.34 121.6	132.03 141.83 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52 31.52	31.52 31.52 (69)
Pumps and fans gains (Table 5a)	
(70)m= 0 0 0 0 0 0 0 0 0 0	0 0 (70)
Losses e.g. evaporation (negative values) (Table 5)	
(71)m= -68.12 -6	-68.12 -68.12 (71)
Water heating gains (Table 5)	33.12 35.12
	109.59 112.14 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m + (69)m + (70)m + (68)m + (69)m + (70)m + (68)m + (69)m + (70)m + (68)m + (69)m + (70)m + (68)m + (69)m + (70)m + (68)m + (69)m + (70)m + (68)m + (69)m + (70)m + (68)m + (69)m + (70)m + (68)m + (69)m + (70)m + (68)m + (89)m + (80)m$	
(73)m= 324.09 322.41 312.75 297.28 281.86 266.76 256.8 261.6 269.41 285.04	302.99 316.19 (73)
6. Solar gains:	ble evientation
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applica	
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b	FF Gains Table 6c (W)
	0.8 = 16 (75)
Northeast 0.9x 0.77 x 1.54 x 11.28 x 0.55 x	0.8 = 5.3 (75)

Northeast 0.9x	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x 0.77 x 4.65 x 41.38 x 0.55 x 0.8 = 58.67 Northeast 0.9x 0.77 x 1.54 x 41.38 x 0.55 x 0.8 = 19.43 Northeast 0.9x 0.77 x 4.65 x 67.96 x 0.55 x 0.8 = 96.35 Northeast 0.9x 0.77 x 1.54 x 67.96 x 0.55 x 0.8 = 31.91 Northeast 0.9x 0.77 x 4.65 x 91.35 x 0.55 x 0.8 = 129.52 Northeast 0.9x 0.77 x 4.65 x 91.35 x 0.55 x 0.8 = 129.52 Northeast 0.9x 0.77 x 4.65 x 97.38 x 0.55 x 0.8 = 138.08 Northeast 0.9x 0.77 x	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x	(75) (75) (75) (75) (75) (75) (75) (75)
Northeast 0.9x 0.77 x 1.54 x 67.96 x 0.55 x 0.8 = 31.91 Northeast 0.9x 0.77 x 4.65 x 91.35 x 0.55 x 0.8 = 129.52 Northeast 0.9x 0.77 x 1.54 x 91.35 x 0.55 x 0.8 = 42.89 Northeast 0.9x 0.77 x 4.65 x 97.38 x 0.55 x 0.8 = 138.08 Northeast 0.9x 0.77 x 4.65 x 97.38 x 0.55 x 0.8 = 45.73 Northeast 0.9x 0.77 x 4.65 x 91.1 x 0.55 x 0.8 = 129.17 Northeast 0.9x 0.77 x 1.54 x 91.1 x 0.55 x 0.8 = 42.78 Northeast 0.9x 0.77 x	(75) (75) (75) (75) (75) (75)
Northeast 0.9x 0.77 x 4.65 x 91.35 x 0.55 x 0.8 = 129.52 Northeast 0.9x 0.77 x 1.54 x 91.35 x 0.55 x 0.8 = 42.89 Northeast 0.9x 0.77 x 4.65 x 97.38 x 0.55 x 0.8 = 138.08 Northeast 0.9x 0.77 x 4.65 x 97.38 x 0.55 x 0.8 = 45.73 Northeast 0.9x 0.77 x 4.65 x 91.1 x 0.55 x 0.8 = 129.17 Northeast 0.9x 0.77 x 1.54 x 91.1 x 0.55 x 0.8 = 42.78 Northeast 0.9x 0.77 x 4.65 x 72.63 x 0.55 x 0.8 = 102.98	(75) (75) (75) (75) (75) (75)
Northeast 0.9x	(75) (75) (75) (75)
Northeast 0.9x 0.77 x 4.65 x 97.38 x 0.55 x 0.8 = 138.08 Northeast 0.9x 0.77 x 1.54 x 97.38 x 0.55 x 0.8 = 45.73 Northeast 0.9x 0.77 x 4.65 x 91.1 x 0.55 x 0.8 = 129.17 Northeast 0.9x 0.77 x 1.54 x 91.1 x 0.55 x 0.8 = 42.78 Northeast 0.9x 0.77 x 4.65 x 72.63 x 0.55 x 0.8 = 102.98	(75) (75) (75)
Northeast 0.9x	(75) (75)
Northeast 0.9x	(75)
Northeast 0.9x] `
Northeast 0.9x 0.77 x 4.65 x 72.63 x 0.55 x 0.8 = 102.98	(75)
	(75)
Northeast 0.9x 0.77 x 1.54 x 72.63 x 0.55 x 0.8 = 34.1	(75)
Northeast 0.9x 0.77 x 4.65 x 50.42 x 0.55 x 0.8 = 71.49	(75)
Northeast 0.9x 0.77 x 1.54 x 50.42 x 0.55 x 0.8 = 23.68	(75)
Northeast 0.9x 0.77 x 4.65 x 28.07 x 0.55 x 0.8 = 39.8	(75)
Northeast 0.9x 0.77 x 1.54 x 28.07 x 0.55 x 0.8 = 13.18	(75)
Northeast 0.9x 0.77 x 4.65 x 14.2 x 0.55 x 0.8 = 20.13	(75)
Northeast 0.9x 0.77 x 1.54 x 14.2 x 0.55 x 0.8 = 6.67	(75)
Northeast 0.9x 0.77 x 4.65 x 9.21 x 0.55 x 0.8 = 13.06	(75)
Northeast 0.9x 0.77 x 1.54 x 9.21 x 0.55 x 0.8 = 4.33	(75)
Southwest _{0.9x} 0.77 x 1.37 x 36.79 0.55 x 0.8 = 30.74	(79)
Southwest _{0.9x} 0.77 x 1.37 x 62.67 0.55 x 0.8 = 52.36	(79)
Southwest _{0.9x} 0.77 x 1.37 x 85.75 0.55 x 0.8 = 71.64	(79)
Southwest _{0.9x} 0.77 x 1.37 x 106.25 0.55 x 0.8 = 88.77	(79)
Southwest _{0.9x} 0.77 x 1.37 x 119.01 0.55 x 0.8 = 99.43	(79)
Southwest _{0.9x} 0.77 x 1.37 x 118.15 0.55 x 0.8 = 98.71	(79)
Southwest _{0.9x} 0.77 x 1.37 x 113.91 0.55 x 0.8 = 95.17	(79)
Southwest _{0.9x} 0.77 x 1.37 x 104.39 0.55 x 0.8 = 87.22	(79)
Southwest _{0.9x} 0.77 x 1.37 x 92.85 0.55 x 0.8 = 77.58	(79)
Southwest _{0.9x} 0.77 x 1.37 x 69.27 0.55 x 0.8 = 57.87	(79)
Southwest _{0.9x} 0.77 x 1.37 x 44.07 0.55 x 0.8 = 36.82	(79)
Southwest _{0.9x} 0.77 x 1.37 x 31.49 0.55 x 0.8 = 26.31	(79)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m	
	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts	
(84)m= 376.12 418.12 462.49 514.32 553.7 549.28 523.92 485.89 442.15 395.89 366.61 359.89	(84)
7. Mean internal temperature (heating season)	
Temperature during heating periods in the living area from Table 9, Th1 (°C)	(85)
Utilisation factor for gains for living area, h1,m (see Table 9a)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	

(86)m=	0.99	0.99	0.98	0.95	0.86	0.69	0.53	0.59	0.83	0.96	0.99	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)					
(87)m=	19.65	19.8	20.07	20.43	20.75	20.93	20.98	20.98	20.84	20.45	19.99	19.63		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	19.82	19.82	19.82	19.83	19.83	19.84	19.84	19.85	19.84	19.83	19.83	19.82		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	ee Table	9a)						
(89)m=	0.99	0.99	0.97	0.93	0.81	0.59	0.4	0.46	0.75	0.95	0.99	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwell	ing T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	18.05	18.27	18.66	19.18	19.59	19.8	19.84	19.84	19.72	19.21	18.55	18.02		(90)
									1	LA = Livin	g area ÷ (4	4) =	0.54	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	.A) × T2					
(92)m=	18.92	19.1	19.42	19.86	20.22	20.42	20.46	20.46	20.33	19.88	19.33	18.89		(92)
		nent to t	r	1	l temper		m Table	4e, whe	re appro	priate				
(93)m=	18.92	19.1	19.42	19.86	20.22	20.42	20.46	20.46	20.33	19.88	19.33	18.89		(93)
		•	uirement		1.4.		44	T.I.I. 0	41.	4 T : /:	70)			
				mperatul using Ta		ied at st	ер 11 от	i able 9i	o, so tna	t 11,m=(76)m an	d re-calc	sulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:					-					
(94)m=	0.99	0.99	0.97	0.93	0.83	0.65	0.47	0.53	0.79	0.95	0.98	0.99		(94)
	<u> </u>		<u>`</u>	4)m x (8		l								(05)
(95)m=		412.2	449.11	477.26	457.39	355.18	247.65	256.79	347.83	374.72	361	357.37		(95)
(96)m=	4.3	age exte	6.5	perature 8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			!		Į	Į	[(39)m :			!				()
(97)m=	982.63	952.37	864.84	725.6	562.97	380.13	252.36	264.48	408.95	613.2	811.65	979		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	4 x [(97)m – (95)m] x (4	1)m			
(98)m=	453.6	363	309.31	178.81	78.55	0	0	0	0	177.43	324.46	462.49		_
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	2347.64	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								46.54	(99)
9b. En	ergy rec	quiremer	nts – Coi	mmunity	heating	scheme	;							
						-	ater heat	• .	-		unity sch	neme.	_	7(004)
				•		•	heating (l able 1	1) '0' if n	one			0	(301)
Fractio	n of spa	ace heat	from co	mmunity	/ system	1 – (30	1) =						1	(302)
includes	boilers, h	eat pumps	s, geotherr	mal and wa	aste heat t		orocedure r stations.			up to four (other heat	sources; tl		7(202-)
				ity heat									1	(303a)
				ity heat		•							0.8	(303a)
Fractio	n of cor	nmunity	heat fro	m heat s	source 2	(Water)							0.2	(303b)
Fractio	n of tota	al space	heat fro	m Comn	nunity h	eat pum)			(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and	charging	method	l (Table	4c(3)) fo	r commu	unity hea	iting sys	tem			1	(305)

Distribution loss factor (Table 12c) for commu	ınity heating system		Г	1.05	(306)
Distribution loss factor (Table 12c) for commu)	L T	1.05](306)
Space heating	anity ricuting system (vvator	,	L	kWh/year	١
Annual space heating requirement				2347.64	7
Space heat from Community heat pump		(98) x (304a) x	(305) x (306) =	2465.03	(307a)
Efficiency of secondary/supplementary heating	0	(308			
Space heating requirement from secondary/s	upplementary system	(98) x (301) x 1	00 ÷ (308) =	0	(309)
Water heating Annual water heating requirement			[1825.34]
If DHW from community scheme: Water heat from CHP (Water)		(64) x (303a) x	(305) x (306) =	1533.28	(310a)
Water heat from heat source 2 (Water)		(64) x (303a) x	(305) x (306) =	383.32	(310b)
Electricity used for heat distribution	0.01 >	(307a)(307	e) + (310a)(310e)] =	24.65	(313)
Electricity used for heat distribution (Water)	0.01 >	(307a)(307	e) + (310a)(310e)] =	19.17	(313)
Cooling System Energy Efficiency Ratio				0	(314)
Space cooling (if there is a fixed cooling syste	em, if not enter 0)	= (107) ÷ (314)	=	0	(315)
Electricity for pumps and fans within dwelling mechanical ventilation - balanced, extract or			[157.84	(330a)
warm air heating system fans				0	(330b)
pump for solar water heating	0	(330g)			
Total electricity for the above, kWh/year	157.84	(331)			
Energy for lighting (calculated in Appendix L)				234.98	(332)
Electricity generated by PVs (Appendix M) (n	egative quantity)			-576.34	(333)
Total delivered energy for all uses (307) + (30	09) + (310) + (312) + (315) +	+ (331) + (33	32)(237b) =	2281.5	(338)
12b. CO2 Emissions – Community heating so					
	Enei kWh	gy /year	Emission factor I kg CO2/kWh	Emissions (g CO2/year	
CO2 from other sources of space and water hefficiency of heat source 1 (%)	neating (not CHP) If there is CHP using two fuels i	repeat (363) to	(366) for the second fuel	280	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 10	00 ÷ (367b) x	0.52	456.91	(367)
Electrical energy for heat distribution	[(313) x		0.52	12.79	(372)
Water heating from separate community syst	em				
CO2 from other sources of space and water Efficiency of heat source 1 (%)	heating (not CHP) If there is CHP using two fuels in	repeat (363) to	(366) for the second fuel	280	(367a)
Efficiency of heat source 2 (%)	If there is CHP using two fuels	repeat (363) to	(366) for the second fuel	100	(367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 10	00 ÷ (367b) x	0 =	284.21	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 10	00 ÷ (367b) x	0.52	198.94	(368)
Electrical energy for heat distribution	[(313) x		0.52	9.95	(372)

Total CO2 associated with community system	ns (363)(366) + (368)(372)	=	962.8	(373)
CO2 associated with space heating (secondary	(309) x	0	=	0	(374)
CO2 associated with water from immersion h	eater or instantaneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and water h	neating (373) + (374) + (375) =			962.8	(376)
CO2 associated with electricity for pumps and	d fans within dwelling (331)) x	0.52	=	81.92	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	121.95	(379)
Energy saving/generation technologies (333) Item 1	` ′ ''	0.52 × 0.01 =	= [-299.12	(380)
Total CO2, kg/year	of (376)(382) =			867.55	(383)
Dwelling CO2 Emission Rate (383)	÷ (4) =			17.2	(384)
El rating (section 14)				87.82	(385)