RIBA Stage 2 Energy Assessment 51 Calthorpe Street

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Contents:

Executive Summary	
Carbon Emission Factors	6
Establishing CO ₂	7
Baseline	
Demand Reduction	10
Cooling and Overheating	14
Heating Infrastructure	17
Renewable Energy	19
Peak Energy Demand	28
Cost to Occupants	29
Conclusion	30
Appendix A	31
Appendix B	32

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About the Scheme

The proposed scheme involves the change of use of an existing building with an extension of a basement and a new level on top. The redevelopment comprises 8 residential units and 3 level of office spaces over the 6-storey building. The refurbishment works for part of the ground floor to the 2nd levels provide 7 residential units and the new extension to the 3rd level provides 1 additional residential unit. The refurbished part ground and lower ground level provides approx. 580m^2 of office space and the new addition of the basement accommodates extra 339m^2 of office space.

Planning policy

The scheme has been developed in accordance with the Intend to Publish London Plan 2019 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
- Non-domestic development should achieve 15% CO₂ improvement through energy efficiency measures 'Be Lean' stage
- Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
 - 1. through a cash in lieu contribution to the borough's carbon offset fund, or
 - 2. off-site provided that an alternative proposal is identified, and delivery is certain

Summary

All the residential units and the non-domestic unit have been analysed.

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 L2A (office) The actual building CO₂ emissions rate (BER) is no greater than
 the notional building CO₂ target emissions rate.
- New build, Part L1A (Flat 6,7 and 8) The actual dwelling CO₂ emissions rate (DER) is no
 greater than the notional CO2 target emissions rate.
- Refurbishment, Part L1B (Flat 1 to 5) 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 CO_2 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 52.5% beyond Building Regulations through energy efficiency measures and maximised of renewable technologies (Air Source Heat Pumps)
- Residential part of the development achieves 28.3% CO₂ improvement through energy efficiency measures, 'Be Lean' stage
- Non-domestic part of the development achieves 9.1% CO₂ improvement through energy
 efficiency measures, 'Be Lean' stage. The development is unable to achieve the 15%
 improvement due to high hot water demand which is 54.5% of the whole energy demand.
- A further improvement of 35.3% CO₂ has been achieved through renewable technologies 'Be Green' stage (Air Source Heat Pumps)
- Overall, the scheme achieves an improvement of 52.5% 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 £55,026

Executive Summary

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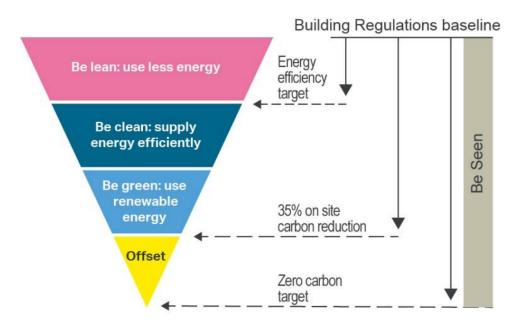
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Energy hierarchy

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:
 - Low U-values for opaque elements and fenestration
 - Low a-value
 - Low air permeability
 - High efficiency lighting and sensors
 - Mechanical ventilation with heat recovery
- Be Green:
 - o Communal Air Source Heat Pumps to provide space heating and hot water

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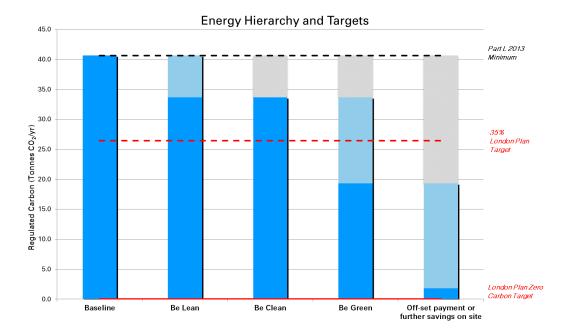
GLA's Energy Hierarchy: Regulated carbon emissions

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 17.2% from the fabric energy efficiency measures described in the 'Be Lean' section and will reduce total carbon emissions by 52.5% 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).

Therefore, the scheme meets and exceeds the planning policy carbon reduction target and complies with London Plan Policy 5.2 and Intend to Publish London Plan 2019 Policy SI2.

The carbon offset payment to meet the zero-carbon target has been calculated as £55,026



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Regulated CO₂ emissions - Site-wide

Site-wide				
GLA's Energy Hierarchy: Regulated CO ₂ - Calculated using SAP 2012 CO ₂ factors				
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	53.68	44.82	-	43.01
CO ₂ emissions saving (tCO ₂ /yr)	-	8.86	-	1.81
Saving from each stage (%)	-	16.5	-	3.4
Total CO ₂ emissions saving (tCO ₂ /yr)	10.67			

19.9% total CO₂ savings over notional specification for existing buildingsand 2013 Building Regulations Part L achieved

specification for existing buildingsand 2013 Building Regulations Part L achieved

GLA's Energy Hierarchy: Regulated CO ₂ - Calculated using SAP 10.0 CO ₂ factors				
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	40.65	33.67	-	19.31
CO ₂ emissions saving (tCO ₂ /yr)	-	6.98	-	14.36
Saving from each stage (%)	-	17.2	-	35.3
Total CO ₂ emissions saving (tCO ₂ /yr)	21.34			
52.5% total CO ₂ savings over notional				

Regulated CO₂ emissions - Non-domestic

Non-domestic					
GLA's Energy Hierarchy: Regulated CO ₂ - Calculated using SAP 2012 CO ₂ factors					
	Baseline:	Be lean:	Be clean:	Be green:	
CO ₂ emissions (tCO ₂ /yr)	35.00	31.12	_	30.72	
CO ₂ emissions saving (tCO ₂ /yr)	_	3.87	_	0.40	
Saving from each stage (%)	_	11.11	_	1.2	
Total CO ₂ emissions saving (tCO ₂ /yr)	4.28				
12.2% total CO ₂ savings over 2013 Build	ing Regulations	Part L achieve	ed		
GLA's Energy Hierarchy: Regulated CO ₂	- Calculated us	ing SAP 10.0 (CO ₂ factors		
	Baseline:	Be lean:	Be clean:	Be green:	
CO ₂ emissions (tCO ₂ /yr)	23.56	21.42	-	13.79	
CO ₂ emissions saving (tCO ₂ /yr)	_	2.14	_	7.63	
Saving from each stage (%)	_	9.1	_	32.4	
Total CO ₂ emissions saving (tCO ₂ /yr)	9.77				
41.5% total CO ₂ savings over 2013 Build	ing Regulations	Part L achieve	ed		

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Regulated CO₂ emissions - Domestic new built

Domestic new built				
GLA's Energy Hierarchy: Regulated CO ₂	 Calculated us 	ing SAP 2012	CO ₂ factors	
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	4.57	4.44	-	4.09
CO ₂ emissions saving (tCO ₂ /yr)	-	0.13	-	0.35
Saving from each stage (%)	_	2.9	_	7.6
Total CO ₂ emissions saving (tCO ₂ /yr)	0.48			
10.6% total CO ₂ savings over 2013 Building Regulations Part L achieved				
GLA's Energy Hierarchy: Regulated CO ₂	 Calculated us 	ing SAP 10.0 (CO ₂ factors	
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	4.09	3.83	_	1.84
CO ₂ emissions saving (tCO ₂ /yr)	-	0.26	_	2.00
Saving from each stage (%)	-	6.4	_	48.7
Total CO ₂ emissions saving (tCO ₂ /yr)	2.26			
55.1% total CO ₂ savings over 2013 Building Regulations Part L achieved				

Regulated CO₂ emissions - Domestic refurbishment

Domestic refurbishment				
GLA's Energy Hierarchy: Regulated CO ₂	- Calculated us	sing SAP 2012	CO ₂ factors	
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	14.11	9.26	-	8.20
CO ₂ emissions saving (tCO ₂ /yr)	-	4.85	-	1.06
Saving from each stage (%)	-	34.4	-	7.5
Total CO ₂ emissions saving (tCO ₂ /yr)	5.91			
41.9% total CO ₂ savings over notional				
specification for existing buildingsachiev	red			
GLA's Energy Hierarchy: Regulated CO ₂	- Calculated us	sing SAP 10.0 (CO ₂ factors	

GLA's Energy Hierarchy: Regulated CO ₂ - Calculated using SAP 10.0 CO ₂ factors				
	Baseline:	Be lean:	Be clean:	Be green:
CO ₂ emissions (tCO ₂ /yr)	12.99	8.41	-	3.68
CO ₂ emissions saving (tCO ₂ /yr)	-	4.58	-	4.73
Saving from each stage (%)	-	35.2	-	36.4
Total CO ₂ emissions saving (tCO ₂ /yr)	9.31			
71 7% total CO savings over notional				

^{71.7%} total CO₂ savings over notional specification for existing buildings achieved

Carbon Emission Factors

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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 CO ₂ /kWh)		
	SAP 2012	SAP10.0	
Natural Gas	0.216	0.210	
Grid Electricity	0.519	0.233	

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.

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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 Intend to Publish London Plan 2019.

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 Policy 5.9 of London Plan and Intent to Publish London Plan 2019 Policy 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 Policy 5.6 of London Plan and Intent to Publish London Plan 2019 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 Policy 5.7 of London Plan and Intent to Publish London Plan 2019 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.

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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.

CO ₂ Emissions - Regulated and Unreg	ulated (tonnes CO ₂ /	/r) - SAP 10.0 - Site-	-wide
	Regulated Emissions	Unregulated Emissions	Total Emissions
Baseline: Part L 2013	40.65	15.97	56.62
Be Lean: Use less energy	33.67	15.97	49.64
Be Clean: Supply energy efficiently	_	_	-
Be Green: Use renewable energy	19.31	15.97	35.28
CO ₂ Emissions - Regulated and Unreg	ulated (tonnes CO ₂ /y	/r) - SAP 10.0 - Non	-domestic
	Regulated Emissions	Unregulated Emissions	Total Emissions
Baseline: Part L 2013	23.56	10.46	34.02
Be Lean: Use less energy	21.42	10.46	31.88
Be Clean: Supply energy efficiently	_	_	_
Be Green: Use renewable energy	13.79	10.46	24.25
CO ₂ Emissions - Regulated and Unreg	ulated (tonnes CO ₂ /y	/r) - SAP 10.0 - Don	nestic
	Regulated Emissions	Unregulated Emissions	Total Emissions
Baseline: Part L 2013	17.09	5.52	22.60
Be Lean: Use less energy	12.25	5.52	17.76
Be Clean: Supply energy efficiently	_	_	_
Be Green: Use renewable energy	5.52	5.52	11.03

Carbon offsetting

London Plan's Policy 5.2 and Intend to Publish London Plan 2019 Policy SI2, requires carbon dioxide reductions to be achieved as far as possible on-site 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. The table below confirms the cash—in–lieu contribution for both domestic and non–domestic units.

Regulated carbon dioxide savings from each stage of the energy hierarchy – SAP 10.0				
	(tonnes CO ₂ /yr)	%		
Be Lean: Savings from energy demand reduction	6.98	17.2%		
Be Clean: Savings from heat networks	0.00	0.0%		
Be Green: Savings from renewable energy	14.36	35.3%		
Cumulative on-site savings	21.34	52.5%		
Carbon shortfall	19.31	-		
	(tonnes CO ₂)			
Cumulative savings for offset	579.22	·		
Cash-in-lieu contribution	£55,026			

Baseline

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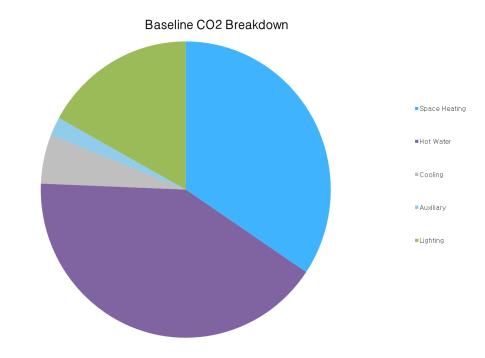
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Building regulations Part L 2013 minimum compliance

The total baseline carbon emissions for the whole scheme is 40.65 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 hot water is the primary source of carbon dioxide emissions, and space heating is the second largest, across the scheme as a whole. The carbon emissions from the domestic part of the scheme are mostly from space heating, whereas the carbon emissions from the nondomestic part of the scheme are from hot water.

Carbon Emissi	ons in tonnes CO ₂ /yr.			
Heating	Hot Water	Cooling	Auxiliary	Lighting
13.99	16.76	2.18	0.83	6.89



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Be Lean: summary

Demand reduction measures have reduced the scheme's carbon emissions by 17.2% (using SAP 10.0 figures) over the minimum Part L 2013 Building Regulations baseline and notional specification for existing buildings (Appendix 4 of GLA's Guidance).

U-values

Non- Domestic		
Element	Minimum Building Regulations U-value W/m²K	Proposed U-value W/m ² K
Flat roof	0.25	0.12
Wall - Lower ground floor and ground floor	0.35	0.23
Wall - Basement	0.35	0.12
Ground floor	0.25	0.12
Exposed floor	0.25	0.12
Windows - Lower ground floor and ground floor	2.20	1.6 (g-value 0.50)
Windows - Basement	2.20	1.2 (g-value 0.27)
Doors	2.20	1.4

Domestic			
Element	Minimum Building Regulations U-value W/m²K	Existing Building U- value W/m ² K Appendix 4 (GLA guidance 2020)	Proposed U-value W/m ² K
Flat roof	0.20	0.18	0.12
Pitched roof	0.20	0.18	0.12
Wall - Existing	-	0.55	0.23
Wall - New	0.30	_	0.12
Corridor wall	0.30	_	0.12
Ground floor	0.25	0.55	0.12
Exposed floor	0.25	0.55	0.12
Windows - Existing	2.00	1.60	1.6
		(g-value 0.63)	(g-value 0.63)
Windows - New	2.00	1.60	1.2
		(g-value 0.63)	(g-value 0.50)
Rooflights	2.00	1.60	1.2
		(g-value 0.63)	(g-value 0.50)
Doors	2.00	1.60	1.4

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

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Air permeability

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

Air permeability (m3/hm2 @50 Pa)	Minimum Building Regulations	Existing Building Appendix 4 (GLA guidance 2020)	Proposed
Non-domestic	10	10	5
Domestic - Existing (Flat 1 to 5)	10	10	5
Domestic - New (Flat 6, 7 and 8)	10	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 default psi-value has been used for all junctions.

Thermal Mass:

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

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Heating

<u>Domestic:</u> 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 2.90 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.

Non-domestic: For the 'Be Lean' scenario, the scheme has been modelled with a gas boiler with an efficiency of 91% (as required by the GLA). For the 'Be Green' final scenario, a communal air source heat pump with a minimum COP of 2.90 will be proposed as the main heating system. Heat will be provided via radiators and will be controlled by local time and temperature.

Hot Water

<u>Domestic:</u> 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 communal air source heat pump, with a minimum COP of 2.90. A top-up electric immersion heater will provide less than 20% of the hot water demand.

Non-domestic: For the 'Be Lean', the hot water will be provided by the main gas heating system (gas boilers with an efficiency of 91%). For the 'Be Green' final scenario, hot water will be provided by the air source heat pump, with a minimum COP of 2.90. A top-up electric immersion heater will provide less than 20% of the hot water demand.

Ventilation

<u>Domestic:</u> Balanced ventilation with heat recovery has been specified for the new apartments (flat 6, 7 and 8).

- The apartments with one wet room have been modelled with an SFP of 0.58 W/I/s and a heat recovery efficiency of 90%.
- The apartments with three wet rooms have been modelled with an SFP of 0.71 W/l/s and a heat recovery efficiency of 86%.

Natural ventilation with extract fans fr the bathrooms has been specified for the existing flats (1 to 5). Non-domestic: Mechanical ventilation with heat recovery and demand control ventilation (dependent on occupancy and speed control) has been specified for the offices and meeting rooms of the commercial area, with a minimum heat recovery efficiency of 85% and an SFP of 1.4W/(l/s). Extract ventilation has been specified for the toilets with a flow rate less than 5l/s/m² and an SFP less than 0.3W/l/s.

Cooling

Domestic: No cooling has been specified for the apartments.

Non-domestic: Cooling will be provided by an air source heat pump with EER of 3.8 and a SEER of 4.2.

Lighting

<u>Domestic:</u> High efficiency lighting has been specified for the development with a minimum efficacy of 75 lumens/W.

Non-domestic: High efficiency lighting has been specified for the commercial area with a minimum efficacy of 120lumens/W. PIR sensors have been specified for all areas with a parasitic power of less than 0.1W/m². Photoelectric controlled daylight dimming sensors have been specified for the offices with a parasitic power of less than 0.1W/m².

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Energy demand following energy efficiency measures (MWh/year)

	Space Heating	Hot water	Lighting	Auxiliary	Cooling	Unregulated gas	Unregulated electricity
Domestic	35.2	18.8	3.1	0.9	0.0	0.0	12.3
Non- domestic	4.8	61.1	15.0	4.8	12.8	0.0	44.9

Fabric energy efficiency

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement (%)
Domestic - New	13.56	12.61	7%
Domestic - Existing	43.79	25.51	42%
Domestic	57.35	38.12	34%

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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
- 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.
 - Light-coloured 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.
 - High albedo materials: A high albedo (reflective) surface has been specified for the
 roof and vertical facades in order to minimise the heat absorbed by the roof, and
 significant thermal insulation has been specified to prevent any heat absorbed
 being transferred into the building.
 - Insulation levels have been maximised and the resulting U-values are lower than
 required by Building Regulations. The build-ups therefore prevent the penetration of
 heat as much as practically possible. See the 'Be Lean' section of this report for
 target u values.
 - A reduced air permeability rate 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

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

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- 4. Provide passive ventilation
 - Openable windows are specified on all facades of the building.
 - Shallow floorplates have been specified with dual aspect units where possible 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 offices to make
 use of 'free cooling' where the outside air temperature is below that in the building
 during summer months.
 - A mixed mode system will be implemented. This will be complimentary to the
 passive cooling measures taken. During summer months, mechanical ventilation
 using fans will remove hot air from the building. The building will also adopt a
 zoned design to allow natural ventilation where possible and mechanical ventilation
 where there are increased cooling loads such as server/IT rooms and equipment
 and high-density offices.
 - The mechanical systems will comply with the Domestic and Non-Domestic Building Services Compliance Guide as it is demonstrated in the 'Be Lean' section.

Cooling and Overheating

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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
Flat 1	Slight
Flat 2	Not significant
Flat 3	Not significant
Flat 4	Not significant
Flat 5	Not significant
Flat 6	Medium
Flat 7	Medium
Flat 8	Slight
Offices - Basement	Not significant
Offices - Lower Ground	Not significant
Offices - Ground	Not significant

According to the GLA guidance on preparing energy assessments (April 2020) Section 8, a dynamic modelling in line with CIBSE TM52 and TM59 should be carried out to assess the risk of overheating. However, the risk of overheating from the SAP and SBEM model indicates no significant to medium risk, therefore an overheating analysis has not been undertaken.

Active cooling

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

In the non-domestic unit, the actual cooling demand is above that of the notional, as it is shown in the table below. According to the latest GLA guidance, the cooling demand should be lower than the notional building. The proposed unit consists of existing solid brick façade (that will be internally insulated) and existing windows. The design team has considered all available measures to reduce internal heat gains and solar heat gains on the new windows of the basement). However, a high g-value of 0.5 needs to be specified for the existing windows (lower ground floor and ground floor) to match the appearance and character of the existing building. Therefore, the scheme results in a higher cooling demand compared to the notional building.

	Area weighted average non- domestic cooling demand (MJ/m²)	Total area weighted non- domestic cooling demand (MJ/year)
Actual	111.6	137680
Notional	98.1	121025

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

- Location: Indoor cooling units have been specified on a localised basis where internal gains
 are too high. The units will be fully fitted with local temperature controls for optimal usage.
- The location of the outdoor units that 'dump' the heat has been carefully conspired carefully so not to cause problems for people and the environment, and not to add to the urban heat island effect. They will be located on the roof space and will allow adequate air movement around the condensing units; this will ensure maximum operating efficiency and will limit the impacts of dumped heat on people and the environment.
- The AC systems will have the following efficiencies which are in compliance with the Non-Domestic Building Services Compliance Guide:
 - Seasonal Energy Efficiency Ratio of 4.2
 - o Energy Efficiency Ratio of 3.8

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Heating infrastructure including CHP

Once demand for energy has been minimised, schemes must demonstrate how their energy systems have been selected in accordance with the order of preference in Policy 5.6B of London Plan and Policy SI3 of Intended to publish London Plan. This has involved a systematic appraisal of the potential to connect to existing or planned heating networks and on site communal and CHP systems.

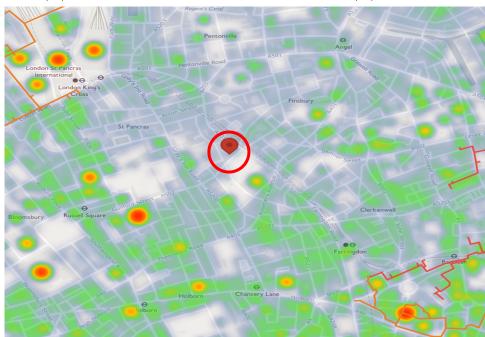
To comply with London Plan Policy SI 3, developments in Heat Network Priority Areas (HNPAs) should have a communal low-temperature heating system and should select a heat source in accordance with the following heating hierarchy:

- a) 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)
- d) use ultra-low NOx gas boilers

(CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of London Plan Policy SI 1 Improving air quality)

Connect to local existing or planned heat network

The illustration below shows the London heat map. Red lines are existing heat networks and orange lines are proposed heat networks. 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.

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Use zero-emission and/or local secondary heat sources

According to the GLA and Intend to Publish London Plan 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. The possibilities of capturing waste heat from nearby sources has been undertaken, however the amount of heat available is likely a fraction of the scheme's demand which makes its collection trivial within the context of 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 administrative burden of managing CHP electricity sales at a small scale without an active energy service companies (ESCOs) is prohibitive for smaller operators of residential developments.

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

Use ultra-low NOx gas boilers

Where it is clearly demonstrate 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).

Air quality impacts

An air quality assessment is required for all major developments as per the Intend to Publish London Plan 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.

Renewable Energy

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Renewable Energy Feasibility:

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

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

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

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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 is 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 £30,000. 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 (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
✓	√√√	\ \ \ \ \ \ \ \ \
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.

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Photovoltaic Panels (PV) - Rejected

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 development will not have solar PVs installed, as there is limited roof space with the ASHP taking up majority of the available space.

Local, site-specific impact (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
√ √	$\checkmark\checkmark$	√√√√
No local air quality impacts, use of unutilised roof space, no noise issues, visual impact, 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.

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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 (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
No local air quality impacts, use of unutilised roof space, no noise issues, visual impact, 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	Lower carbon saving as primarily displacing gas, uses minimal grid electricity, no local air impact, medium embodied energy of panels.
	years.	

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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 (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (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 issues for wiring and metering.	Medium capital costs of installation, typical payback of 5 years, Feed in Tariff available, limited servicing and maintenance, costs of 2–3% typical.	High carbon saving from electricity, output limited from urban installation, consumes little grid electricity, no local air impact, low embodied energy of panels

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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.

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Air Source Heat Pump (GSHP) -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 (out of 5)	Economic viability (out of 5)	CO ₂ and sustainability (out of 10)
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.	Medium- high capital costs of installation, typical payback >15 years where gas is displaced, Renewable Heat Incentive available Limited servicing and maintenance i.e. 1 visit per year, mechanical parts may require replacement over lifespan.	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.

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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 sustainability (out of 10)	Total Score
Biomass Boiler	Rejected - High air quality impact	✓	/ / /	////	9
Photovoltaic	Accepted - High CO ₂ savings and have low visual impact	√√	√√	√√√√ √√√	12
Solar Thermal	Rejected - Low CO ₂ savings compared to PV panels	√√	/ / /	√√√√ √	11
Wind Energy	Rejected - High visual and noise impact	√	/ / / /	////	10
GSHP	Rejected - High capital cost	√ √	✓	√ √ √ √ √ √ √ √	11
ASHP	Accepted - Can provide carbon savings with minimal site impact	V V V	√ √	√√√√ √√	13

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

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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 2.9 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 (£)	35,000	95,000
Maintenance and replacement cost (£)	40,000	10,000
Total (£)	75,000	105,000
Energy demand (kWh)	119,876	46,119
Cost of gas/electricity (p/kWh)	5	12.5
Annual operational cost (£)	5,994	5,765

It should be noted that the figures above are based on SAP and SBEM 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 (£)	30,000
Predicted Annual Savings (£)	229
Payback Period (years)	131.0
Energy and Carbon Performance Criteria	Value
Predicted Annual Energy Saved (kWh/yr)	73,757
Annual Carbon Emissions Reductions (kg CO ₂ /year) using SAP10.0 carbon factors	14,362
CO ₂ Emissions Reduction (%) with SAP10.0	35.3%

End-users will be supplied with regular information to control and operate the system and maintenance visits. The performance of the system will be monitored postconstruction to ensure it is achieving the expected performance approved during planning, in line with the 'Be Seen policy.

Peak Energy Demand

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Flexibility and peak energy demand

The scheme is required to minimise both annual and peak energy demand as it is required by Intend to Publish London Plan Policy SI2 and SI3.

Flexibility potential and revised peak demand

The scheme will reduce the peak demand by incorporate the following measures:

Flexibility achieved through:	Yes/No	Details
Electrical energy storage (kWh) capacity	No	-
Heat energy storage (kWh) capacity	Yes	Thermal store of 2000l
Renewable energy generation (load matching)	No	-
Gateway to enable automated demand response	No	-
Smart systems integration (e.g. smart charge points for EV, gateway etc.)	No	-
Other initiative	No	-

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Cost to Occupants

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Controls

The proposed scheme sets out to address demand side response to energy efficiency, including smart meters, to provide more consumption data to inform control which will allow the running of some equipment at a lower capacity during times of peak demand. The design team will also explore the possibility of energy storage, smart controls, to optimise heating and power systems at a later stage of the project.

Running costs

Average cost per apartment

Electricity

Maximum operational energy expenses come from heating and hot water. The domestic and nondomestic units are being serviced by a system breakup of 80% demand being met by air source heat pumps and 20% from electric immersion heater.

The scheme wide demand figures below have been derived from SAP DER worksheets.

Electricity demand	kWh/year
Heating and hot water	19,969
Lighting	3.801
Ventilation	623
Unregulated	23,671
Fuel	Price
Electricity	12.5p/kWh

Cost/apartment/year

£739

Conclusion

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Summary

All the residential units and the non-domestic unit have been analysed.

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 L2A (office) The actual building CO₂ emissions rate (BER) is no greater than
 the notional building CO₂ target emissions rate.
- New build, Part L1A (Flat 6,7 and 8) The actual dwelling CO₂ emissions rate (DER) is no
 greater than the notional CO2 target emissions rate.
- Refurbishment, Part L1B (Flat 1 to 5) 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 CO_2 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 52.5% beyond Building Regulations through energy efficiency measures and maximised of renewable technologies (Air Source Heat Pumps)
- Residential part of the development achieves 28.3% CO₂ improvement through energy efficiency measures, 'Be Lean' stage
- Non-domestic part of the development achieves 9.1% CO₂ improvement through energy
 efficiency measures, 'Be Lean' stage. The development is unable to achieve the 15%
 improvement due to high hot water demand which is 54.5% of the whole energy demand.
- A further improvement of 35.3% CO₂ has been achieved through renewable technologies 'Be Green' stage (Air Source Heat Pumps)
- Overall, the scheme achieves an improvement of 52.5% 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 £55,026

Appendix A

Energy Assessment 51 Calthorpe Street

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) (MWh/year)	Total fuel consumption (non- residential) (MWh/year)
Grid electricity	47.3	104,1
Gas boilers (communal/individual)	_	-
Gas CHP	-	_
Connection to existing District Heating network	_	-
Other gas use (e.g. cookers)	-	_

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Appendix B

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SAP and BRUKL 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 Residential TER from the TER SAP worksheet for Flat 6, 7 and 8. DER from Existing scenario DER SAP worksheet for Flat 1 to 5
- Be Lean Residential DER from the Be Lean scenario DER SAP worksheet
- Be Green Residential DER from the Be Green scenario DER SAP worksheet
- Baseline Non-domestic TER from the Be Lean scenario BRUKL
- Be Lean Non-domestic BER from the Be Lean scenario BRUKL
- Be Green Non-domestic BER from the Be Green scenario BRUKL

Appendix B

Energy Assessment 51 Calthorpe Street

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Baseline Residential – TER from the TER SAP worksheet for Flat 6, 7 and 8. DER from Existing scenario DER SAP worksheet for Flat 1 to 5

DER WorkSheet: Existing dwelling (SAP)

			User D) otoilo:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 20		Stroma Number: STF					0016363 on: 1.0.4.26		
Address :	Flat 01, 51 Caltho			Address		-Baselin	e			
1. Overall dwelling dim	·	ipe olicei	, LOND	J14, VVC	IX UI II I					
9			Area	a(m²)		Av. He	ight(m)		Volume(m³)	
Ground floor					(1a) x		2.7	(2a) =	193.32	(3a)
Total floor area TFA = ((1a)+(1b)+(1c)+(1d)+(1e)+(1r	n)	71.6	(4)			•		
Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	.(3n) =	193.32	(5)
2. Ventilation rate:										
	main heating	secondar heating	ry	other		total			m³ per hour	
Number of chimneys	0 +	0	7 + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	Ī + Ē	0	j = F	0	x 2	20 =	0	(6b)
Number of intermittent	fans					3	x	10 =	30	(7a)
Number of passive ven	ts				F	0	x	10 =	0	(7b)
Number of flueless gas	fires					0	X	40 =	0	(7c)
C					L				_]` ′
								Air ch	nanges per hou	r
Infiltration due to chimn						30		÷ (5) =	0.16	(8)
	the dwelling (ne)	nded, procee	d to (17), (otherwise o	ontinue fr	om (9) to	(16)			1,0
Number of storeys in Additional infiltration	the dwelling (ris)						[(9)	-1]x0.1 =	0	(9) (10)
	0.25 for steel or timber	er frame or	0.35 for	r masonr	v constr	uction	[(0)	1,10.1	0.35	(11)
if both types of wall are	present, use the value corr				•				7777]` ′
- ·	nings); if equal user 0.35 n floor, enter 0.2 (unse	alad) or 0	1 (coala	nd) also	ontor O					1,40
•	enter 0.05, else enter (,	. i (Scale	<i>u)</i> , eise	enter 0				0.05	(12) (13)
•	ws and doors draught								1	(14)
Window infiltration	.			0.25 - [0.2	x (14) ÷ 1	00] =			0.248	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0.80318311664347	
Air permeability value	e, q50, expressed in c	ubic metre	s per ho	our per s	quare m	etre of e	envelope	area	0	(17)
If based on air permeat	oility value, then (18) =	[(17) ÷ 20]+(8), otherw	ise (18) = (16)				0.8	(18)
	lies if a pressurisation test l	has been dor	ne or a deg	gree air pe	meability	is being u	sed			1
Number of sides shelte Shelter factor	red			(20) = 1 -	0.075 x (1	19)1 =			2	(19) (20)
Infiltration rate incorpor	ating shelter factor			(21) = (18	`	- /1			0.85	(21)
Infiltration rate modified	•	ed		, , ,					0.00](= :)
Jan Feb	Mar Apr Ma	1	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind s	speed 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 Fasts: (00-)::	(22) 4								=	
Wind Factor $(22a)m = (22a)m = 1.27$	22)m ÷ 4 1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	1	
(22a)111 1.2J	1.20 1.1 1.00	0.90	1 0.33	0.92	'	1.00	1.14	1.10	J	

DER WorkSheet: Existing dwelling (SAP)

Adjusted infiltr	ation rate	e (allowi	ng for sl	nelter an	ıd wind s	speed) =	(21a) x	(22a)m					
0.87	0.85	0.84	0.75	0.73	0.65	0.65	0.63	0.68	0.73	0.77	0.8]	
Calculate effe		•	rate for t	he appli	cable ca	se	!	!	<u> </u>	!	!		
If mechanica				a.) (aa			.=\\	. (00)	\ (00 \			0	(23a)
If exhaust air h) = (23a)			0	(23b)
If balanced with		-	-	_								0	(23c)
a) If balance			1		i		- 	 	- 	· · ·	' ' ') ÷ 100] 1	(240)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If balance						, 	- ^ `	ŕ	r ´ `		Ι ,	1	(24b)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(240)
c) If whole h	iouse exti n < 0.5 ×			•	•				5 x (23h)			
(24c)m = 0	0.0	0	0	0	0	0	0	0	0	0	0	1	(24c)
d) If natural	ventilatio	n or wh	ole hous	se nositiv	ve input	ventilatio	on from	loft				J	, ,
,	n = 1, the			•	•				0.5]				
(24d)m= 0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82]	(24d)
Effective air	change r	rate - er	nter (24a) or (24l	o) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82		(25)
3. Heat losse	s and he	at loss i	paramet	er:									
ELEMENT	Gros		Openin		Net Ar	ea	U-val	ue	AXU		k-value	9	ΑΧk
	area ((m²)	'n	Ξ	A ,r	m²	W/m2	2K	(W/I	K)	kJ/m²·	K	kJ/K
Doors					3	X	1.6	=	4.8				(26)
Windows Type	e 1				2.36	х1	/[1/(1.6)+	0.04] =	3.55				(27)
Windows Type	∋ 2				1.93	x1	/[1/(1.6)+	0.04] =	2.9				(27)
Windows Type	∋ 3				1.8	x1	/[1/(1.6)+	0.04] =	2.71				(27)
Floor					71.6	X	0.55	=	39.38				(28)
Walls Type1	52.87	7	13.3	8	39.49) x	0.55	=	21.72				(29)
Walls Type2	32.34	4	0		32.34	1 x	0.14	<u> </u>	4.64	= [(29)
Total area of e	elements,	m²			156.8	1							(31)
Party wall					20.9	X	0	=	0				(32)
Party ceiling					71.6								(32b)
* for windows and ** include the area						ated using	ı formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
Fabric heat los							(26)(30) + (32) =				86.14	(33)
Heat capacity		•	,					((28).	(30) + (32	2) + (32a).	(32e) =	16100.4	
Thermal mass	•	•	P = 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 bridge				using Ap	pendix l	K						23.52	(36)
if details of therma	•	•		• .	•								`` ′
Total fabric he	at loss							(33) +	(36) =			109.67	(37)
Ventilation hea	at loss ca	lculated	monthl	/				(38)m	= 0.33 × ((25)m x (5))	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

							I						(00)
(38)m= 56.07	55.13	54.21	49.89	49.08	45.32	45.32	44.62	46.76	49.08	50.71	52.42		(38)
Heat transfer of			450.55	450.74	454.00	454.00	154.00	· · · ·	= (37) + (37)		[]		
(39)m= 165.73	164.79	163.87	159.55	158.74	154.98	154.98	154.28	156.43	158.74	160.38 Sum(39) ₁	162.09	159.55	(39)
Heat loss para	meter (l	HLP), W	m²K						= (39)m ÷		12 / 12-	139.33	
(40)m= 2.31	2.3	2.29	2.23	2.22	2.16	2.16	2.15	2.18	2.22	2.24	2.26		_
Number of day	s in mo	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	2.23	(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	rement:								kWh/yea	ir:	
Assumed occu	inancy	N									20		(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		.28		(42)
Annual averag	•	ater usaç	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		88	3.45		(43)
Reduce the annua							ò achieve	a water us	se target o				, ,
		,	, ,			<u> </u>		_		·			
Jan Hot water usage ii	Feb	Mar day for ea	Apr	May	Jun	Jul Table 1c x	Aug	Sep	Oct	Nov	Dec		
		90.22				1	· <i>′</i>	86.68	90.22	93.76	97.3		
(44)m= 97.3	93.76	90.22	86.68	83.15	79.61	79.61	83.15	l		m(44) ₁₁₂ =	<u> </u>	1061.44	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x D	7 Tm / 3600			· /	<u> </u>	1001.44	()
(45)m= 144.29	126.2	130.22	113.53	108.94	94	87.11	99.96	101.15	117.88	128.68	139.74		
If instantaneous v	otor booti	na at naint	of upo (no	, hat water	· otorogo)	antar O in	havaa (46		Total = Su	m(45) ₁₁₂ =	=	1391.71	(45)
If instantaneous w			,	1		1		` ′	4- 00				(40)
(46)m= 21.64 Water storage	18.93 loss:	19.53	17.03	16.34	14.1	13.07	14.99	15.17	17.68	19.3	20.96		(46)
Storage volum) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	eating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufact		oclared I	oss fost	or ic kno	wo (k\A/k	n/day/):							(40)
Temperature f				JI IS KIIU	wii (Kvvi	i/uay).					0		(48) (49)
Energy lost fro				ear			(48) x (49)) =			0		(50)
b) If manufact		-	-		or is not		(10) // (10)	,			0		(30)
Hot water stora	_			e 2 (kW	h/litre/da	ıy)					0		(51)
If community h	_		on 4.3										(=0)
Volume factor Temperature factor			2h							-	0		(52) (53)
Energy lost fro				oor			(47) v (51)) x (52) x (53) -		0		
Enter (50) or (-	, KVVII/y	zai			(47) X (31)) X (32) X (55) -		0		(54) (55)
Water storage	. , .	•	or each	month			((56)m = (55) × (41)ı	m		<u> </u>		()
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains												Н	, ,
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
	<u> </u>					I							

Primary circuit loss (annual) from Table 3	0 (58)											
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	1											
(modified by factor from Table H5 if there is solar water heating and a c	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= 49.58 43.16 45.98 42.75 42.37 39.26 40.57 42.37	42.75 45.98 46.24 49.58 (61)											
Total heat required for water heating calculated for each month (62)m = 0	0.85 × (45)m + (46)m + (57)m + (59)m + (61)m											
	143.9 163.86 174.92 189.32 (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												
	143.9 163.86 174.92 189.32											
	t from water heater (annual) ₁₁₂ 1922.28 (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]											
	44.32 50.69 54.35 58.86 (65)											
include (57)m in calculation of (65)m only if cylinder is in the dwelling or												
	Thot water is from community fleating											
5. Internal gains (see Table 5 and 5a):												
Metabolic gains (Table 5), Watts	Con Oct Nov Doo											
Jan Feb Mar Apr May Jun Jul Aug	Sep Oct Nov Dec 114.22 114.22 114.22 (66)											
	, ,											
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Ta												
	15.52 19.7 22.99 24.51 (67)											
Appliances gains (calculated in Appendix L, equation L13 or L13a), also s												
	153.54 164.73 178.86 192.13 (68)											
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see												
(69)m= 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42	34.42 34.42 34.42 (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= -91.37 -91.37 -91.37 -91.37 -91.37 -91.37 -91.37 -91.37 -91.37	-91.37 -91.37 -91.37 (71)											
Water heating gains (Table 5)												
(72)m= 81.15 78.5 73.65 67.27 62.92 57.04 52.56 58.91	61.56 68.13 75.48 79.11 (72)											
Total internal gains = $(66)m + (67)m + (68)m + (68)m$	69)m + (70)m + (71)m + (72)m											
(73)m= 366.26 363.03 348.97 327.22 305.45 284.78 272.09 279.02 2	290.88 312.83 337.6 356.02 (73)											
6. Solar gains:												
Solar gains are calculated using solar flux from Table 6a and associated equations to conv	vert to the applicable orientation.											
	g_ FF Gains											
Table 6d m² Table 6a Tab	ble 6b Table 6c (W)											
Southeast 0.9x 0.77 x 2.36 x 36.79 x 0	0.63 × 0.7 = 53.07 (77)											
Southeast 0.9x 0.77 x 2.36 x 62.67 x (0.63 × 0.7 = 90.41 (77)											

		,		,		_						_
Southeast _{0.9x}	0.77	X	2.36	X	85.75	X	0.63	×	0.7	=	123.7	(77)
Southeast _{0.9x}	0.77	X	2.36	X	106.25	X	0.63	X	0.7	=	153.27	(77)
Southeast _{0.9x}	0.77	X	2.36	X	119.01	X	0.63	X	0.7	=	171.67	(77)
Southeast _{0.9x}	0.77	X	2.36	X	118.15	X	0.63	X	0.7	=	170.43	(77)
Southeast _{0.9x}	0.77	X	2.36	X	113.91	X	0.63	X	0.7	=	164.31	(77)
Southeast _{0.9x}	0.77	X	2.36	X	104.39	X	0.63	x	0.7	=	150.58	(77)
Southeast 0.9x	0.77	X	2.36	X	92.85	X	0.63	x	0.7	=	133.94	(77)
Southeast _{0.9x}	0.77	X	2.36	X	69.27	X	0.63	X	0.7	=	99.92	(77)
Southeast _{0.9x}	0.77	X	2.36	X	44.07	X	0.63	x	0.7	=	63.57	(77)
Southeast 0.9x	0.77	X	2.36	X	31.49	X	0.63	x	0.7	=	45.42	(77)
Southwest _{0.9x}	0.77	X	1.8	X	36.79		0.63	x	0.7	=	20.24	(79)
Southwest _{0.9x}	0.77	x	1.8	X	62.67]	0.63	X	0.7	=	34.48	(79)
Southwest _{0.9x}	0.77	x	1.8	x	85.75	Ī	0.63	_ x [0.7	<u> </u>	47.17	(79)
Southwest _{0.9x}	0.77	x	1.8	x	106.25	Ī	0.63	x	0.7	-	58.45	(79)
Southwest _{0.9x}	0.77	X	1.8	X	119.01	Ī	0.63	×	0.7	=	65.47	(79)
Southwest _{0.9x}	0.77	j×	1.8	x	118.15	Ī	0.63	x [0.7	=	64.99	(79)
Southwest _{0.9x}	0.77	x	1.8	x	113.91	Ī	0.63	×	0.7	=	62.66	(79)
Southwest _{0.9x}	0.77	X	1.8	X	104.39	Ī	0.63	×	0.7	=	57.43	(79)
Southwest _{0.9x}	0.77	x	1.8	X	92.85	i	0.63	= x	0.7	-	51.08	(79)
Southwest _{0.9x}	0.77	x	1.8	X	69.27	Ī	0.63	= x	0.7	=	38.1	(79)
Southwest _{0.9x}	0.77	X	1.8	X	44.07	ī	0.63	x [0.7	=	24.24	(79)
Southwest _{0.9x}	0.77	X	1.8	X	31.49	i i	0.63	- x	0.7	=	17.32	(79)
Northwest _{0.9x}	0.77	X	1.93	X	11.28	X	0.63	= x	0.7	= =	13.31	(81)
Northwest _{0.9x}	0.77	X	1.93	X	22.97] x	0.63	x	0.7	= =	27.09	(81)
Northwest _{0.9x}	0.77	X	1.93	X	41.38	i x	0.63	= x	0.7	= =	48.81	(81)
Northwest _{0.9x}	0.77	x	1.93	X	67.96	X	0.63	x [0.7	=	80.17	(81)
Northwest _{0.9x}	0.77	x	1.93	X	91.35	X	0.63	= x	0.7	=	107.76	(81)
Northwest _{0.9x}	0.77	X	1.93	X	97.38	i x	0.63	- x	0.7	=	114.88	(81)
Northwest _{0.9x}	0.77	X	1.93	X	91.1] x	0.63	- x	0.7	=	107.47	(81)
Northwest 0.9x	0.77	X	1.93) X	72.63] x	0.63	= x	0.7		85.68	(81)
Northwest _{0.9x}	0.77] x	1.93)]	50.42	d x	0.63	= x	0.7	=	59.48	(81)
Northwest 0.9x	0.77] x	1.93	X	28.07	j ×	0.63	= x	0.7	=	33.11	(81)
Northwest 0.9x	0.77] x	1.93) x	14.2	d x	0.63	= x	0.7	=	16.75	(81)
Northwest _{0.9x}	0.77]]	1.93)]	9.21] x	0.63	= x	0.7	=	10.87	(81)
L	-	J				_			-			` ′
Solar gains in w	atts, calcul	ated	for each mon	th		(83)m	n = Sum(74)m .	(82)m				
ĭ 	151.98 219	-	291.88 344.9	_	50.31 334.44	293	.68 244.5	171.13	104.56	73.61		(83)
Total gains – int	ternal and s	solar	(84)m = (73)r	n + (83)m , watts		,		•			
(84)m= 452.89	515.01 568	3.66	619.1 650.3	5 6	35.09 606.54	572	.71 535.38	483.96	442.16	429.63		(84)
7. Mean intern	al te <u>mperat</u>	ture (heating seaso	on)								
Temperature d		,			area from Ta	ble 9	, Th1 (°C)				21	(85)
Utilisation facto	•	•		_			` ,					
Jan		1ar	Apr Ma	Ť	Jun Jul	A	ug Sep	Oct	Nov	Dec		
				-			<u> </u>				I	

(86)m=	1	0.99	0.99	0.98	0.95	0.89	0.8	0.83	0.94	0.98	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=	18.49	18.68	19.03	19.55	20.06	20.53	20.78	20.74	20.36	19.71	19.04	18.5		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	able 9, Ti	 h2 (°C)					
(88)m=	19.13	19.14	19.15	19.19	19.19	19.23	19.23	19.23	19.21	19.19	19.18	19.16		(88)
Utilisa	ation fac	tor for g	ains for ı	rest of d	welling, l	h2,m (se	ee Table	9a)						
(89)m=	0.99	0.99	0.99	0.97	0.92	0.8	0.59	0.65	0.88	0.97	0.99	1		(89)
Mean	internal	temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)	•	•		
(90)m=	16.96	17.15	17.5	18.04	18.55	19	19.17	19.16	18.85	18.21	17.54	16.98		(90)
								•	f	LA = Livin	g area ÷ (4	4) =	0.32	(91)
Mean	internal	temper	ature (fo	r the wh	ole dwel	lina) = fl	LA × T1	+ (1 – fL	.A) × T2			'		
(92)m=		17.65	18	18.53	19.04	19.49	19.7	19.67	19.34	18.7	18.03	17.48		(92)
Apply	adjustn	nent to the	ne mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	17.46	17.65	18	18.53	19.04	19.49	19.7	19.67	19.34	18.7	18.03	17.48		(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	
ine ui	Jan	Feb	Mar	using Ta Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm		iviay	Juli	Jui	_ Aug	Оер	Oct	INOV	Dec		
(94)m=		0.99	0.98	0.96	0.92	0.82	0.66	0.71	0.89	0.97	0.99	0.99		(94)
		hmGm ,	W = (94	1)m x (84	1)m		l .							
(95)m=	449.67	509.35	557.95	596.02	598.03	521.42	402.48	406.24	475.98	468.92	437.3	427.09		(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)
							-``	x [(93)m	 		ı	ı	l	
` '	2180.65		1884.61		1164.81	758.6	479.86	505.07	820.21	1285.59		2151.96	I	(97)
•	e heating	<u> </u>	987.03	r each m 677.41	10nth, k\ 421.68	Wh/mont	$\frac{1}{0} = 0.02$	24 x [(97])m – (95 0)m] x (4 607.6	1)m 946.86	1283.31		
(98)m=	1287.85	1009.23	987.03	677.41	421.08	U	0		Ů				7220.00	(98)
								Tota	l per year	(kvvn/year	r) = Sum(9	8)15,912 =	7280.98	Ⅎ
-				kWh/m²									101.69	(99)
			ıts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
•	e heatir	•	t from o	ooondon	/aupple	montory	ovotom					İ		7(201)
	•			econdar	• • •	mentary	•		(201) -				0	(201)
				nain syst	` '			(202) = 1 -		(000)1			1	(202)
			•	main sys				(204) = (2	02) × [1 –	(203)] =			1	(204)
	•	•		ing syste									90.3	(206)
Efficie	ency of s	seconda	ry/supple	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									1	
		1069.23	987.03	677.41	421.68	0	0	0	0	607.6	946.86	1283.31	I	
(211)m				00 ÷ (20							l	l	l	(211)
	1426.19	1184.09	1093.06	750.18	466.98	0	0	0 Tata	0	672.87	1048.57			7 ,
								rota	l (kWh/yea	ai) –Sum(2	۱۱) _{15,10} 12	2	8063.1	(211)

Space heating fuel (secondary), k	Wh/month									
$= \{[(98)\text{m x } (201)] \} \text{ x } 100 \div (208)$ $(215)\text{m} = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$) 0	0	0	0	0	0	0	0		
` '				Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	<u> </u>	0	(215)
Water heating										
Output from water heater (calculate	ed above)								•	
	5.28 151.31	133.26	127.68	142.33	143.9	163.86	174.92	189.32		_
Efficiency of water heater									81	(216)
(217)m= 88.96 88.9 88.76 88	.4 87.64	81	81	81	81	88.15	88.71	88.99		(217)
Fuel for water heating, kWh/month (219) m = (64) m x $100 \div (217)$ m										
` '	172.64	164.52	157.63	175.72	177.66	185.89	197.17	212.75		
	'			Tota	I = Sum(2	19a) ₁₁₂ =			2227.7	(219)
Annual totals						k۱	Wh/year	•	kWh/year	- -
Space heating fuel used, main sys	em 1								8063.1	
Water heating fuel used									2227.7	
Electricity for pumps, fans and elec	tric keep-hot	t								
central heating pump:								30		(230c)
Total electricity for the above, kWh	/year			sum	of (230a).	(230g) =			30	(231)
Electricity for lighting									421.2	(232)
12a. CO2 emissions – Individual I	neating syste	ms inclu	uding mi	cro-CHF)					
			ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	
Space heating (main system 1)		kW					2/kWh	tor =		
Space heating (main system 1) Space heating (secondary)		kW (211	/h/year			kg CO	2/kWh		kg CO2/yea	ar ¬
		kW (211) (215)	/h/year			kg CO2	2/kWh	=	kg CO2/yea	ar](261)
Space heating (secondary)		(215) (218)	/h/year 1) x 5) x	+ (263) + (264) =	0.2°	2/kWh	=	kg CO2/yea	(261) (263)
Space heating (secondary) Water heating	tric keep-hot	(21s) (21s) (21s) (26s)	/h/year 1) x 5) x 9) x	+ (263) + (264) =	0.2°	2/kWh	=	kg CO2/yea 1741.63 0 481.18	(261) (263) (264)

sum of (265)...(271) =

(272) ÷ (4) =

Total CO2, kg/year

El rating (section 14)

Dwelling CO2 Emission Rate

2456.98

34.32

72

(272)

(273)

(274)

		User Details:				
Access Names	Chris Hocknell		mh a ri	STD0	016262	
Assessor Name: Software Name:	Stroma FSAP 2012	Stroma Nur Software Ve			016363 n: 1.0.4.26	
Software Name.	-	operty Address: Flat 0		VEISIO	11. 1.0.4.20	
Address :	Flat 02, 51 Calthorpe Street,					
1. Overall dwelling dime		LONDON, WOTA OTH	•			
		Area(m²)	Av. Height(m)		Volume(m³)	
Ground floor		68.42 (1a) x	3.13	(2a) =	214.15	(3a)
First floor		29.89 (1b) x	2.2	(2b) =	65.76	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1n)	98.31 (4)				_1
Dwelling volume		(3a)+(3	8b)+(3c)+(3d)+(3e)+	(3n) =	279.91	(5)
2. Ventilation rate:						_
	main secondary heating heating	y other	total		m³ per hour	
Number of chimneys	0 + 0	+ 0 =	0 x	40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0 x	20 =	0	(6b)
Number of intermittent fa	ns		3 ×	10 =	30	(7a)
Number of passive vents			0 x	10 =	0	(7b)
Number of flueless gas fi	res		0 x	40 =	0	(7c)
				Air ch	anges per hou	ır
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a	a)+(7b)+(7c) =	30	÷ (5) =	0.11	7(8)
•	een carried out or is intended, proceed			. (3) =	0.11](0)
Number of storeys in the	ne dwelling (ns)			Γ	2	(9)
Additional infiltration			[(9)	-1]x0.1 =	0.1	(10)
Structural infiltration: 0.	25 for steel or timber frame or	0.35 for masonry cons	truction	[0.35	(11)
if both types of wall are pr deducting areas of openin	resent, use the value corresponding to	the greater wall area (after				
	loor, enter 0.2 (unsealed) or 0.	1 (sealed), else enter ()	Γ	0	(12)
If no draught lobby, ent	,	,		Ì	0.05	(13)
Percentage of windows	and doors draught stripped			Ī	1	(14)
Window infiltration	• ,,	0.25 - [0.2 x (14) ÷	100] =	Ī	0.248	(15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	Į.	.85517631062771	8(16)
Air permeability value,	q50, expressed in cubic metres	s per hour per square i	metre of envelope	area	0	(17)
If based on air permeabil	ity value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		Ī	0.86	(18)
Air permeability value applie	s if a pressurisation test has been done	e or a degree air permeabilit	y is being used	_		
Number of sides sheltere	d				2	(19)
Shelter factor		(20) = 1 - [0.075 x]		Ţ	0.85	(20)
Infiltration rate incorporat		(21) = (18) x (20) =	=	L	0.73	(21)
Infiltration rate modified for			1 1			
Jan Feb	Mar Apr May Jun	Jul Aug Sep	Oct Nov	Dec		
Monthly average wind sp	eed from Table 7					

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		
A discount in City of the second	. / . !!		14	.1		(04 -)	(00 -)					
Adjusted infiltration rat	e (allowi	ng for sr	0.78	a wina s	o.69	(21a) X 0.67	(22a)m 0.73	0.78	0.82	0.85		
Calculate effective air	1		1			0.07	0.73	0.76	0.02	0.03		
If mechanical ventila	ation:										0	(23a)
If exhaust air heat pump	using Appe	endix N, (2	3b) = (23a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If balanced with heat reco	overy: effic	iency in %	allowing for	or in-use f	actor (fron	n Table 4h) =				0	(23c)
a) If balanced mech	anical ve	entilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (2:	2b)m + (23b) × [′	1 – (23c)	÷ 100]	
(24a)m= 0 0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balanced mech	anical ve	entilation	without	heat rec	covery (N	ЛV) (24b)m = (22	2b)m + (2	23b)	·		
(24b)m= 0 0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house ex			•	•				5 (00)	,			
if (22b)m < 0.5 >	``	<u> </u>	ŕ			ŕ	 	<u> </u>	ŕ			(240)
(24c)m= 0 0	0	0	0		0	0	0	0	0	0		(24c)
d) If natural ventilation if (22b)m = 1, th			•	•				0.51				
(24d)m= 0.93 0.91	0.9	0.82	0.81	0.74	0.74	0.73	0.76	0.81	0.83	0.86		(24d)
Effective air change	rate - er	ıter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)	!	ļ	ļ		
(25)m= 0.93 0.91	0.9	0.82	0.81	0.74	0.74	0.73	0.76	0.81	0.83	0.86		(25)
Heat losses and he	eat loss i	paramete	er:									
3. Heat losses and he	SS	Openin	gs	Net Ar		U-valı		AXU		k-value		ΑXk
ELEMENT Gros	SS		gs	A ,r	m²	W/m2	!K	(W/I	K)	k-value kJ/m²·ł		kJ/K
ELEMENT Gros area Doors	SS	Openin	gs		m² x	W/m2	=		K)			kJ/K (26)
ELEMENT Gros area Doors Windows Type 1	SS	Openin	gs	A ,r	m² x x1.	W/m2 1.6 /[1/(1.6)+	= 0.04] =	(W/I	K)			kJ/K
ELEMENT Gros area Doors Windows Type 1 Windows Type 2	SS	Openin	gs	A ,r	m² x x1. x1.	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] =	(W/I 3.168	K)			kJ/K (26)
ELEMENT Gros area Doors Windows Type 1	SS	Openin	gs	A ,r	m ² x x10 x10	W/m2 1.6 /[1/(1.6)+	0.04] = 0.04] =	3.168 3.97	K)			kJ/K (26) (27)
ELEMENT Gros area Doors Windows Type 1 Windows Type 2	SS	Openin	gs	A ,r 1.98 2.64 1.44	x1. x1. x1.	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] =	3.168 3.97 2.17	K)			kJ/K (26) (27) (27)
ELEMENT Gros area Doors Windows Type 1 Windows Type 2 Windows Type 3	SS	Openin	gs	A ,r 1.98 2.64 1.44 2.55	x1. x1. x1. x1.	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] =	3.168 3.97 2.17 3.83	K)			kJ/K (26) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4	SS	Openin	gs	A ,r 1.98 2.64 1.44 2.55 2.34	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	(W/I 3.168 3.97 2.17 3.83 3.52	K)			kJ/K (26) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5	SS	Openin	gs	A ,r 1.98 2.64 1.44 2.55 2.34 0.81	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	(W/I 3.168 3.97 2.17 3.83 3.52 1.22	K)			kJ/K (26) (27) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6	SS	Openin	gs	A ,r 1.98 2.64 1.44 2.55 2.34 0.81	m² x 1	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	(W/I 3.168 3.97 2.17 3.83 3.52 1.22				kJ/K (26) (27) (27) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7	ss (m²)	Openin	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49	x1.	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	(W/I 3.168 3.97 2.17 3.83 3.52 1.22 1.11 3.74				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor	ss (m²)	Openin m	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49	x1.	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	(W/I 3.168 3.97 2.17 3.83 3.52 1.22 1.11 3.74				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type1	8 23	Openin m	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79	x1.	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55	0.04] = 0.04]	(W/I 3.168 3.97 2.17 3.83 3.52 1.22 1.11 3.74 10.1809				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type1 60. Walls Type2 29.2	8 23 3	13.0° 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25	x1.	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55	K	(W/I 3.168 3.97 2.17 3.83 3.52 1.22 1.11 3.74 10.1809 26.28 3.91				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type1 Walls Type2 29.2 Walls Type3 2.8	8 (m²) 3 3 68	13.0 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83	x1.	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0.15	K	(W/I 3.168 3.97 2.17 3.83 3.52 1.22 1.11 3.74 10.1809 26.28 3.91 0.42				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type 1 Walls Type 2 Walls Type 3 Roof Coordinates a read a re	8 (m²) 3 3 68	13.0 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83	x1.	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0.15	K	(W/I 3.168 3.97 2.17 3.83 3.52 1.22 1.11 3.74 10.1809 26.28 3.91 0.42				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (29)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type1 Walls Type2 Walls Type2 Walls Type3 Roof Total area of elements Party wall	8 (m²) 3 3 68	13.0 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83 20.68 132.0 92.15	x1. x1. x1. x1. x1. x1. x2. x2. x2. x3. x4. x4. x4. x4. x4. x4. x4. x4. x4. x4	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.14 0.15 0.18	K	(W/I 3.168 3.97 2.17 3.83 3.52 1.22 1.11 3.74 10.1809 26.28 3.91 0.42 3.72				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31) (32)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type 1 Walls Type 2 Walls Type 2 Walls Type 3 Roof Total area of elements	8 (m²) 3 3 68	13.0 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83 20.68 132.0	x1 x	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.14 0.15 0.18	K	(W/I 3.168 3.97 2.17 3.83 3.52 1.22 1.11 3.74 10.1809 26.28 3.91 0.42 3.72				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (29) (30) (31)

* for windows and ** include the area						ated using	formula 1	/[(1/ U- vaiu	e)+0.04j a	is given in	paragrapri	0.2	
Fabric heat los							(26)(30)	+ (32) =				67.25	(33)
Heat capacity (Cm = S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	13532.85	(34)
Thermal mass	paramet	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	: Medium		250	(35)
For design assess can be used instea				constructi	ion are not	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated ı	using Ap	pendix l	<						19.81	(36)
if details of therma		are not kn	own (36) =	= 0.05 x (3	1)						·		_
Total fabric hea								(33) +	,			87.06	(37)
Ventilation hea					l .	l	l .		_	25)m x (5)	i _		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00)
(38)m= 85.86	84.32	82.81	75.71	74.39	68.21	68.21	67.07	70.59	74.39	77.07	79.88		(38)
Heat transfer c			i		i	i			= (37) + (3		i	l	
(39)m= 172.91	171.37	169.86	162.77	161.44	155.27	155.27	154.12	157.65	161.44	164.13	166.94		7,00
Heat loss para	meter (H	IIP) W/	/m²K						Average = = (39)m ÷	Sum(39) _{1.}	12 /12=	162.76	(39)
(40)m= 1.76	1.74	1.73	1.66	1.64	1.58	1.58	1.57	1.6	1.64	1.67	1.7		
` /							ļ .		Average =	Sum(40) ₁ .	12 /12=	1.66	(40)
Number of day	s in mon	nth (Tab	le 1a)		-	-							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing ener	gy requi	irement:								kWh/ye	ear:	
			irement:									ear:	(42)
Assumed occu if TFA > 13.9	ipancy, N 9, N = 1 -	١		(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (T	ГҒА -13.		kWh/ye	ear:	(42)
Assumed occu	ipancy, N 9, N = 1 - 9, N = 1	N + 1.76 x	[1 - exp	•	•			`	ΓFA -13.	9)		ear:	(42)
Assumed occu if TFA > 13.9 if TFA £ 13.9 Annual average Reduce the annual	ipancy, N 9, N = 1 - 9, N = 1 e hot wa el average l	N + 1.76 x Iter usag	[1 - exp ge in litre usage by	es per da 5% if the d	ay Vd,av	erage = designed t	(25 x N)	+ 36		98	72	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9 Annual averag Reduce the annua not more that 125	ipancy, N 9, N = 1 - 9, N = 1 e hot wa al average l litres per p	N + 1.76 x ter usac hot water person per	[1 - exp ge in litre usage by a day (all w	es per da 5% if the d rater use, f	ay Vd,av	erage = designed (ld)	(25 x N) to achieve	+ 36 a water us	se target o	9) 98	72	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9 Annual averag Reduce the annua not more that 125	ipancy, N 9, N = 1 - 9, N = 1 e hot wa al average i litres per p	N + 1.76 x Iter usag hot water Person per Mar	[1 - exp ge in litre usage by s day (all w Apr	es per da 5% if the d rater use, I	ay Vd,av welling is not and co	erage = designed t ld) Jul	(25 x N) to achieve	+ 36		98	72	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9 Annual averag Reduce the annua not more that 125 Jan Hot water usage ir	ipancy, N 9, N = 1 - 9, N = 1 e hot wa al average i litres per p Feb	N + 1.76 x ter usag hot water person per Mar day for ea	[1 - exp ge in litre usage by a day (all w Apr ach month	es per da 5% if the d ater use, t May Vd,m = fa	ay Vd,av	erage = designed to designed to designed to designed to designed to design desi	(25 x N) to achieve Aug	+ 36 a water us Sep	ce target of	9) 98 Nov	.88 Dec	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9 Annual averag Reduce the annua not more that 125	ipancy, N 9, N = 1 - 9, N = 1 e hot wa al average i litres per p	N + 1.76 x Iter usag hot water Person per Mar	[1 - exp ge in litre usage by s day (all w Apr	es per da 5% if the d rater use, I	ay Vd,av welling is not and co	erage = designed t ld) Jul	(25 x N) to achieve	+ 36 a water us Sep	Oct	9) 98 Nov	.88 Dec		(43)
Assumed occu if TFA > 13.9 if TFA £ 13.9 Annual averag Reduce the annua not more that 125 Jan Hot water usage ir	ipancy, N 9, N = 1 - 9, N = 1 e hot wa al average i litres per p Feb n litres per	ter usag hot water person per Mar day for ea	[1 - exp ge in litre usage by a day (all w Apr ach month	es per da 5% if the d ater use, I May Vd,m = fac 92.95	ay Vd,av welling is not and con Jun ctor from 1	erage = designed to designed t	(25 x N) to achieve Aug (43) 92.95	+ 36 a water us Sep	Oct 100.86 Fotal = Sur	9) 98 Nov 104.81 m(44) ₁₁₂ =	.88 Dec	ear: 1186.55	
Assumed occu if TFA > 13.9 if TFA £ 13.9 Annual averag Reduce the annua not more that 125 Jan Hot water usage ir (44)m= 108.77	ipancy, N 9, N = 1 - 9, N = 1 e hot wa al average i litres per p Feb n litres per	ter usag hot water person per Mar day for ea	[1 - exp ge in litre usage by a day (all w Apr ach month	es per da 5% if the d ater use, I May Vd,m = fac 92.95	ay Vd,av welling is not and con Jun ctor from 1	erage = designed to designed t	(25 x N) to achieve Aug (43) 92.95	+ 36 a water us Sep	Oct 100.86 Fotal = Sur	9) 98 Nov 104.81 m(44) ₁₁₂ =	.88 Dec		(43)
Assumed occu if TFA > 13.9 if TFA £ 13.9 Annual averag Reduce the annua not more that 125 Jan Hot water usage ir (44)m= 108.77 Energy content of	ipancy, N 9, N = 1 - 9, N = 1 e hot wa litres per p Feb n litres per 104.81 hot water to	ter usage hot water werson per Mar 100.86 145.57	[1 - exp ge in litre usage by s day (all w Apr ach month 96.9 culated mo	es per da 5% if the da 5% if the da 4 da	ay Vd,av lwelling is not and co. Jun ctor from 7 88.99	erage = designed to designed t	(25 x N) to achieve Aug (43) 92.95 07m / 3600 111.74	+ 36 a water us Sep 96.9 kWh/mon 113.08	Oct 100.86 Total = Sunth (see Tall 131.78	9) 98 Nov 104.81 m(44) ₁₁₂ = ables 1b, 1	.88 Dec 108.77 c, 1d) 156.21		(43)
Assumed occur if TFA > 13.9 if TFA £ 13.9 Annual average Reduce the annual not more that 125 Jan Hot water usage in (44)m= 108.77 Energy content of (45)m= 161.3 If instantaneous we (46)m= 24.19	pancy, N P, N = 1 e hot wa el average i litres per p Feb n litres per 104.81 hot water of 141.07	ter usage hot water werson per Mar 100.86 145.57	[1 - exp ge in litre usage by s day (all w Apr ach month 96.9 culated mo	es per da 5% if the da 5% if the da 4 da	ay Vd,av lwelling is not and co. Jun ctor from 7 88.99	erage = designed to designed t	(25 x N) to achieve Aug (43) 92.95 07m / 3600 111.74	+ 36 a water us Sep 96.9 kWh/mon 113.08	Oct 100.86 Total = Sunth (see Tall 131.78	9) 98 Nov 104.81 m(44) ₁₁₂ = ables 1b, 1 143.85	.88 Dec 108.77 c, 1d) 156.21	1186.55	(43)
Assumed occur if TFA > 13.9 if TFA £ 13.9 Annual average Reduce the annual not more that 125 Jan Hot water usage in (44)m= 108.77 Energy content of (45)m= 161.3	ppancy, N P, N = 1 - P, N = 1 e hot wa all average in litres per p Feb in litres per 104.81 hot water in 141.07 vater heatin 21.16 loss:	ter usaghot water person per Mar day for ea 100.86 145.57	[1 - exp ge in litre usage by seed ay (all we Apr ach month 96.9 126.91 of use (not) 19.04	es per da 5% if the dater use, I May Vd,m = fac 92.95 onthly = 4. 121.78 o hot water 18.27	ay Vd,av welling is not and con Jun ctor from 1 88.99 190 x Vd,r 105.08	erage = designed to designed t	(25 x N) to achieve Aug (43) 92.95 07m / 3600 111.74 boxes (46) 16.76	+ 36 a water us Sep 96.9 113.08 1 to (61) 16.96	Oct 100.86 Total = Sur 131.78 Total = Sur 19.77	9) Nov 104.81 m(44) ₁₁₂ = ables 1b, 1 143.85 m(45) ₁₁₂ = 21.58	.88 Dec 108.77	1186.55	(43)
Assumed occur if TFA > 13.5 if TFA £ 13.9 Annual average Reduce the annual not more that 125 Jan Hot water usage in (44)m= 108.77 Energy content of (45)m= 161.3 If instantaneous would water storage	pancy, N Poly, N = 1 Poly N	ter usage hot water berson per Mar day for ea 100.86 145.57 ag at point 21.84 includin	ge in litre usage by se day (all w Apr ach month 96.9 126.91 of use (no	es per da 5% if the dater use, I May Vd,m = far 92.95 onthly = 4. 121.78 o hot water 18.27	ay Vd,av lwelling is not and co. Jun ctor from 7 88.99 190 x Vd,r 105.08 storage),	erage = designed to do	(25 x N) to achieve Aug (43) 92.95 07m / 3600 111.74 boxes (46) 16.76 within sa	+ 36 a water us Sep 96.9 113.08 1 to (61) 16.96	Oct 100.86 Total = Sur 131.78 Total = Sur 19.77	9) Nov 104.81 m(44) ₁₁₂ = ables 1b, 1 143.85 m(45) ₁₁₂ = 21.58	72 .88 Dec 108.77 23.43	1186.55	(43) (44) (45) (46)
Assumed occur if TFA > 13.9 if TFA £ 13.9 Annual average Reduce the annual not more that 125 Jan Hot water usage in (44)m= 108.77 Energy content of (45)m= 161.3 If instantaneous we (46)m= 24.19 Water storage Storage volume	ppancy, N Po, N = 1 Po, N = 1 Po hot wa Politres per p Politres per Politres per 104.81 Politres per 141.07 Pater heatin 21.16 Politres (litres) Politres Politre	ter usage hot water person per Mar day for ea 100.86 145.57 ag at point 21.84 including nd no ta	ge in litre usage by seed and factorial and	es per da 5% if the d ater use, f May Vd,m = fa 92.95 onthly = 4. 121.78 o hot water 18.27 colar or W velling, e	ay Vd,av welling is not and co. Jun ctor from 1 88.99 190 x Vd,r 105.08 storage), 15.76	erage = designed to do	(25 x N) to achieve Aug (43) 92.95 77m / 3600 111.74 boxes (46) 16.76 within sa (47)	+ 36 a water us Sep 96.9 113.08 1 to (61) 16.96 ame vess	Oct 100.86 Total = Sunth (see Tail 131.78) Total = Sunth 19.77 sel	9) Nov 104.81 m(44) ₁₁₂ = ables 1b, 1 143.85 m(45) ₁₁₂ = 21.58	72 .88 Dec 108.77 23.43	1186.55	(43) (44) (45) (46)
Assumed occur if TFA > 13.9 if TFA £ 13.9 Annual average Reduce the annual not more that 125 Jan Hot water usage in (44)m= 108.77 Energy content of (45)m= 161.3 If instantaneous work (46)m= 24.19 Water storage Storage volume If community hotherwise if no Water storage	pancy, N Poly, N = 1 Poly N	ter usage hot water wate	ge in litre usage by ser day (all we have month) 96.9 126.91 of use (not) 19.04 and any so ank in dwer (this in	es per da 5% if the d ater use, I May Vd,m = far 92.95 onthly = 4. 121.78 o hot water 18.27 olar or W velling, e	ay Vd,av lwelling is not and co. Jun ctor from 7 88.99 190 x Vd,r 105.08 15.76 /WHRS nter 110	erage = designed to do	(25 x N) to achieve Aug (43) 92.95 77m / 3600 111.74 boxes (46) 16.76 within sa (47)	+ 36 a water us Sep 96.9 113.08 1 to (61) 16.96 ame vess	Oct 100.86 Total = Sunth (see Tail 131.78) Total = Sunth 19.77 sel	9) Nov 104.81 m(44) ₁₁₂ = ables 1b, 1 143.85 m(45) ₁₁₂ = 21.58	72 .88 Dec 108.77 23.43	1186.55	(43) (44) (45) (46) (47)
Assumed occur if TFA > 13.9 if TFA £ 13.9 Annual average Reduce the annual not more that 125 Jan Hot water usage in (44)m= 108.77 Energy content of (45)m= 161.3 If instantaneous work (46)m= 24.19 Water storage Storage volume If community hotherwise if no	pancy, No. 1 - 2 - 2 - 3 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4	N + 1.76 x Inter usage hot water person per Mar day for ea 100.86 145.57 ag at point 21.84 including hot water eclared le	ge in litre usage by ser day (all w Apr ach month 96.9 culated mo 126.91 of use (no 19.04 ing any so ank in dw er (this in	es per da 5% if the d ater use, I May Vd,m = far 92.95 onthly = 4. 121.78 o hot water 18.27 olar or W velling, e	ay Vd,av lwelling is not and co. Jun ctor from 7 88.99 190 x Vd,r 105.08 15.76 /WHRS nter 110	erage = designed to do	(25 x N) to achieve Aug (43) 92.95 77m / 3600 111.74 boxes (46) 16.76 within sa (47)	+ 36 a water us Sep 96.9 113.08 1 to (61) 16.96 ame vess	Oct 100.86 Total = Sunth (see Tail 131.78) Total = Sunth 19.77 sel	9) 98 Nov 104.81 m(44) ₁₁₂ = sbles 1b, 1 143.85 m(45) ₁₁₂ = 21.58	72 .88 Dec 108.77 23.43	1186.55	(43) (44) (45) (46)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known:													
•							,						
Hot water storage loss factor from Table 2 (kWh/litre/da	ay)					0		(51)					
If community heating see section 4.3 Volume factor from Table 2a						0	1	(52)					
Temperature factor from Table 2b						0		(52)					
Energy lost from water storage, kWh/year		(47) x (51)) v (52) v (53) =			l 1						
Enter (50) or (54) in (55)		(47) X (31)) X (32) X (50) –	-	0		(54) (55)					
Water storage loss calculated for each month		((56)m = (55) × (41):	m			l	()					
(56)m= 0 0 0 0 0 0	0	0	0	0	0	0	1	(56)					
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (50) m x [(50) m x [(50) – (50) m x [(50) m x		_	_		_		 lix H	(00)					
(57)m= 0 0 0 0 0 0	0	0	0	0	0	0		(57)					
Primary circuit loss (annual) from Table 3	1	<u> </u>	ļ			0	1 	(58)					
Primary circuit loss calculated for each month (59)m =	(58) ÷ 36	85 × (41)	m			<u> </u>	ı	()					
(modified by factor from Table H5 if there is solar wa	. ,	, ,		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) ÷ 3	65 × (41	\m \m					I						
(61)m= 50.96 46.03 50.96 47.79 47.36 43.89	45.35	47.36	47.79	50.96	49.32	50.96	1	(61)					
	1	<u> </u>	l		l		(50) + (61)						
Total heat required for water heating calculated for eac (62)m= 212.26 187.1 196.53 174.7 169.14 148.97		È	160.86		` ´ 	`	(59)111 + (61)111]	ı (62)					
` '	142.73	159.11		182.74	193.16	207.17	İ	(02)					
Solar DHW input calculated using Appendix G or Appendix H (negati				r contribut	on to wate	er neating)							
(add additional lines if FGHRS and/or WWHRS applies	s, see Ap) 0	0	0	0	l	(63)					
			U	0	U	0		(00)					
Output from water heater	T 440 70	1,50,44	400.00	100 74	100.10	007.47	1						
(64)m= 212.26 187.1 196.53 174.7 169.14 148.97	142.73	159.11	160.86	182.74	193.16	207.17	2134.46	(64)					
		·	out from wa		,			_(04)					
Heat gains from water heating, kWh/month 0.25 ′ [0.85	1] I	(05)					
(65)m= 66.37 58.41 61.14 54.15 52.33 45.91	43.71	49	49.54	56.56	60.16	64.68	İ	(65)					
include (57)m in calculation of (65)m only if cylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	ıeating						
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= 136.17 136.17 136.17 136.17 136.17 136.17	136.17	136.17	136.17	136.17	136.17	136.17		(66)					
Lighting gains (calculated in Appendix L, equation L9 o	r L9a), a	lso see	Table 5				_						
(67)m= 30.69 27.26 22.17 16.78 12.55 10.59	11.44	14.88	19.97	25.35	29.59	31.54		(67)					
Appliances gains (calculated in Appendix L, equation L	.13 or L1	3a), alsc	see Ta	ble 5									
(68)m= 253.57 256.2 249.57 235.45 217.63 200.89	189.7	187.07	193.7	207.81	225.63	242.38		(68)					
Cooking gains (calculated in Appendix L, equation L15	or L15a), also se	ee Table	5			'						
(69)m= 36.62 36.62 36.62 36.62 36.62 36.62	36.62	36.62	36.62	36.62	36.62	36.62		(69)					
Pumps and fans gains (Table 5a)		•	<u>.</u>		<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)		ı					1						
(71)m= -108.93 -108.93 -108.93 -108.93 -108.93 -108.93	-108.93	-108.93	-108.93	-108.93	-108.93	-108.93		(71)					
		<u> </u>			<u> </u>		I						

Total	Water heatin	g gains (T	able 5)												
Table Au	(72)m= 89.21	86.92	82.18	75.2	70.34	6	3.77	58.76	65.8	85 68.81	76.02	83.55	86.93]	(72)
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation. Orientation: Access Factor Table 6d mr Table 6a y Table 6a Table 6b Table 6c Table 6d Table 6	Total interna	al gains =					(66)n	n + (67)m	+ (68	3)m + (69)m + (70)m +	(71)m + (72)	m	•	
Southeast 0,9x	(73)m= 440.3	2 437.23	420.77	394.29	367.37	34	42.09	326.75	334	.65 349.33	376.0	3 405.62	427.71]	(73)
Orientation: Access Factor Table 6d	6. Solar gai	ns:													
Table 60	Solar gains are	e calculated	using solai	r flux from	Table 6a	and	associa	ated equa	tions 1	to convert to th	e applio	able orientat	ion.		
Southeast 0.9% 0.77	Orientation:		actor												
Southeast 0.9x							rab	ie ba		l able 6b		l able 6c		(VV)	
Southeast 0.9x			X	2.6	64	X	36	6.79	X	0.63	X	0.7	=	29.69	(77)
Southeast 0.9x		•	Х	1.4	14	X	36	6.79	X	0.63	X	0.7	<u> </u>	16.19	(77)
Southeast 0.9x			X	2.6	64	X	62	2.67	X	0.63	x	0.7	=	50.57	(77)
Southeast 0 9x 0.77	Southeast 0.9	0.77	X	1.4	14	X	62	2.67	X	0.63	X	0.7	=	27.58	(77)
Southeast 0.9x	Southeast 0.9	0.77	X	2.6	64	X	85	5.75	X	0.63	X	0.7	=	69.19	(77)
Southeast 0 sx	Southeast 0.9	0.77	X	1.4	14	X	85	5.75	x	0.63	X	0.7	=	37.74	(77)
Southeast 0.9x	Southeast 0.9	0.77	x	2.6	64	X	10	6.25	X	0.63	X	0.7	=	85.73	(77)
Southeast 0.9x	Southeast 0.9	0.77	X	1.4	14	X	10	6.25	X	0.63	X	0.7	=	46.76	(77)
Southeast 0.9x	Southeast 0.9	0.77	X	2.6	64	x	11	9.01	x	0.63	x	0.7	=	96.02	(77)
Southeast 0.9x	Southeast 0.9	0.77	x	1.4	14	x	11	9.01	x	0.63	X	0.7	=	52.37	(77)
Southeast 0.9x	Southeast 0.9	0.77	X	2.6	64	x	11	8.15	x	0.63	x	0.7	=	95.33	(77)
Southeast 0.9x	Southeast 0.9	0.77	Х	1.4	14	X	11	8.15	x	0.63	x	0.7	=	52	(77)
Southeast 0.9x	Southeast 0.9	0.77	х	2.6	64	X	11	3.91	X	0.63	x	0.7	=	91.9	(77)
Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 2.64 x 92.85 x 0.63 x 0.7 = 74.91 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 35.56 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 <t< td=""><td>Southeast 0.9</td><td>0.77</td><td>X</td><td>1.4</td><td>14</td><td>х</td><td>11</td><td>3.91</td><td>x</td><td>0.63</td><td>×</td><td>0.7</td><td>=</td><td>50.13</td><td>(77)</td></t<>	Southeast 0.9	0.77	X	1.4	14	х	11	3.91	x	0.63	×	0.7	=	50.13	(77)
Southeast 0.9x 0.77 x 2.64 x 92.85 x 0.63 x 0.7 = 74.91 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 35.56 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 <td< td=""><td>Southeast 0.9</td><td>0.77</td><td>x</td><td>2.6</td><td>64</td><td>x</td><td>10</td><td>4.39</td><td>x</td><td>0.63</td><td>×</td><td>0.7</td><td>_ =</td><td>84.22</td><td>(77)</td></td<>	Southeast 0.9	0.77	x	2.6	64	x	10	4.39	x	0.63	×	0.7	_ =	84.22	(77)
Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 2.64 x 69.27 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 2.64 x 44.07 x 0.63 x 0.7 = 35.56 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southwest 0.9x 0.77 x 2.49 x 36.79 0.63 x 0.7 = <td< td=""><td>Southeast 0.9</td><td>0.77</td><td>x</td><td>1.4</td><td>14</td><td>x</td><td>10</td><td>4.39</td><td>x</td><td>0.63</td><td>×</td><td>0.7</td><td>=</td><td>45.94</td><td>(77)</td></td<>	Southeast 0.9	0.77	x	1.4	14	x	10	4.39	x	0.63	×	0.7	=	45.94	(77)
Southeast 0.9x 0.77 x 2.64 x 69.27 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 2.64 x 44.07 x 0.63 x 0.7 = 35.56 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 19.39 (77) Southwest 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southwest 0.9x 0.77 x 2.49 x 62.67 0.63 x 0.7 = <td< td=""><td>Southeast 0.9</td><td>0.77</td><td>X</td><td>2.6</td><td>64</td><td>x</td><td>92</td><td>2.85</td><td>x</td><td>0.63</td><td>×</td><td>0.7</td><td>=</td><td>74.91</td><td>(77)</td></td<>	Southeast 0.9	0.77	X	2.6	64	x	92	2.85	x	0.63	×	0.7	=	74.91	(77)
Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 2.64 x 44.07 x 0.63 x 0.7 = 35.56 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Southwest 0.9x 0.77 x 2.49 x 36.79 0.63 x 0.7 = 28 (79) Southwest 0.9x 0.77 x 2.49 x 85.75 0.63 x 0.7 = 47.69 <td< td=""><td>Southeast 0.9</td><td>0.77</td><td>X</td><td>1.4</td><td>14</td><td>x</td><td>92</td><td>2.85</td><td>x</td><td>0.63</td><td>x</td><td>0.7</td><td>_ =</td><td>40.86</td><td>(77)</td></td<>	Southeast 0.9	0.77	X	1.4	14	x	92	2.85	x	0.63	x	0.7	_ =	40.86	(77)
Southeast 0.9x 0.77 x 2.64 x 44.07 x 0.63 x 0.7 = 35.56 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 25.4 (77) Southwest0.9x 0.77 x 2.49 x 36.79 0.63 x 0.7 = 28 (79) Southwest0.9x 0.77 x 2.49 x 85.75 0.63 x 0.7 = 47.69 (79) Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 80.85 (79)	Southeast 0.9	0.77	x	2.6	64	x	69	9.27	x	0.63	×	0.7	=	55.89	(77)
Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southwest0.9x 0.77 x 2.49 x 36.79 0.63 x 0.7 = 28 (79) Southwest0.9x 0.77 x 2.49 x 85.75 0.63 x 0.7 = 47.69 (79) Southwest0.9x 0.77 x 2.49 x 106.25 0.63 x 0.7 = 80.85 (79) Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 89.91 (79) <t< td=""><td>Southeast 0.9</td><td>0.77</td><td>X</td><td>1.4</td><td>14</td><td>x</td><td>69</td><td>9.27</td><td>x</td><td>0.63</td><td>x</td><td>0.7</td><td>=</td><td>30.48</td><td>(77)</td></t<>	Southeast 0.9	0.77	X	1.4	14	x	69	9.27	x	0.63	x	0.7	=	30.48	(77)
Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southwest0.9x 0.77 x 2.49 x 36.79 0.63 x 0.7 = 28 (79) Southwest0.9x 0.77 x 2.49 x 62.67 0.63 x 0.7 = 47.69 (79) Southwest0.9x 0.77 x 2.49 x 106.25 0.63 x 0.7 = 65.26 (79) Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 80.85 (79) Southwest0.9x 0.77 x 2.49 x 118.15 0.63 x 0.7 = 89.91 (79) Southwest0.9x <td>Southeast 0.9</td> <td>0.77</td> <td>X</td> <td>2.6</td> <td>64</td> <td>x</td> <td>44</td> <td>1.07</td> <td>x</td> <td>0.63</td> <td>x</td> <td>0.7</td> <td></td> <td>35.56</td> <td>(77)</td>	Southeast 0.9	0.77	X	2.6	64	x	44	1.07	x	0.63	x	0.7		35.56	(77)
Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southwest0.9x 0.77 x 2.49 x 36.79 0.63 x 0.7 = 28 (79) Southwest0.9x 0.77 x 2.49 x 62.67 0.63 x 0.7 = 47.69 (79) Southwest0.9x 0.77 x 2.49 x 106.25 0.63 x 0.7 = 65.26 (79) Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 80.85 (79) Southwest0.9x 0.77 x 2.49 x 118.15 0.63 x 0.7 = 89.91 (79) Southwest0.9x 0.77 x 2.49 x 113.91 0.63 x 0.7 = 86.68 (79)	Southeast 0.9	0.77	Х	1.4	14	x	44	1.07	x	0.63	x	0.7	- =	19.39	(77)
Southwest0.9x 0.77 x 2.49 x 36.79 0.63 x 0.7 = 28 (79) Southwest0.9x 0.77 x 2.49 x 62.67 0.63 x 0.7 = 47.69 (79) Southwest0.9x 0.77 x 2.49 x 106.25 0.63 x 0.7 = 65.26 (79) Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 80.85 (79) Southwest0.9x 0.77 x 2.49 x 118.15 0.63 x 0.7 = 89.91 (79) Southwest0.9x 0.77 x 2.49 x 113.91 0.63 x 0.7 = 86.68 (79)	Southeast 0.9x	0.77	х	2.6	64	x	31	1.49	x	0.63	×	0.7	- -	25.4	(77)
Southwest0.9x 0.77 x 2.49 x 62.67 0.63 x 0.7 = 47.69 (79) Southwest0.9x 0.77 x 2.49 x 85.75 0.63 x 0.7 = 65.26 (79) Southwest0.9x 0.77 x 2.49 x 106.25 0.63 x 0.7 = 80.85 (79) Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 90.56 (79) Southwest0.9x 0.77 x 2.49 x 118.15 0.63 x 0.7 = 89.91 (79) Southwest0.9x 0.77 x 2.49 x 113.91 0.63 x 0.7 = 86.68 (79)	Southeast 0.9	0.77	x	1.4	14	x	31	1.49	x	0.63	×	0.7		13.86	(77)
Southwest0.9x 0.77 x 2.49 x 85.75 0.63 x 0.7 = 65.26 (79) Southwest0.9x 0.77 x 2.49 x 106.25 0.63 x 0.7 = 80.85 (79) Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 90.56 (79) Southwest0.9x 0.77 x 2.49 x 118.15 0.63 x 0.7 = 89.91 (79) Southwest0.9x 0.77 x 2.49 x 113.91 0.63 x 0.7 = 86.68 (79)	Southwest _{0.9}	0.77	X	2.4	19	x	36	6.79		0.63	×	0.7	=	28	(79)
Southwest0.9x 0.77 x 2.49 x 106.25 0.63 x 0.7 = 80.85 (79) Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 90.56 (79) Southwest0.9x 0.77 x 2.49 x 118.15 0.63 x 0.7 = 89.91 (79) Southwest0.9x 0.77 x 2.49 x 113.91 0.63 x 0.7 = 86.68 (79)	Southwest _{0.9}	0.77	x	2.4	19	x	62	2.67		0.63	×	0.7	= =	47.69	(79)
Southwest0.9x 0.77 x 2.49 x 106.25 0.63 x 0.7 = 80.85 (79) Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 90.56 (79) Southwest0.9x 0.77 x 2.49 x 118.15 0.63 x 0.7 = 89.91 (79) Southwest0.9x 0.77 x 2.49 x 113.91 0.63 x 0.7 = 86.68 (79)	Southwest _{0.9}	0.77	X	2.4	19	х	85	5.75		0.63	×	0.7	╡ -	65.26	(79)
Southwest0.9x 0.77 x 2.49 x 119.01 0.63 x 0.7 = 90.56 (79) Southwest0.9x 0.77 x 2.49 x 118.15 0.63 x 0.7 = 89.91 (79) Southwest0.9x 0.77 x 2.49 x 113.91 0.63 x 0.7 = 86.68 (79)	Southwest _{0.9}		X	2.4	19	х	10	6.25		0.63	×	0.7	= =	80.85	(79)
Southwest _{0.9x} 0.77 x 2.49 x 118.15 0.63 x 0.7 = 89.91 (79) Southwest _{0.9x} 0.77 x 2.49 x 113.91 0.63 x 0.7 = 86.68 (79)	Southwest _{0.9}		X			X					= x		╡ -		=
Southwest _{0.9x} 0.77 x 2.49 x 113.91 0.63 x 0.7 = 86.68 (79)											╡		╡ -		=
	Southwest _{0.9}					, i					=		╡ -		=
	Southwest _{0.9}					1				0.63	×	0.7	╡ -	79.44	(79)

Southwest _{0.9x}	0.77	٦ ,	0.40	1	00.05	1	0.00	l "	0.7	1 =	70.00	(79)
Southwest _{0.9x}	0.77] X]	2.49	X 1	92.85] 1	0.63	X	0.7]	70.66	=
Southwest _{0.9x}	0.77] X]	2.49	X	69.27] 1	0.63	X	0.7] = 1 _	52.71	(79)
Southwest _{0.9x}	0.77	X	2.49	X	44.07] 1	0.63	X	0.7] = 1	33.54	(79)
<u> </u>	0.77	X	2.49	X	31.49] 1	0.63	X	0.7] = 1	23.96	(79)
Northwest 0.9x	0.77	X	2.55	X	11.28	X	0.63	X	0.7] = 1	8.79	(81)
Northwest 0.9x	0.77	」 X ¬	2.34	X	11.28	X 1	0.63	X	0.7] = 1	8.07	(81)
Northwest 0.9x	0.77	X	0.81	X	11.28	X 1	0.63	X	0.7] = 1	2.79	(81)
Northwest 0.9x	0.77	X	0.74	X	11.28	X	0.63	X	0.7] = 1	2.55	(81)
Northwest 0.9x	0.77	X	2.55	X	22.97	X	0.63	X	0.7] =	17.9	(81)
Northwest 0.9x	0.77	X	2.34	X	22.97	X	0.63	X	0.7	=	16.42	(81)
Northwest 0.9x	0.77	X	0.81	X	22.97	X	0.63	X	0.7	=	5.69	(81)
Northwest _{0.9x}	0.77	X	0.74	X	22.97	X	0.63	X	0.7] =	5.19	(81)
Northwest _{0.9x}	0.77	X	2.55	X	41.38	X	0.63	X	0.7	=	32.25	(81)
Northwest _{0.9x}	0.77	X	2.34	X	41.38	X	0.63	X	0.7	=	29.59	(81)
Northwest _{0.9x}	0.77	X	0.81	X	41.38	X	0.63	X	0.7	=	10.24	(81)
Northwest _{0.9x}	0.77	X	0.74	X	41.38	X	0.63	X	0.7	=	9.36	(81)
Northwest _{0.9x}	0.77	X	2.55	X	67.96	X	0.63	X	0.7	=	52.96	(81)
Northwest _{0.9x}	0.77	X	2.34	X	67.96	X	0.63	x	0.7	=	48.6	(81)
Northwest 0.9x	0.77	X	0.81	X	67.96	X	0.63	X	0.7] =	16.82	(81)
Northwest 0.9x	0.77	X	0.74	X	67.96	X	0.63	X	0.7	=	15.37	(81)
Northwest 0.9x	0.77	X	2.55	X	91.35	X	0.63	X	0.7	=	71.19	(81)
Northwest 0.9x	0.77	X	2.34	X	91.35	x	0.63	x	0.7	=	65.32	(81)
Northwest 0.9x	0.77	X	0.81	X	91.35	x	0.63	x	0.7	=	22.61	(81)
Northwest 0.9x	0.77	X	0.74	X	91.35	X	0.63	x	0.7	=	20.66	(81)
Northwest 0.9x	0.77	X	2.55	X	97.38	X	0.63	x	0.7	=	75.89	(81)
Northwest 0.9x	0.77	X	2.34	X	97.38	X	0.63	x	0.7] =	69.64	(81)
Northwest 0.9x	0.77	X	0.81	X	97.38	x	0.63	x	0.7	=	24.11	(81)
Northwest _{0.9x}	0.77	X	0.74	X	97.38	X	0.63	x	0.7	=	22.02	(81)
Northwest _{0.9x}	0.77	X	2.55	x	91.1	X	0.63	X	0.7] =	71	(81)
Northwest 0.9x	0.77	X	2.34	x	91.1	x	0.63	x	0.7] =	65.15	(81)
Northwest _{0.9x}	0.77	X	0.81	X	91.1	X	0.63	X	0.7	=	22.55	(81)
Northwest _{0.9x}	0.77	x	0.74	x	91.1	x	0.63	x	0.7] =	20.6	(81)
Northwest 0.9x	0.77	X	2.55	x	72.63	x	0.63	x	0.7] =	56.6	(81)
Northwest 0.9x	0.77	X	2.34	x	72.63	x	0.63	x	0.7	Ī =	51.94	(81)
Northwest _{0.9x}	0.77	X	0.81	x	72.63	x	0.63	x	0.7	j =	17.98	(81)
Northwest _{0.9x}	0.77	X	0.74	x	72.63	x	0.63	x	0.7	j =	16.42	(81)
Northwest _{0.9x}	0.77	X	2.55	x	50.42	x	0.63	x	0.7	j =	39.29	(81)
Northwest _{0.9x}	0.77	X	2.34	x	50.42	x	0.63	x	0.7	j =	36.06	(81)
Northwest _{0.9x}	0.77	x	0.81	×	50.42	×	0.63	x	0.7	j =	12.48	(81)
Northwest _{0.9x}	0.77	x	0.74	×	50.42	x	0.63	x	0.7	j =	11.4	(81)
Northwest _{0.9x}	0.77	X	2.55	X	28.07	X	0.63	x	0.7	j =	21.87	(81)
L		1						ı				

Northwest 0.	9x 0.77	X	2.3	4	x	2	8.07	X	0.63	X	0.7	=	20.07	(81)
Northwest 0.	9x 0.77	X	8.0	1	x	2	8.07	X	0.63	X	0.7	=	6.95	(81)
Northwest 0.	9x 0.77	X	0.7	4	x	2	8.07	X	0.63	X	0.7	=	6.35	(81)
Northwest 0.	9x 0.77	X	2.5	5	x	1	14.2	X	0.63	X	0.7	=	11.06	(81)
Northwest 0.	9x 0.77	X	2.3	4	x	1	14.2	X	0.63	X	0.7	=	10.15	(81)
Northwest 0.	9x 0.77	X	8.0	1	x	1	14.2	X	0.63	X	0.7	=	3.51	(81)
Northwest 0.	9x 0.77	X	0.7	4	x	1	14.2	X	0.63	X	0.7	=	3.21	(81)
Northwest 0.	9x 0.77	X	2.5	5	x	9	9.21	X	0.63	X	0.7	=	7.18	(81)
Northwest 0.	9x 0.77	X	2.3	4	x	9	9.21	X	0.63	X	0.7	=	6.59	(81)
Northwest 0.	9x 0.77	X	8.0	1	x	9	9.21	X	0.63	X	0.7	=	2.28	(81)
Northwest 0.	9x 0.77	X	0.7	4	x	9	9.21	X	0.63	X	0.7	=	2.08	(81)
Solar gains	in watts, c	alculated	for eac	n month				(83)m	= Sum(74)m	(82)m			-	
(83)m= 96.		253.62	347.09	418.74	<u> </u>	28.9	408.02	352.	54 285.67	194.3	2 116.43	81.36		(83)
Total gains	– internal a	and solar	(84)m =	: (73)m	+ (8	83)m	, watts				_	,	1	
(84)m= 536	608.27	674.39	741.37	786.11	77	70.99	734.77	687.	19 635	570.3	5 522.05	509.07		(84)
7. Mean ir	nternal temp	perature ((heating	season)									
Temperat	ure during h	neating p	eriods ir	the livi	ng	area f	rom Tab	ole 9,	Th1 (°C)				21	(85)
Utilisation	factor for g	ains for I	iving are	ea, h1,m	ı (s	ee Ta	ble 9a)					_		
Ja	n Feb	Mar	Apr	May		Jun	Jul	Αι	ıg Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.98	0.96	(0.88	0.77	0.8	1 0.94	0.99	1	1		(86)
Mean inte	rnal temper	ature in I	iving are	ea T1 (fo	ollo	w ste	ps 3 to 7	in T	able 9c)					
(87)m= 18.	98 19.14	19.45	19.92	20.34	2	20.72	20.89	20.8	36 20.57	20.02	19.46	19.01		(87)
Temperat	ure during h	neating p	eriods ir	rest of	dw	elling	from Ta	ble 9), Th2 (°C)	-	-	-	•	
(88)m= 19		19.52	19.57	19.58	_	9.63	19.63	19.6		19.58	19.56	19.54		(88)
Utilisation	factor for g	ains for r	est of d	vellina	h2	m (se	e Table	9a)	•		•	•	•	
(89)m= 1	\neg	0.99	0.98	0.93	$\overline{}$	0.8	0.6	0.6	6 0.9	0.98	1	1		(89)
Moon into	rnal tampar	oturo in t	the reet	of dwall	ina	T2 /f/	allow etc	L	to 7 in Toh	lo Oo)	_!		I	
(90)m= 17	rnal temper	18.19	18.69	19.11	Ť	9.48	19.6	19.5	1	18.8	18.23	17.76		(90)
(00)		10.10	10.00	10.11	<u> </u>	0.10	10.0	10.	ļ		ving area ÷ (ļ.	0.33	(91)
											,	,	0.00	(0.)
	rnal temper	``			_			r `		1	1 40.04	10.47	1	(02)
(92)m= 18.		18.6	19.09	19.52	<u> </u>	9.89	20.03	20.0		19.2	18.64	18.17		(92)
(93)m= 18.	ustment to t 12 18.29	18.6	19.09	19.52	_	9.89	20.03	20.0		19.2	18.64	18.17	1	(93)
` '	heating req		10.00	10.02	H.	0.00	20.00	20.0	71 10:70	10.2	10.04	10.17		()
	he mean in		nneratui	e obtair	ned	at ste	en 11 of	Tabl	e 9h. so th:	at Ti m:	=(76)m an	d re-calc	culate	
	tion factor f					at ott	эр 11 OI	IGDI	0 00, 00 111	at 11,111	(10)111 a11	u ro ouic	diato	
Ja	n Feb	Mar	Apr	May		Jun	Jul	Αι	ıg Sep	Oct	Nov	Dec		
Utilisation	factor for g	ains, hm	:										•	
(94)m= 1		0.99	0.97	0.93	(0.82	0.65	0.7	1 0.9	0.98	0.99	1		(94)
	ns, hmGm	` ` 	, ·									1	1	
(95)m= 534		666.85	721.69	731.95	_	33.65	480.22	485.	81 574.51	558.9	519.12	507.69		(95)
Monthly a (96)m= 4.	verage exte	r r			_		40.0	10	, , , , ,	1400	7.	1 40	1	(06)
$_{1}$ Uh $_{1}$ m= $_{1}$ $_{4}$	3 4.9	6.5	8.9	11.7	1 1	14.6	16.6	16.	4 14.1	10.6	7.1	4.2	I	(96)

Heat loss rate for mean internal temperature I m W = [(30)m x [(03)m (06)m]		
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m] (97)m= 2389.79 2295.15 2055.99 1658.99 1261.97 821.89 532.02 556.89 890.8 1389.23 1893.66 2332.11		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m		, ,
(98)m= 1380.28 1135.92 1033.52 674.85 394.33 0 0 0 617.71 989.67 1357.36		
Total per year (kWh/year) = Sum(98) _{15,912} =	7583.65	(98)
Space heating requirement in kWh/m²/year	77.14	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		7
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)
Efficiency of main space heating system 1	90.3	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	kWh/yea	ar
Space heating requirement (calculated above)		
1380.28 1135.92 1033.52 674.85 394.33 0 0 0 617.71 989.67 1357.36		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)		(211)
1528.55 1257.94 1144.54 747.35 436.69 0 0 0 684.06 1095.98 1503.17		7,044
Total (kWh/year) =Sum(211) _{15,1012} =	8398.29	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)		
(215)m =		
Total (kWh/year) =Sum(215) _{15,1012} =	0	(215)
Water heating		_
Output from water heater (calculated above)		
212.26 187.1 196.53 174.7 169.14 148.97 142.73 159.11 160.86 182.74 193.16 207.17		7
Efficiency of water heater	81	(216)
(217)m= 88.94 88.86 88.67 88.22 87.29 81 81 81 87.99 88.64 88.95		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m		
(219)m= 238.65 210.56 221.64 198.04 193.77 183.91 176.2 196.43 198.6 207.67 217.92 232.91		
Total = Sum(219a) ₁₁₂ =	2476.3	(219)
Annual totals kWh/year	kWh/year	_
Space heating fuel used, main system 1	8398.29	
Water heating fuel used	2476.3	
Electricity for pumps, fans and electric keep-hot		
central heating pump:		(230c)
Total electricity for the above, kWh/year sum of (230a)(230g) =	30	(231)
Electricity for lighting	542.02	(232)
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 =	1814.03 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	534.88 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2348.91 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	15.57 (267)
Electricity for lighting	(232) x	0.519 =	281.31 (268)
Total CO2, kg/year	sum	of (265)(271) =	2645.79 (272)
Dwelling CO2 Emission Rate	(272	?) ÷ (4) =	26.91 (273)
El rating (section 14)			75 (274)

		User Details:				
Assessor Name:	Chris Hocknell		Number:	STRO	016363	
Software Name:	Stroma FSAP 2012	Softwa	re Version:	Versio	n: 1.0.4.26	
	F	Property Address:	Flat 03-Baseline			
Address :	Flat 03, 51 Calthorpe Street	, LONDON, WC1	X 0HH			
1. Overall dwelling dime	nsions:					
		Area(m²)	Av. Height	t(m)	Volume(m³)	<u> </u>
Ground floor		56.13	1a) x 3.33	(2a) =	186.91	(3a)
First floor		45.8	1b) x 2.2	(2b) =	100.76	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1ı	n) 101.93 (4)			
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3d	e)+(3n) =	287.67	(5)
2. Ventilation rate:						
	main seconda heating heating	ry other	total		m³ per houi	•
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 far	ns		3	x 10 =	30	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fir	res		0	x 40 =	0	(7c)
				Air ob	anges per be	
Infiltration due to chimne	/s, flues and fans = (6a)+(6b)+(7	7a)+(7b)+(7c) =	F	, ,	anges per ho	_
•	een carried out or is intended, procee		30 ontinue from (9) to (16)	÷ (5) =	0.1	(8)
Number of storeys in th		, ,,	() ()		2	(9)
Additional infiltration	O ()			[(9)-1]x0.1 =	0.1	(10)
Structural infiltration: 0.	25 for steel or timber frame or	0.35 for masonry	construction	Ì	0.35	(11)
if both types of wall are pro deducting areas of openin	resent, use the value corresponding to	o the greater wall area	(after	•		
	loor, enter 0.2 (unsealed) or 0	.1 (sealed), else e	enter 0	[0	(12)
If no draught lobby, ent	ter 0.05, else enter 0			j	0.05	(13)
Percentage of windows	s and doors draught stripped			j	1	(14)
Window infiltration		0.25 - [0.2	x (14) ÷ 100] =	İ	0.248	(15)
Infiltration rate		(8) + (10) +	(11) + (12) + (13) + (15	i) = (.8522851100084	35 (16)
Air permeability value,	q50, expressed in cubic metre	es per hour per sq	uare metre of enve	lope area	0	(17)
If based on air permeabili	ity value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (1	6)	Ì	0.85	(18)
Air permeability value applies	s if a pressurisation test has been do	ne or a degree air perr	neability is being used	_		
Number of sides sheltere	d	(00) 4 5	0.075 (40)1		3	(19)
Shelter factor			0.075 x (19)] =	ļ	0.78	(20)
Infiltration rate incorporati		(21) = (18)	x (20) =		0.66	(21)
Infiltration rate modified for		1 1	_ _	. _ 1		
Jan Feb	Mar Apr May Jun	Jul Aug	Sep Oct N	Nov Dec		
Monthly average wind spe	eed from Table 7					

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 infilt	ration rat	e (allowi	ng for sl	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.84	0.83	0.81	0.73	0.71	0.63	0.63	0.61	0.66	0.71	0.74	0.78		
Calculate effe		•	rate for t	he appli	cable ca	se	-	-	-	-	-		(23a)
If exhaust air l			endix N (2	(23a) = (23a	a) × Fmv (e	eguation (I	N5)) othe	rwise (23h	n) = (23a)			0	(23a)
If balanced wi									(===)			0	(23c)
a) If balanc		•	•	•		•		•	2b)m + (23b) × [1 – (23c)		(200)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balanc	ed mech	anical ve	entilation	without	heat red	covery (N	иV) (24k	o)m = (2:	2b)m + (23b)		ı	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole	house ex	tract ver	ntilation o	or positiv	e input v	ventilatio	on from o	outside	•	•	•	•	
if (22b)	m < 0.5 >	< (23b), t	hen (24	c) = (23b	o); other	wise (24	c) = (22l	b) m + 0	.5 × (23k) '		1	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)	l ventilation m = 1, th			•	•				0.51				
(24d)m= 0.85	0.84	0.83	0.76	0.75	0.7	0.7	0.69	0.72	0.75	0.78	0.8		(24d)
Effective ai	r change	rate - er	nter (24a	ı) or (24k	o) or (24	c) or (24	d) in bo	x (25)	!	!	!	ı	
(25)m= 0.85	0.84	0.83	0.76	0.75	0.7	0.7	0.69	0.72	0.75	0.78	0.8		(25)
							1			1			
3. Heat loss	es and he	eat loss r	paramet	er:				•	•				
3. Heat loss ELEMENT	Gros	ss	Openin	ıgs	Net Ar		U-val		AXU		k-value		AXk
ELEMENT	_	ss		ıgs	Net Ar A ,r		W/m2		(W/		k-value kJ/m²·l		kJ/K
ELEMENT Doors	Gros area	ss	Openin	ıgs		m² x	W/m2	2K =	(W/ 3.168				kJ/K (26)
ELEMENT Doors Windows Typ	Gros area ee 1	ss	Openin	ıgs	A ,r	m² x	W/m2 1.6 /[1/(1.6)+	2K = = 0.04] =	(W/				kJ/K
ELEMENT Doors Windows Typ Windows Typ	Gros area ne 1 ne 2	ss	Openin	ıgs	A ,r	m² x x1 x1	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+	2K = · 0.04] = · 0.04] =	(W/ 3.168				kJ/K (26) (27) (27)
ELEMENT Doors Windows Typ Windows Typ Windows Typ	Gros area ne 1 ne 2	ss	Openin	ıgs	A ,r	m² x x1 x1	W/m2 1.6 /[1/(1.6)+	2K = · 0.04] = · 0.04] =	(W/ 3.168 3.97				kJ/K (26) (27) (27) (27)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor	Gros area ne 1 ne 2	ss	Openin	ıgs	A ,r 1.98 2.64 2.28	m² x x1 x1	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+	2K = · 0.04] = · 0.04] =	(W/ 3.168 3.97 3.43	K)			kJ/K (26) (27) (27)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1	Gros area ne 1 ne 2	ss (m²)	Openin	gs 1 ²	A ,r 1.98 2.64 2.28 2.34	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+	2K =	(W/ 3.168 3.97 3.43 3.52	K)			kJ/K (26) (27) (27) (27)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2	Gros area ne 1 ne 2 ne 3	ss (m²)	Openin m	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0.04] = 0.04] = = =	(W/ 3.168 3.97 3.43 3.52 32.505	K)			kJ/K (26) (27) (27) (27) (28)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1	Gros area ne 1 ne 2 ne 3	52 65	Openin	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55	2K = 0.04] = 0.04] = 0.04] = = = =	(W/ 3.168 3.97 3.43 3.52 32.505 31.89	K)			kJ/K (26) (27) (27) (27) (28) (29)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2	Gros area one 1 one 2 one 3 one 3 one 3 one 3 one 3 one 5 on	52 55 55	12.5 1.98	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55	2K = 0.04] = 0.04] = 0.04] = = = = = = =	(W/ 3.168 3.97 3.43 3.52 32.505 31.89 4.54	K)			kJ/K (26) (27) (27) (27) (28) (29)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof	Gros area one 1 one 2 one 3 one 3 one 3 one 3 one 3 one 5 on	52 55 55	12.5 1.98	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55	2K = 0.04] = 0.04] = 0.04] = = = = = = =	(W/ 3.168 3.97 3.43 3.52 32.505 31.89 4.54	K)			kJ/K (26) (27) (27) (27) (28) (29) (29)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of	Gros area one 1 one 2 one 3 one 3 one 3 one 3 one 3 one 5 on	52 55 55	12.5 1.98	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0.18	2K =	(W/ 3.168 3.97 3.43 3.52 32.505 31.89 4.54 3.7	K)			kJ/K (26) (27) (27) (28) (29) (29) (30) (31)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall	Gros area one 1 one 2 one 3 one 3 one 3 one 3 one 3 one 5 on	52 55 55	12.5 1.98	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0.18	2K =	(W/ 3.168 3.97 3.43 3.52 32.505 31.89 4.54 3.7	K)			kJ/K (26) (27) (27) (28) (29) (30) (31)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling * for windows an	Gros area one 1 one 2 one 3 one 3 one 3 one 3 one 5 on	52 55 55 55 57 58 59 59 59 59 59 59 59 59 59 59 59 59 59	12.5 1.98 0	gs 1 ² 4 3	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8 51.98 5.32 43.87	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0.18	2K =	(W/ 3.168 3.97 3.43 3.52 32.505 31.89 4.54 3.7	K)	kJ/m²·l		kJ/K (26) (27) (27) (28) (29) (30) (31) (32)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling	Gros area one 1 one 2 one 3 one 3 one 3 one 6 on	52 55 55 5, m ² ows, use e	12.5 1.98 0	gs 1 ² 4 3	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8 51.98 5.32 43.87	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0.18	2K =	(W/ 3.168 3.97 3.43 3.52 32.505 31.89 4.54 3.7	K)	kJ/m²·l		kJ/K (26) (27) (27) (28) (29) (30) (31) (32) (32a)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling * for windows an ** include the are	Gros area on e 1 one 2 one 3 one 3 one 3 one 5 o	ows, use e sides of in = S (A x	12.5 1.98 0	gs 1 ² 4 3	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8 51.98 5.32 43.87	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0 formula 1	2K = 0.04 = 0.04 = 0.04 = = = = = = = = = =	(W/ 3.168 3.97 3.43 3.52 32.505 31.89 4.54 3.7	K)	kJ/m²·l	K	(26) (27) (27) (28) (29) (30) (31) (32a) (32b)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling * for windows an ** include the are Fabric heat lo	Gros area on e 1 one 2 one 3 one 3 one 3 one 5 o	ows, use e sides of in = S (A x (A x k)	12.5 1.98 0 effective winternal wall	igs 1 ² 4 3 3 Indow U-va	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8 51.98 5.32 43.87 alue calculatitions	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0 formula 1	2K = 0.04 = 0.04 = 0.04 = = = = = = = = = =	(W/ 3.168 3.97 3.43 3.52 32.505 31.89 4.54 3.7	K)	kJ/m²·l	3.2	kJ/K (26) (27) (27) (28) (29) (30) (31) (32) (32a) (32b)

n be u	منملم أميطام			بلمصلمانيم		ايدئلمصمص	/							
	Ū	`	,		using Ap = 0.05 x (3	•	`						27.57	(36
	abric hea		are not kin	OWII (30) -	- 0.00 X (3	')			(33) +	(36) =			122.23	(37
entila	tion hea	t loss ca	alculated	l monthly	У				(38)m	= 0.33 × (25)m x (5)	ı	-	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
3)m=	81.13	79.82	78.54	72.52	71.4	66.16	66.16	65.19	68.17	71.4	73.68	76.06		(3
eat tra	ansfer c	oefficier	nt, W/K		•	•	•	•	(39)m	= (37) + (3	38)m	•	•	
9)m=	203.36	202.05	200.77	194.75	193.63	188.39	188.39	187.42	190.41	193.63	195.91	198.29		
eat lo	ss parai	meter (H	HLP), W/	m²K			•			Average = = (39)m ÷	Sum(39) _{1.}	12 /12=	194.75	(3
0)m=	2	1.98	1.97	1.91	1.9	1.85	1.85	1.84	1.87	1.9	1.92	1.95		
umbe	r of dav	s in mor	nth (Tabl	le 1a)					,	Average =	Sum(40) _{1.}	12 /12=	1.91	(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
. Wa	ter heat	ing ener	gy requi	rement:								kWh/ye	ear:	
			. 1										1	,
sum	ed occu					10 /T	-	\0\1 - 0 (1012 v /	Γ Ε Λ 13		76		(
	A > 13.9		+ 1.76 x	[1 - exp	(-0.0003	349 X (11	-A -13.9)2)] + 0.0) X C1 UC	II A - 13.	.9)			
if TF	A £ 13.9), N = 1				•)2)] + 0.0 (25 x N)	•	II A - 13.		.67		(
if TF nnual educe t	A £ 13.9 average the annua), N = 1 e hot wa l average	ater usaç hot water	ge in litre	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed	, ,-	+ 36		99	.67		(-
if TF nnual duce t	A £ 13.9 average the annua	o, N = 1 e hot wa l 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 Iwelling is	erage = designed i	(25 x N) to achieve	+ 36 a water us	se target o	99	Γ		(
if TF, nnual educe t t more	A £ 13.9 average the annual that 125	o, N = 1 e hot wa l average litres per p	nter 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		99	.67 Dec		(
if TF, nnual educe t t more [t wate	A £ 13.9 average the annual that 125 Jan r usage in	o, N = 1 e hot wa l average litres per p Feb litres per	nter 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, I May Vd,m = fac	ay Vd,av welling is not and co Jun ctor from	erage = designed i id) Jul Table 1c x	(25 x N) to achieve Aug	+ 36 a water us Sep	e target o	99 Nov	Dec]	(
if TF, nnual duce t t more [t wate	A £ 13.9 average the annual that 125	o, N = 1 e hot wa l average litres per p	nter 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	Oct	99 Nov	Dec 109.64	1106.06	
if TF, nnual educe to the more [of water water [of	A £ 13.9 average the annual that 125 l Jan r usage in	e hot wa l average litres per p Feb litres per 105.65	hot water person per Mar day for ea	ge in litre usage by day (all w Apr ach month 97.68	es per da 5% if the d vater use, I May Vd,m = fal 93.69	ay Vd,av welling is not and co Jun ctor from 1	erage = designed id) Jul Fable 1c x 89.7	(25 x N) to achieve Aug	+ 36 a water us Sep	Oct 101.66 Fotal = Su	99 Nov 105.65 m(44) ₁₁₂ =	Dec 109.64	1196.06	
if TF, nnual duce t t more t wate l)m= ergy c	A £ 13.9 average the annual that 125 l Jan r usage in	e hot wa l average litres per p Feb litres per 105.65	hot water person per Mar day for ea	ge in litre usage by day (all w Apr ach month 97.68	es per da 5% if the d vater use, I May Vd,m = fal 93.69	ay Vd,av welling is not and co Jun ctor from 1	erage = designed id) Jul Fable 1c x 89.7	(25 x N) to achieve Aug (43) 93.69	+ 36 a water us Sep	Oct 101.66 Fotal = Su	99 Nov 105.65 m(44) ₁₁₂ =	Dec 109.64	1196.06	
if TF, nnual duce t t more t wate l)m= ergy c	A £ 13.9 average the annual that 125 Jan r usage in 109.64 ontent of a	P, N = 1 e hot wa l average litres per p Feb litres per 105.65	hot water person per Mar day for ea 101.66	ge in litre usage by day (all w Apr ach month 97.68	es per da 5% if the d vater use, I May Vd,m = fac 93.69	ay Vd,av welling is not and co Jun ctor from 7 89.7	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69	+ 36 a water us Sep 97.68 0 kWh/mon	Oct 101.66 Fotal = Su th (see Ta	Nov 105.65 m(44) ₁₁₂ = ables 1b, 1	Dec 109.64 = c, 1d) 157.46	1196.06	
if TFA	A £ 13.9 average the annual that 125 Jan r usage in 109.64 ontent of 1 162.59	Pe hot was a verage litres per per litres per per litres per litre	Mar day for ea 101.66 used - cale	ge in litre usage by day (all w Apr ach month 97.68 culated mo	es per da 5% if the da 5% if th	ay Vd,av lwelling is not and co Jun ctor from 7 89.7 190 x Vd,r	erage = designed in did) Jul Fable 1c x 89.7 m x nm x E 98.16	(25 x N) to achieve Aug (43) 93.69	+ 36 a water us Sep 97.68 0 kWh/mon 113.98	Oct 101.66 Fotal = Su th (see Ta	Nov 105.65 m(44) ₁₁₂ = ables 1b, 1 145	Dec 109.64 = c, 1d) 157.46		
if TFA innual duce to the more the water t	average the annual that 125 I Jan r usage in 109.64 ontent of 162.59 anneous we 24.39	Pe hot was a verage litres per per litres per per litres per litre	Mar day for ea 101.66 used - cale	ge in litre usage by day (all w Apr ach month 97.68 culated mo	es per da 5% if the da 5% if th	ay Vd,av lwelling is not and co Jun ctor from 7 89.7 190 x Vd,r	erage = designed in did) Jul Fable 1c x 89.7 m x nm x E 98.16	(25 x N) to achieve Aug (43) 93.69 07m / 3600 112.64	+ 36 a water us Sep 97.68 0 kWh/mon 113.98	Oct 101.66 Fotal = Su th (see Ta	Nov 105.65 m(44) ₁₁₂ = ables 1b, 1 145	Dec 109.64 = c, 1d) 157.46		
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if TFA innual iduce to the more if water if	average the annual that 125 lan rusage in 109.64 ontent of 162.59 anneous we 24.39 storage e volume	Pe hot water atter heating 21.33 loss: e hot water 1.33 loss: e (litres)	Mar day for ea 101.66 used - calc 146.74 ag at point 22.01	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (no	es per da 5% if the da 5% if th	ay Vd,av welling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage),	erage = designed id) Jul Table 1c x 89.7 m x nm x E 98.16 enter 0 in 14.72 storage	(25 x N) to achieve Aug (43) 93.69 7m / 3600 112.64 boxes (46) 16.9 within sa	+ 36 a water us Sep 97.68 113.98 1 to (61) 17.1	Oct 101.66 Total = Su 132.84 Total = Su 19.93	Nov 105.65 m(44) ₁₁₂ = ables 1b, 1 145 m(45) ₁₁₂ = 21.75	Dec 109.64 = c, 1d) 157.46		
if TFA innual iduce to the more if wate if wate if wate if wate if wate if wate if wate if wate comn com	A £ 13.9 average the annual that 125 from 109.64 ontent of 162.59 aneous was 24.39 storage a volume nunity here.	e hot water 105.65 hot water 142.2 ater heatin 21.33 loss: e (litres) eating a	Mar day for ea 101.66 used - calc 146.74 ag at point 22.01 including nd no ta	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (no	es per da 5% if the d rater use, f May Vd,m = fac 93.69 onthly = 4. 122.75 o hot water 18.41 colar or W relling, e	ay Vd,av welling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage), 15.89	erage = designed idd) Jul Table 1c x 89.7 98.16 enter 0 in 14.72 storage	(25 x N) to achieve Aug (43) 93.69 7Tm / 3600 112.64 boxes (46) 16.9 within sa (47)	+ 36 a water us Sep 97.68 0 kWh/mon 113.98 0 to (61) 17.1 ame vess	Oct 101.66 Total = Su 132.84 Total = Su 19.93 sel	Nov 105.65 m(44) ₁₁₂ = ables 1b, 1 145 m(45) ₁₁₂ = 21.75	Dec 109.64 = c, 1d) 157.46 = 23.62		
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Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (. , .	•	or each	month			((56)m = ((55) × (41)r	m		0		(55)
	0	0				1	/	. , , ,		0			(56)
(56)m= 0 If cylinder contains	_	·	0 rage (57)	0 m = (56)m	0 x [(50) – (0 H11)] ÷ (5	0 0) else (5	7)m = (56)	0 m where (0 m Append	ix H	(30)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
		<u> </u>	-						-				(58)
Primary circuit Primary circuit	•	•			50\m - /	'58\ ± 36	S5 × (41)	ım			0		(30)
(modified by				•	,	,	` ,		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	46.03	50.96	48.17	47.74	44.24	45.71	47.74	48.17	50.96	49.32	50.96		(61)
Total heat requ	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= 213.55	188.23	197.7	176.1	170.5	150.16	143.87	160.38	162.15	183.79	194.31	208.42		(62)
Solar DHW input	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	on to wate	er heating)	l	
(add additiona	l lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from w	ater hea	ter				•	•	•			•	'	
(64)m= 213.55	188.23	197.7	176.1	170.5	150.16	143.87	160.38	162.15	183.79	194.31	208.42		
							Outp	out from wa	ater heater	r (annual)₁	12	2149.17	(64)
Heat gains fro	m water	heating,	kWh/mo	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m]	
(65)m= 66.8													
,50,	58.79	61.53	54.58	52.75	46.28	44.07	49.39	49.94	56.91	60.54	65.1		(65)
include (57)						<u> </u>			56.91			eating	(65)
include (57)	m in calc	culation o	of (65)m	only if c		<u> </u>			56.91			eating	(65)
include (57) 5. Internal ga	m in calc ains (see	culation of Table 5	of (65)m and 5a	only if c		<u> </u>			56.91			eating	(65)
include (57)	m in calc ains (see	culation of Table 5	of (65)m and 5a	only if c		<u> </u>			56.91			eating	(65)
include (57) 5. Internal ga	m in calc ains (see as (Table Feb	culation of Table 5	of (65)m and 5a	only if c	ylinder i	s in the o	dwelling	or hot w	56.91 ater is fr	om com	munity h	eating	(65)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83	m in calc ains (see as (Table Feb 137.83	culation of Table 5 (a) Watt	of (65)m and 5a ts Apr 137.83	only if c): May 137.83	ylinder i: Jun 137.83	Jul 137.83	Aug 137.83	or hot w	56.91 ater is fr	om com	munity h	eating	
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include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 31.91	m in calcular in c	Table 5 5), Watt Mar 137.83 ted in Ap	of (65)m and 5a ts Apr 137.83 ppendix 17.45	only if c May 137.83 L, equati 13.04	Jun 137.83 ion L9 o	Jul 137.83 r L9a), a	Aug 137.83 Iso see	Sep 137.83 Table 5 20.76	56.91 ater is fr Oct 137.83	Nov	Dec	eating	(66)
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include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 31.91 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78	m in calcular (calcular (calcular (calcular 36.78)	Table 5 5), Watt Mar 137.83 ted in Ap 23.05 ulated in 255.32 tted in Ap 36.78	and 5a ts Apr 137.83 opendix 17.45 Append 240.88 opendix 36.78	only if constructions only if constructions only if constructions on the construction of the construction of the construction of the construction on the construction of the construction	Jun 137.83 ion L9 of 11.01 uation L 205.52 ion L15	Jul 137.83 r L9a), a 11.9 13 or L1 194.07 or L15a	Aug 137.83 Iso see 15.47 3a), also 191.38	Sep 137.83 Table 5 20.76 See Tal 198.16 ee Table	56.91 ater is fr Oct 137.83 26.36 ole 5 212.6 5	Nov 137.83 30.77	Dec 137.83 32.8 247.96	eating	(66) (67) (68)
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include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 31.91 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fail (70)m= 3	m in calc ains (see as (Table Feb 137.83 (calculat 28.34 ins (calc 262.1 (calculat 36.78 as gains 3	ted in Ap 25.32 ted in Ap 36.78 (Table 5	of (65)m and 5a ts Apr 137.83 opendix 17.45 Append 240.88 opendix 36.78 5a)	only if construction only if c	Jun 137.83 ion L9 of 11.01 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 11.9 13 or L1 194.07 or L15a) 36.78	Aug 137.83 Iso see 15.47 3a), also 191.38), also se 36.78	Sep 137.83 Table 5 20.76 See Tal 198.16 ee Table 36.78	56.91 ater is fr Oct 137.83 26.36 ble 5 212.6 5 36.78	Nov 137.83 30.77 230.83	Dec 137.83 32.8 247.96	eating	(66) (67) (68) (69)
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include (57) 5. Internal games Jan (66)m= 137.83 Lighting gains (67)m= 31.91 Appliances ga (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fait (70)m= 3 Losses e.g. ev (71)m= -110.27	m in calcons (Table Feb 137.83 (Calcular 28.34 ins (calcular 36.78 ns gains 3 vaporatio -110.27	ted in Ap 255.32 ulated in Ap 36.78 (Table 5	of (65)m and 5a ts Apr 137.83 opendix 17.45 Append 240.88 opendix 36.78 ive valu	only if c): May 137.83 L, equati 13.04 dix L, equ 222.65 L, equati 36.78 3 es) (Tab	Jun 137.83 ion L9 of 11.01 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 11.9 13 or L1 194.07 or L15a) 36.78	Aug 137.83 Iso see 15.47 3a), also 191.38), also se 36.78	Sep 137.83 Table 5 20.76 see Tal 198.16 ee Table 36.78	56.91 ater is fr Oct 137.83 26.36 ble 5 212.6 5 36.78	Nov 137.83 30.77 230.83 36.78	Dec 137.83 32.8 247.96 36.78	eating	(66) (67) (68) (69) (70)
include (57) 5. Internal games Jan (66)m= 137.83 Lighting gains (67)m= 31.91 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fames (70)m= 3 Losses e.g. even	m in calcons (Table Feb 137.83 (Calcular 28.34 ins (calcular 36.78 ns gains 3 vaporatio -110.27	ted in Ap 255.32 ulated in Ap 36.78 (Table 5	of (65)m and 5a ts Apr 137.83 opendix 17.45 Append 240.88 opendix 36.78 ive valu	only if c): May 137.83 L, equati 13.04 dix L, equ 222.65 L, equati 36.78 3 es) (Tab	Jun 137.83 ion L9 of 11.01 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 11.9 13 or L1 194.07 or L15a) 36.78	Aug 137.83 Iso see 15.47 3a), also 191.38), also se 36.78	Sep 137.83 Table 5 20.76 see Tal 198.16 ee Table 36.78	56.91 ater is fr Oct 137.83 26.36 ble 5 212.6 5 36.78	Nov 137.83 30.77 230.83 36.78	Dec 137.83 32.8 247.96 36.78	eating	(66) (67) (68) (69) (70)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 31.91 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fair (70)m= 3 Losses e.g. even (71)m= -110.27 Water heating (72)m= 89.79	m in calce in s (Table Feb 137.83 (calcular 28.34 ins (calcular 36.78 ins gains 3 vaporatio 47.48	ted in Ap 255.32 ted in Ap 36.78 (Table 5 3 on (negat -110.27)	of (65)m and 5a ts Apr 137.83 ppendix 17.45 Appendix 240.88 oppendix 36.78 ive valu -110.27	only if c): May 137.83 L, equati 13.04 dix L, equ 222.65 L, equat 36.78 3 es) (Tab	Jun 137.83 ion L9 of 11.01 uation L 205.52 ion L15 36.78 3 le 5) -110.27	Jul 137.83 r L9a), a 11.9 13 or L1 194.07 or L15a) 36.78	Aug 137.83 Iso see 15.47 3a), also 191.38), also se 36.78	Sep 137.83 Table 5 20.76 See Tal 198.16 See Table 36.78	56.91 ater is fr Oct 137.83 26.36 ble 5 212.6 5 36.78 3 -110.27	Nov 137.83 30.77 230.83 36.78 3	Dec 137.83 32.8 247.96 36.78 3	eating	(66) (67) (68) (69) (70) (71)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 31.91 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fail (70)m= 3 Losses e.g. even (71)m= -110.27 Water heating	m in calc ains (see s (Table Feb 137.83 (calculat 28.34 ins (calc 262.1 (calculat 36.78 ns gains 3 vaporatio -110.27 gains (T 87.48 gains =	ted in Ap 255.32 ted in Ap 36.78 (Table 5 3 on (negat -110.27)	of (65)m and 5a ts Apr 137.83 ppendix 17.45 Appendix 240.88 oppendix 36.78 ive valu -110.27	only if c): May 137.83 L, equati 13.04 dix L, equ 222.65 L, equat 36.78 3 es) (Tab	Jun 137.83 ion L9 of 11.01 uation L 205.52 ion L15 36.78 3 le 5) -110.27	Jul 137.83 r L9a), a 11.9 13 or L1 194.07 or L15a) 36.78	Aug 137.83 Iso see 15.47 3a), also 191.38), also se 36.78	Sep 137.83 Table 5 20.76 See Tal 198.16 See Table 36.78 3 -110.27	56.91 ater is fr Oct 137.83 26.36 ble 5 212.6 5 36.78 3 -110.27	Nov 137.83 30.77 230.83 36.78 3	Dec 137.83 32.8 247.96 36.78 3	eating	(66) (67) (68) (69) (70) (71)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 31.91 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fames (70)m= 3 Losses e.g. even (71)m= -110.27 Water heating (72)m= 89.79 Total internal	m in calc ains (see as (Table Feb 137.83 (calculat 28.34 ins (calc 262.1 (calculat 36.78 as gains 3 vaporatio -110.27 gains (T 87.48 gains =	culation of Table 5 25), Watt Mar 137.83 ted in Ap 23.05 ulated in 255.32 uted in Ap 36.78 (Table 5 3 on (negat -110.27	of (65)m and 5a ts Apr 137.83 ppendix 17.45 Appendix 240.88 ppendix 36.78 sa) 3 sive valu -110.27	only if construction only if c	Jun 137.83 ion L9 of 11.01 uation L 205.52 ion L15 36.78 3 le 5) -110.27	Jul 137.83 r L9a), a 11.9 13 or L1 194.07 or L15a; 36.78 3	Aug 137.83 Iso see 15.47 3a), also 191.38), also se 36.78 3	Sep 137.83 Table 5 20.76 See Tal 198.16 See Table 36.78 3 -110.27 69.36 + (69)m + (56.91 ater is fr Oct 137.83 26.36 ble 5 212.6 5 36.78 3 -110.27 76.49 70)m + (7	Nov 137.83 30.77 230.83 36.78 3 -110.27 84.09 1)m + (72)	Dec 137.83 32.8 247.96 36.78 3	eating	(66) (67) (68) (69) (70) (71)

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

Orientation: Access Fa	actor	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x 0.77	X	2.34	x	11.28	X	0.63	x	0.7	=	8.07	(75)
Northeast 0.9x 0.77	X	2.34	x	22.97	X	0.63	x	0.7	=	16.42	(75)
Northeast 0.9x 0.77	X	2.34	x	41.38	X	0.63	x	0.7	_ =	29.59	(75)
Northeast 0.9x 0.77	x	2.34	X	67.96	X	0.63	x	0.7	= =	48.6	(75)
Northeast 0.9x 0.77	X	2.34	x	91.35	X	0.63	x	0.7	=	65.32	(75)
Northeast 0.9x 0.77	X	2.34	X	97.38	X	0.63	x	0.7	=	69.64	(75)
Northeast 0.9x 0.77	X	2.34	x	91.1	X	0.63	x	0.7	=	65.15	(75)
Northeast 0.9x 0.77	X	2.34	X	72.63	X	0.63	x	0.7	=	51.94	(75)
Northeast 0.9x 0.77	X	2.34	X	50.42	X	0.63	x	0.7	=	36.06	(75)
Northeast _{0.9x} 0.77	X	2.34	X	28.07	X	0.63	x	0.7	=	20.07	(75)
Northeast _{0.9x} 0.77	X	2.34	X	14.2	X	0.63	x	0.7	=	10.15	(75)
Northeast 0.9x 0.77	X	2.34	X	9.21	X	0.63	x	0.7	=	6.59	(75)
Southeast 0.9x 0.77	X	2.64	x	36.79	X	0.63	x	0.7	=	89.06	(77)
Southeast 0.9x 0.77	X	2.64	X	62.67	X	0.63	x	0.7	=	151.7	(77)
Southeast 0.9x 0.77	X	2.64	X	85.75	X	0.63	x	0.7	=	207.56	(77)
Southeast 0.9x 0.77	X	2.64	X	106.25	X	0.63	x	0.7	=	257.18	(77)
Southeast 0.9x 0.77	X	2.64	X	119.01	X	0.63	x	0.7	=	288.06	(77)
Southeast 0.9x 0.77	X	2.64	x	118.15	X	0.63	x	0.7	=	285.98	(77)
Southeast 0.9x 0.77	X	2.64	X	113.91	X	0.63	x	0.7	=	275.71	(77)
Southeast 0.9x 0.77	X	2.64	X	104.39	X	0.63	x	0.7	=	252.67	(77)
Southeast 0.9x 0.77	X	2.64	X	92.85	X	0.63	x	0.7	=	224.74	(77)
Southeast 0.9x 0.77	X	2.64	X	69.27	X	0.63	x	0.7		167.66	(77)
Southeast 0.9x 0.77	X	2.64	X	44.07	X	0.63	x	0.7	=	106.67	(77)
Southeast 0.9x 0.77	X	2.64	x	31.49	X	0.63	x	0.7	=	76.21	(77)
Southwest _{0.9x} 0.77	X	2.28	X	36.79]	0.63	x	0.7	=	25.64	(79)
Southwest _{0.9x} 0.77	X	2.28	x	62.67]	0.63	x	0.7	=	43.67	(79)
Southwest _{0.9x} 0.77	X	2.28	X	85.75]	0.63	x	0.7	=	59.75	(79)
Southwest _{0.9x} 0.77	X	2.28	X	106.25]	0.63	x	0.7	=	74.04	(79)
Southwest _{0.9x} 0.77	X	2.28	X	119.01]	0.63	x	0.7	=	82.93	(79)
Southwest _{0.9x} 0.77	X	2.28	X	118.15		0.63	x	0.7	=	82.33	(79)
Southwest _{0.9x} 0.77	X	2.28	X	113.91		0.63	x	0.7	=	79.37	(79)
Southwest _{0.9x} 0.77	X	2.28	X	104.39		0.63	x	0.7	=	72.74	(79)
Southwest _{0.9x} 0.77	X	2.28	X	92.85		0.63	X	0.7	=	64.7	(79)
Southwest _{0.9x} 0.77	X	2.28	X	69.27		0.63	x	0.7	=	48.27	(79)
Southwest _{0.9x} 0.77	X	2.28	X	44.07		0.63	x	0.7	=	30.71	(79)
Southwest _{0.9x} 0.77	X	2.28	X	31.49		0.63	X	0.7	=	21.94	(79)
Solar gains in watts, ca			_			n = Sum(74)m		1		ı	(05)
(83)m= 122.76 211.79	296.9	379.81 436.3		37.95 420.23	377	.35 325.5	236	147.53	104.74		(83)
Total gains – internal a		· , , , ,	<u> </u>		747	02 604 44	640.0	F60 F0	E40.05	1	(84)
(84)m= 571.22 657.07	725.33	781.29 810.2	0 1	786.1 752.78	717	.93 681.14	618.8	560.56	540.35		(04)

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) Man
Sep Oct Nov Dec Dec Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct Nov Dec Sep Oct
Residual
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 18.74 18.92 19.24 19.72 20.17 20.6 20.82 20.79 20.46 19.86 19.25 18.75 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.34 19.35 19.35 19.39 19.4 19.44 19.44 19.44 19.44 19.42 19.4 19.39 19.37 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 1 0.99 0.99 0.98 0.98 0.94 0.83 0.63 0.63 0.68 0.9 0.98 0.99 1 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 17.35 17.53 17.86 18.36 18.81 19.23 19.39 19.38 19.1 18.51 17.89 17.38 (90) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 − fLA) × T2 (92)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 (93) S. 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-calculate the utilisation factor for gains, hm: Q4)m= 1 0.99 0.99 0.97 0.94 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 0.90 0.99 1 0.90 0.99 0.97 0.94 0.84 0.84 0.89 0.73 0.9 0.98 0.99 1
Ref 18.74 18.92 19.24 19.72 20.17 20.6 20.82 20.79 20.46 19.86 19.25 18.75 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) Ref 19.34 19.35 19.35 19.39 19.4 19.44 19.44 19.44 19.42 19.4 19.39 19.37 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) Ref 1
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m=
(88)m=
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 1 0.99 0.99 0.98 0.94 0.83 0.63 0.68 0.9 0.98 0.99 1 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 17.35 17.53 17.86 18.36 18.81 19.23 19.39 19.38 19.1 18.51 17.89 17.38 (90) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2 (92)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 (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-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: (94)m= 1 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 Useful gains, hmGm, W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 (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)
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) Fig.
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 17.35 17.53 17.86 18.36 18.81 19.23 19.39 19.38 19.1 18.51 17.89 17.38 (90) ### Read internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2 (92)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 (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-calculate the utilisation factor for gains using Table 9a Utilisation factor for gains, hm: (94)m= 1 0.99 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 Utseful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 (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)
(90)m=
(90)m=
Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2 (92)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 (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-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: (94)m= 1 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 (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)
(92)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 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-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: (94)m= 1 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 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)
(92)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 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-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: (94)m= 1 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 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)
(93)m= 17.73 17.91 18.24 18.73 19.18 19.6 19.78 19.76 19.47 18.88 18.26 17.75 (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-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: (94)m= 1 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 (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)
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-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: (94)m= 1 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 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)
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: (94)m= 1 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 (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)
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: (94)m= 1 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 (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)
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 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 (94) Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 (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)
Utilisation factor for gains, hm: (94)m= 1
(94)m= 1 0.99 0.99 0.97 0.94 0.84 0.68 0.73 0.9 0.98 0.99 1 (94) Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 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)
Useful gains, hmGm , W = (94)m x (84)m (95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 (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)
(95)m= 568.72 652.23 715.58 759.34 757.77 662.19 513.28 520.58 614.94 604.16 556.53 538.44 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)
(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)
(vo) (vo)
(97)m= 2730.66 2628.57 2356.13 1913.57 1448.21 941.6 598.54 629.75 1021.62 1602.83 2186.44 2687.69 (97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m
(98)m= 1608.48 1328.1 1220.58 831.05 513.69 0 0 0 743 1173.54 1599.04
Total per year (kWh/year) = Sum(98) _{15,912} = 9017.48 (98)
Space heating requirement in kWh/m²/year 88.47 (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) = $
Fraction of total hooting from main system 1 (204) = (202) × (4 (202)) =
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] = 1$ (204)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$ 1 (204) Efficiency of main space heating system 1 90.3 (206) Efficiency of secondary/supplementary heating system, %

										Ī	
Jan Feb Ma		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space heating requiremen	`	i					740	4470.54	4500.04	İ	
1608.48 1328.1 1220		513.69	0	0	0	0	743	1173.54	1599.04		(0.1.1)
$(211)m = \{[(98)m \times (204)] \}$ $1781.27 1470.77 1351$		568.87	0	0	0	0	822.82	1299.6	1770.81		(211)
1701.27 1470.77 1001.	03 320.02	300.01	Ů	U				211),5.1012		9986.14	(211)
Space heating fuel (second	darv), kWh	month				,	,	715,1012		0000.11	」` ′
= {[(98)m x (201)] } x 100 ÷											
(215)m= 0 0 0	0	0	0	0	0	0	0	0	0		_
					Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
Water heating		I									
Output from water heater (c 213.55 188.23 197.		170.5	150.16	143.87	160.38	162.15	183.79	194.31	208.42		
Efficiency of water heater	I	l								81	(216)
(217)m= 89.1 89.03 88.8	8 88.52	87.79	81	81	81	81	88.29	88.85	89.12		(217)
Fuel for water heating, kWh		•									
(219) m = (64) m x $100 \div (2$ (219)m = 239.67 211.42 222.4		194.21	185.39	177.62	198	200.19	208.17	218.7	233.86		
(210)111 200.07 211.42 222.	14 100.00	104.21	100.00	177.02		I = Sum(2		210.7	200.00	2488.61	(219)
Annual totals							k\	Wh/year		kWh/year	
Space heating fuel used, ma	ain system	1						-		9986.14	
Water heating fuel used										2488.61	Ī
Water heating fuel used Electricity for pumps, fans a	nd electric	keep-ho	t							2488.61	
-	nd electric	keep-ho	t						30	2488.61	(230c)
Electricity for pumps, fans a		·	t		sum	of (230a).	(230g) =		30	2488.61	(230c) (231)
Electricity for pumps, fans a central heating pump:		·	t		sum	of (230a).	(230g) =		30		,
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting	e, kWh/yea	ır		uding mi			(230g) =		30	30	(231)
Electricity for pumps, fans a central heating pump: Total electricity for the above	e, kWh/yea	ır	ems inclu							30 563.55	(231) (232)
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting	e, kWh/yea	ır	ems inclu En	ergy			Emiss	ion fac		30 563.55 Emissions	(231)
Electricity for pumps, fans a central heating pump: Total electricity for the abov Electricity for lighting 12a. CO2 emissions – Indi	e, kWh/yea vidual heat	ır	ems inclu En kW				Emiss kg CO	ion fac 2/kWh		30 563.55 Emissions kg CO2/yea	(231) (232)
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting	e, kWh/yea vidual heat	ır	ems inclu En kW (211	ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	30 563.55 Emissions kg CO2/yea 2157.01	(231) (232) ar
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting 12a. CO2 emissions – Indi Space heating (main system Space heating (secondary)	e, kWh/yea vidual heat	ır	ems inclu En kW (211	ergy /h/year			Emiss kg CO: 0.2	ion fac 2/kWh 16	tor =	30 563.55 Emissions kg CO2/yea 2157.01	(231) (232) (232) (261) (263)
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting 12a. CO2 emissions – India Space heating (main system Space heating (secondary)) Water heating	e, kWh/yea vidual heat	ır	ems inclu En kW (211 (215	ergy /h/year /) × /) × /) ×			Emiss kg CO	ion fac 2/kWh 16	tor = =	30 563.55 Emissions kg CO2/yea 2157.01 0 537.54	(231) (232) (232) (261) (263) (264)
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting 12a. CO2 emissions – India Space heating (main system Space heating (secondary)) Water heating Space and water heating	e, kWh/yea vidual heat n 1)	ing syste	ems inclu En kW (211 (215 (219 (261	ergy /h/year /) × /) × /) ×	cro-CHF		Emiss kg CO2 0.2 0.5 0.2	ion fac 2/kWh 16 19	tor = =	30 563.55 Emissions kg CO2/yea 2157.01 0 537.54 2694.55	(231) (232) (232) (261) (263) (264) (265)
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting 12a. CO2 emissions – Indi Space heating (main system Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans a	e, kWh/yea vidual heat n 1)	ing syste	ems inclu En kW (211 (215 (219 (261	ergy /h/year /b) x /b) x /b) x /l) + (262)	cro-CHF		Emiss kg CO2 0.2 0.5 0.5	ion fac 2/kWh 16 19 16	tor = = =	30 563.55 Emissions kg CO2/yea 2157.01 0 537.54 2694.55 15.57	(231) (232) (232) (261) (263) (264) (265) (267)
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting 12a. CO2 emissions – Indi Space heating (main system Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans a Electricity for lighting	e, kWh/yea vidual heat n 1)	ing syste	ems inclu En kW (211 (215 (219 (261	ergy /h/year i) x 5) x 9) x	cro-CHF	264) =	Emiss kg CO: 0.2 0.5 0.5 0.5	ion fac 2/kWh 16 19 16	tor = = =	30 563.55 Emissions kg CO2/yea 2157.01 0 537.54 2694.55 15.57 292.48	(231) (232) (232) (261) (263) (264) (265) (267) (268)
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting 12a. CO2 emissions – India Space heating (main system Space heating (secondary)) Water heating Space and water heating Electricity for pumps, fans a Electricity for lighting Total CO2, kg/year	e, kWh/yea vidual heat n 1)	ing syste	ems inclu En kW (211 (215 (219 (261	ergy /h/year /b) x /b) x /b) x /l) + (262)	cro-CHF	(264) = sum o	Emiss kg CO: 0.2 0.5 0.5 0.5 f (265)(2	ion fac 2/kWh 16 19 16	tor = = =	30 563.55 Emissions kg CO2/yea 2157.01 0 537.54 2694.55 15.57 292.48 3002.6	(231) (232) (232) (261) (263) (264) (265) (267) (268) (268)
Electricity for pumps, fans a central heating pump: Total electricity for the above Electricity for lighting 12a. CO2 emissions – Indi Space heating (main system Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans a Electricity for lighting	e, kWh/yea vidual heat n 1)	ing syste	ems inclu En kW (211 (215 (219 (261	ergy /h/year /b) x /b) x /b) x /l) + (262)	cro-CHF	(264) = sum o	Emiss kg CO: 0.2 0.5 0.5 0.5	ion fac 2/kWh 16 19 16	tor = = =	30 563.55 Emissions kg CO2/yea 2157.01 0 537.54 2694.55 15.57 292.48	(231) (232) (232) (261) (263) (264) (265) (267) (268)

		User Details:			
Assessor Name:	Chris Hocknell	Stroma Nur	mbor: STD	0016363	
Software Name:	Stroma FSAP 2012	Software Ve		sion: 1.0.4.26	
Contivare Harrie.	Stroma i Gra 2012	Property Address: Flat 0		7.01.7.20	
Address :	Flat 04, 51 Calthorpe Str	eet, LONDON, WC1X 0HF			
1. Overall dwelling dime					
		Area(m²)	Av. Height(m)	Volume(m³)	
Ground floor		83.77 (1a) x	3.06 (2a) =	256.34	(3a)
First floor		20.32 (1b) x	2.2 (2b) =	44.7	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+	.(1n) 104.09 (4)			-
Dwelling volume		(3a)+(3	(3c)+(3c)+(3d)+(3e)+(3n) =	301.04	(5)
2. Ventilation rate:					•
	main secon heating heatir		total	m³ per hour	
Number of chimneys	0 + 0	+ 0 =	0 x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0 x 20 =	0	(6b)
Number of intermittent fa	ns		4 x 10 =	40	(7a)
Number of passive vents			0 x 10 =	0	(7b)
Number of flueless gas fi	res		0 x 40 =	0	(7c)
			Δir	changes per hou	ır
Infiltration due to chimne	ys, flues and fans = (6a)+(6b	n)+(7a)+(7h)+(7c) =			,
	een carried out or is intended, pro		40 ÷ (5) =	0.13	(8)
Number of storeys in the	he dwelling (ns)			2	(9)
Additional infiltration			[(9)-1]x0.1 =	0.1	(10)
	.25 for steel or timber frame	•	truction	0.35	(11)
if both types of wall are po deducting areas of openio	resent, use the value correspondir ngs): if equal user 0.35	ng to the greater wall area (after			
•	floor, enter 0.2 (unsealed) o	or 0.1 (sealed), else enter ()	0	(12)
If no draught lobby, en	ter 0.05, else enter 0			0.05	_
Percentage of window	s and doors draught strippe	d		1	(13)
					(13) (14)
Window infiltration		0.25 - [0.2 x (14) ÷	100] =	0.248	╣.
Window infiltration Infiltration rate			(12) + (13) + (15) =	0.248 0.880872626188352	(14) (15)
Infiltration rate	q50, expressed in cubic mo	(8) + (10) + (11) +	(12) + (13) + (15) =		(14) (15)
Infiltration rate Air permeability value, If based on air permeabil	ity value, then (18) = [(17) ÷ 2	(8) + (10) + (11) + etres per hour per square (0)+(8), otherwise (18) = (16)	(12) + (13) + (15) = metre of envelope area	0.880872626188352	(14) (15) (16)
Infiltration rate Air permeability value, If based on air permeabil Air permeability value applie	lity value, then $(18) = [(17) \div 2]$ is if a pressurisation test has been	(8) + (10) + (11) + etres per hour per square (0)+(8), otherwise (18) = (16)	(12) + (13) + (15) = metre of envelope area	0.880872626188352 0	(14) (15) (16) (17) (18)
Infiltration rate Air permeability value, If based on air permeabil Air permeability value applie Number of sides sheltere	lity value, then $(18) = [(17) \div 2]$ is if a pressurisation test has been	(8) + (10) + (11) + etres per hour per square i D]+(8), otherwise (18) = (16) done or a degree air permeabilit	(12) + (13) + (15) = metre of envelope area y is being used	0.880872626188352 0 0.888	(14) (15) (16) (17) (18)
Infiltration rate Air permeability value, If based on air permeabil Air permeability value applie Number of sides sheltere Shelter factor	ity value, then (18) = [(17) ÷ 2) s if a pressurisation test has been ed	(8) + (10) + (11) + etres per hour per square in the control of	(12) + (13) + (15) = metre of envelope area y is being used (19)] =	0.880872626188352 0 0.888	(14) (15) (16) (17) (18) (19) (20)
Infiltration rate Air permeability value, If based on air permeabil Air permeability value applie Number of sides sheltere Shelter factor Infiltration rate incorporate	lity value, then (18) = [(17) ÷ 2) is if a pressurisation test has been ed	(8) + (10) + (11) + etres per hour per square i D]+(8), otherwise (18) = (16) done or a degree air permeabilit	(12) + (13) + (15) = metre of envelope area y is being used (19)] =	0.880872626188352 0 0.888	(14) (15) (16) (17) (18)
Infiltration rate Air permeability value, If based on air permeability value applies Air permeability value applies Number of sides sheltered Shelter factor Infiltration rate incorporate Infiltration rate modified for	ity value, then (18) = [(17) + 2) is if a pressurisation test has been ed ting shelter factor for monthly wind speed	(8) + (10) + (11) + etres per hour per square i D]+(8), otherwise (18) = (16) done or a degree air permeabilit (20) = 1 - [0.075 x (21) = (18) x (20) =	(12) + (13) + (15) = metre of envelope area y is being used (19)] =	0.880872626188352 0 0.888 1 0.92 0.81	(14) (15) (16) (17) (18) (19) (20)
Infiltration rate Air permeability value, If based on air permeability value applied Air permeability value applied Number of sides sheltered Shelter factor Infiltration rate incorporate	ity value, then (18) = [(17) + 2) is if a pressurisation test has been ed ting shelter factor for monthly wind speed Mar Apr May Ju	(8) + (10) + (11) + etres per hour per square (10) + (8), otherwise (18) = (16) done or a degree air permeabilit (20) = 1 - [0.075 x (21) = (18) x (20) =	(12) + (13) + (15) = metre of envelope area y is being used (19)] =	0.880872626188352 0 0.888 1 0.92 0.81	(14) (15) (16) (17) (18) (19) (20)

4.9

4.4

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

(22)m=

Wind Factor (2	22a\m =	(22)m ÷	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		
A .15 4 1 5 614.		. / . !!		14	.1		(04 -)	(00 -)				ı	
Adjusted infiltr	ation rat	e (allowi	ng for si	neiter an	d wind s	speed) = 0.77	(21a) x	(22a)m 0.81	0.88	0.92	0.96]	
Calculate effe	1		l		l '	l '	0.75	0.01	0.00	0.52	0.50		
If mechanic												0	(23a)
If exhaust air h		•	•	, ,	,	. ,	**	•) = (23a)			0	(23b)
If balanced wit		-	-	_					>		, (aa)	0	(23c)
a) If balance	ed mech	anical ve	entilation 0	with he	at recove	ery (MVI	HR) (248	a)m = (2) 0	2b)m + (0	23b) × [1 – (23c) 	i ÷ 100] I	(24a)
, ,	<u> </u>		<u> </u>								U		(244)
b) If balance (24b)m= 0		o 0	0	0	neat rec	overy (i	0 0	0	0	0	0	1	(24b)
c) If whole h			<u> </u>		<u> </u>							l	(= .2)
•	n < 0.5 ×			•	•				.5 × (23b)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural									•	•	•	•	
	m = 1, the	<u> </u>	<u>`</u> _				- ``					1	(0.4.1)
(24d)m= 1.04	1.02	1	0.9	0.88	0.8	0.8	0.78	0.83	0.88	0.92	0.96		(24d)
Effective air	change 1.02	rate - er	iter (24a 0.9	0.88	0.8 or (24)	c) or (24 0.8	0.78	x (25) 0.83	0.88	0.92	0.96	1	(25)
(23)111- 1.04	1.02	_ '	0.9	0.00	0.0	0.0	0.76	0.03	0.00	0.92	0.90		(23)
3. Heat losse		·											
3. Heat losse ELEMENT	Gros	SS	oaramet Openir m	ıgs	Net Ar A ,r		U-val W/m2		A X U (W/	K)	k-value kJ/m²·l		A X k kJ/K
		SS	Openir	ıgs	Net Ar A ,r 1.98	m²			A X U (W/	K)			
ELEMENT	Gros area	SS	Openir	ıgs	A ,r	m² x	W/m2	2K =	(W/	K)			kJ/K
ELEMENT Doors	Gros area e 1	SS	Openir	ıgs	A ,r	m² x x1	W/m2	= 	(W/ 3.168	K)			kJ/K (26)
ELEMENT Doors Windows Type	Gros area e 1 e 2	SS	Openir	ıgs	A ,r	m² x x1 x1	W/m2 1.6 /[1/(1.6)+	eK = 	3.168 2.17	K)			kJ/K (26) (27)
ELEMENT Doors Windows Type Windows Type	Gros area e 1 e 2 e 3	SS	Openir	ıgs	A ,r 1.98 1.44 2.64	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0.04] = 0.04] =	3.168 2.17 3.97	K)			kJ/K (26) (27) (27)
Doors Windows Type Windows Type Windows Type	Gros area e 1 e 2 e 3 e 4	SS	Openir	ıgs	A ,r 1.98 1.44 2.64 0.69	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	EK = 0.04] = 0.04] = 0.04] = 0.04] =	3.168 2.17 3.97 1.04	K)			kJ/K (26) (27) (27) (27)
Doors Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area e 1 e 2 e 3 e 4 e 5	SS	Openir	ıgs	A ,r 1.98 1.44 2.64 0.69 1.8	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	EK = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	3.168 2.17 3.97 1.04 2.71	K)			kJ/K (26) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area e 1 e 2 e 3 e 4 e 5 e 6	SS	Openir	ıgs	A ,r 1.98 1.44 2.64 0.69 1.8	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0	3.168 2.17 3.97 1.04 2.71 2.17	K)			kJ/K (26) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area e 1 e 2 e 3 e 4 e 5 e 6	SS	Openir	ıgs	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0	(W// 3.168 2.17 3.97 1.04 2.71 2.17				kJ/K (26) (27) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area e 1 e 2 e 3 e 4 e 5 e 6	ss (m²)	Openir	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0	(W// 3.168 2.17 3.97 1.04 2.71 2.17 13.02 6.38				kJ/K (26) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7	ss (m²)	Openir n	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0	(W// 3.168 2.17 3.97 1.04 2.71 2.17 13.02 6.38 46.073				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7	ss (m²)	Openir n	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55	2K = 0.04] = 0	(W// 3.168 2.17 3.97 1.04 2.71 2.17 13.02 6.38 46.073				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7	ss (m²)	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55	2K = 0.04] = 0	(W// 3.168 2.17 3.97 1.04 2.71 2.17 13.02 6.38 46.073 25.66 2.57				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29)
ELEMENT Doors Windows Type Wi	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 55.6 19.0	SS (m²) 67 9 12	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0.15	2K = 0.04] = 0	(W// 3.168 2.17 3.97 1.04 2.71 2.17 13.02 6.38 46.073 25.66 2.57 3.68				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Roof	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 55.6 19.0	SS (m²) 67 9 12	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92 24.52	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.55 0.14 0.15	2K = 0.04] = 0	(W// 3.168 2.17 3.97 1.04 2.71 2.17 13.02 6.38 46.073 25.66 2.57 3.68				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Roor Walls Type Walls Type Roof Total area of e	Gros area e 1 e 2 e 3 e 4 e 5 e 6 e 7 55.6 19.0	SS (m²) 67 9 12	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92 24.52 13.01	m ²	W/m2 1.6 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.55 0.14 0.15 0.18	2K	(W// 3.168 2.17 3.97 1.04 2.71 2.17 13.02 6.38 46.073 25.66 2.57 3.68 2.34				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31)

(26)...(30) + (32) =

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

Fabric heat loss, W/K = S (A x U)

114.94

(33)

Heat capacity Cm	= S(A x k)						((28)	.(30) + (32	?) + (32a).	(32e) =	18376.29	(34)
Thermal mass para	,	⊃ = Cm ÷	+ TFA) ir	n kJ/m²K				`		, ,	250	(35)
For design assessment	•		,			ecisely the				able 1f	250	(00)
can be used instead of	a detailed calc	ulation.			·							
Thermal bridges :	S (L x Y) cal	culated i	using Ap	pendix l	K						31.32	(36)
if details of thermal brid		own (36) =	= 0.05 x (3	1)			(22)	(20) -				7
Total fabric heat lo		الطائم مصال					(33) +		0E) m v (E)		146.25	(37)
Ventilation heat los			<u> </u>	1	1	A	· ,	= 0.33 × (, , ,	_		
(38)m= 103.21 101	eb Mar .18 99.16	Apr 89.57	May 87.78	Jun 79.43	Jul 79.43	77.89	Sep 82.65	Oct 87.78	Nov 91.41	95.2		(38)
` /		00.07	07.70	70.40	7 0.40	77.00				30.2		(00)
Heat transfer coeff		205.00	224.02	205.00	1 205 00	204.44	` ′	= (37) + (3	,	044.45		
(39)m= 249.46 247	245.41	235.83	234.03	225.69	225.69	224.14	228.9	234.03 Average =	237.66	241.45	235.81	(39)
Heat loss paramet	er (HLP), W	/m²K						= (39)m ÷	. ,	12 / 12-	233.61	(59)
(40)m= 2.4 2.3	38 2.36	2.27	2.25	2.17	2.17	2.15	2.2	2.25	2.28	2.32		
			•	•	•	•	,	Average =	Sum(40) _{1.}	12 /12=	2.27	(40)
Number of days in					l		_			_	1	
-	eb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31 2	8 31	30	31	30	31	31	30	31	30	31		(41)
4. Water heating	energy requ	irement:								kWh/ye	ear:	
A												
Assumed occupan if TFA > 13.9, N	= 1 + 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		77		(42)
if TFA > 13.9, N if TFA £ 13.9, N	= 1 + 1.76 x = 1					, , -	•	ΓFA -13.	9)			, ,
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave	= 1 + 1.76 x = 1 vt water usag rage hot water	ge in litre	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed t	(25 x N)	+ 36		9)	0.09		(42)
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho	= 1 + 1.76 x = 1 vt water usag rage hot water	ge in litre	es per da 5% if the d	ay Vd,av Iwelling is	erage = designed t	(25 x N)	+ 36		9)			, ,
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres	= 1 + 1.76 x = 1 It water usage rage hot water per person per eb Mar	ge in litre usage by r day (all w Apr	es per da 5% if the d vater use, h	ay Vd,av lwelling is hot and co	erage = designed t ld) Jul	(25 x N) to achieve	+ 36		9)			, ,
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre	= 1 + 1.76 x = 1 It water usage hot water per person per eb Mar s per day for ea	ge in litre usage by r day (all w Apr ach month	es per da 5% if the d rater use, I May Vd,m = fac	ay Vd,av	erage = designed to ld) Jul Table 1c x	(25 x N) to achieve Aug (43)	+ 36 a water us Sep	e target of Oct	9) 100 Nov).09 Dec		, ,
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres	= 1 + 1.76 x = 1 It water usage hot water per person per eb Mar s per day for ea	ge in litre usage by r day (all w Apr	es per da 5% if the d vater use, h	ay Vd,av lwelling is hot and co	erage = designed t ld) Jul	(25 x N) to achieve	+ 36 a water us Sep 98.09	Oct	9) 100 Nov 106.09	Dec 110.1		(43)
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106	= 1 + 1.76 x = 1 It water usage hot water per person per eb Mar s per day for ea	ge in litre usage by a r day (all w Apr ach month 98.09	es per da 5% if the d vater use, I May Vd,m = fac 94.08	ay Vd,av lwelling is not and con Jun ctor from 1	erage = designed to ld) Jul Table 1c x 90.08	(25 x N) o achieve Aug (43) 94.08	+ 36 a water us Sep 98.09	Oct 102.09 Total = Sur	Nov 106.09 m(44) ₁₁₂ =	Dec 110.1	1201.08	, ,
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w	= 1 + 1.76 x = 1 It water usage hot water per person per eb Mar s per day for ea .09 102.09	ge in litre usage by a r day (all w Apr ach month 98.09	es per da 5% if the da vater use, I May Vd,m = factorized 94.08	ay Vd,av lwelling is not and con Jun ctor from 1 90.08	erage = designed to ld) Jul Table 1c x 90.08	(25 x N) o achieve Aug (43) 94.08	+ 36 a water us Sep 98.09	Oct 102.09 Fotal = Sur th (see Ta	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1	Dec 110.1 c, 1d)	1201.08	(43)
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106	= 1 + 1.76 x = 1 It water usage hot water per person per eb Mar s per day for ea .09 102.09	ge in litre usage by a r day (all w Apr ach month 98.09	es per da 5% if the d vater use, I May Vd,m = fac 94.08	ay Vd,av lwelling is not and con Jun ctor from 1	erage = designed to ld) Jul Table 1c x 90.08	(25 x N) o achieve Aug (43) 94.08	+ 36 a water us Sep 98.09 0 kWh/mon	Oct 102.09 Fotal = Sur th (see Ta 133.39	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61	Dec 110.1 : c, 1d) 158.12		(43)
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w	= 1 + 1.76 x = 1 Int water usage hot water per person per eb Mar s per day for ea .09 102.09 vater used - cal 2.8 147.36	ge in litre usage by r day (all w Apr ach month 98.09 culated mo	es per da 5% if the da 5% if the da 4 ater use, l' May Vd,m = fac 94.08	ay Vd,av lwelling is not and co. Jun ctor from 7 90.08	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11	+ 36 a water us Sep 98.09 0 kWh/mon	Oct 102.09 Fotal = Sur th (see Ta	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61	Dec 110.1 : c, 1d) 158.12	1201.08	(43)
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w (45)m= 163.27 143	= 1 + 1.76 x = 1 Int water usage hot water per person per eb Mar s per day for ea .09 102.09 vater used - cal 2.8 147.36	ge in litre usage by r day (all w Apr ach month 98.09 culated mo	es per da 5% if the da 5% if the da 4 ater use, l' May Vd,m = fac 94.08	ay Vd,av lwelling is not and co. Jun ctor from 7 90.08	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11	+ 36 a water us Sep 98.09 0 kWh/mon	Oct 102.09 Fotal = Sur th (see Ta 133.39	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61	Dec 110.1 : c, 1d) 158.12		(43)
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w (45)m= 163.27 143 If instantaneous water I (46)m= 24.49 213 Water storage loss	= 1 + 1.76 x = 1 It water usage hot water per person per eb Mar s per day for each of the second	ge in litre usage by day (all w Apr ach month 98.09 culated mo 128.47 for use (no	es per da 5% if the da 5% if th	ay Vd,av lwelling is not and co. Jun ctor from 7 90.08 190 x Vd,r 106.37 r storage),	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in	(25 x N) to achieve Aug (43) 94.08 7m / 3600 113.11 boxes (46) 16.97	+ 36 a water us Sep 98.09 114.46 10 to (61) 17.17	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61 m(45) ₁₁₂ =	Dec 110.1 c, 1d) 158.12		(43) (44) (45)
if TFA > 13.9, N if TFA £ 13.9, N Annual average had reduce the annual average had reduce the annual average in litre Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w (45)m= 163.27 14: If instantaneous water I (46)m= 24.49 21. Water storage loss Storage volume (literal	= 1 + 1.76 x = 1 It water usage hot water per person per eb Mar sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sperid for each of the special for each of the sperid for each of the sper	ge in litre usage by r day (all w Apr ach month 98.09 culated mo 128.47 f of use (no	es per da 5% if the da 5% if th	ay Vd,av Iwelling is that and co. Jun ctor from 7 90.08 190 x Vd,r 106.37 storage),	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage	(25 x N) o achieve Aug (43) 94.08 97m / 3600 113.11 boxes (46) 16.97 within sa	+ 36 a water us Sep 98.09 114.46 10 to (61) 17.17	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61 m(45) ₁₁₂ = 21.84	Dec 110.1 c, 1d) 158.12		(43) (44) (45)
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if TFA > 13.9, N if TFA £ 13.9, N Annual average have not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w (45)m= 163.27 142 If instantaneous water in the storage loss Storage volume (little otherwise if no storage)	= 1 + 1.76 x = 1 If water usage hot water per person per eb Mar s per day for each of the second of	ge in litre usage by day (all w Apr ach month 98.09 culated mo 128.47 for use (no 19.27 and any so ank in dw	es per da 5% if the d rater use, f May Vd,m = fac 94.08 123.27 hot water 18.49 plar or W relling, e	ay Vd,av lwelling is not and co. Jun ctor from 1 90.08 190 x Vd,r 106.37 storage), 15.96	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage) litres in	(25 x N) to achieve Aug (43) 94.08 7m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 114.46 17.17 ame vess	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61 m(45) ₁₁₂ = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46)
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w (45)m= 163.27 14: If instantaneous water I Water storage loss Storage volume (lit If community heatin	= 1 + 1.76 x = 1 It water usage hot water per person per beb Mar sper day for each of the specific for each of the speci	ge in litre usage by r day (all w Apr ach month 98.09 culated mo 128.47 f of use (no 19.27 and any so ank in dw er (this in	es per da 5% if the d rater use, I May Vd,m = far 94.08 onthly = 4. 123.27 o hot water 18.49 olar or W velling, e	ay Vd,av lwelling is that and co. Jun ctor from 7 90.08 190 x Vd,n 106.37 storage), 15.96 /WHRS .nter 110 nstantar	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 94.08 7m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 114.46 17.17 ame vess	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61 m(45) ₁₁₂ = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46)
if TFA > 13.9, N if TFA £ 13.9, N Annual average had reduce the annual average had reduce the annual average in litre Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w (45)m= 163.27 14: If instantaneous water I Water storage loss Storage volume (little community heating of the community heating	= 1 + 1.76 x = 1 It water usage hot water per person per eb Mar s per day for each of the second of	ge in litre usage by r day (all w Apr ach month 98.09 culated mo 128.47 for use (no 19.27 and any so ank in dw er (this in	es per da 5% if the d rater use, I May Vd,m = far 94.08 onthly = 4. 123.27 o hot water 18.49 olar or W velling, e	ay Vd,av lwelling is that and co. Jun ctor from 7 90.08 190 x Vd,n 106.37 storage), 15.96 /WHRS .nter 110 nstantar	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 94.08 7m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 114.46 17.17 ame vess	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61 m(45) ₁₁₂ = 21.84	Dec 110.1		(43) (44) (45) (46) (47)
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w (45)m= 163.27 142 If instantaneous water if Water storage loss Storage volume (lift If community heatif Otherwise if no sto Water storage loss a) If manufacturer	= 1 + 1.76 x = 1 It water usage hot water per person per below Mar sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the sper day for each of the specific forms and no taken the specific forms and no taken the specific forms and no taken the specific forms and the specific forms are specific forms and the specific forms and the specific forms and the specific forms and the specific forms are specific forms.	ge in litre usage by day (all w Apr ach month 98.09 culated mo 128.47 for use (no 19.27 ank in dw er (this in oss factor 2b	es per da 5% if the d fater use, f May Vd,m = fat 94.08 123.27 hot water 18.49 color or W velling, e ncludes i	ay Vd,av lwelling is that and co. Jun ctor from 7 90.08 190 x Vd,n 106.37 storage), 15.96 /WHRS .nter 110 nstantar	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage 0 litres in neous con/day):	(25 x N) to achieve Aug (43) 94.08 7m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 114.46 17.17 ame vess ers) ente	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61 m(45) ₁₁₂ = 21.84	Dec 110.1		(43) (44) (45) (46) (47)
if TFA > 13.9, N if TFA £ 13.9, N Annual average ho Reduce the annual ave not more that 125 litres Jan F Hot water usage in litre (44)m= 110.1 106 Energy content of hot w (45)m= 163.27 14: If instantaneous water l Water storage loss Storage volume (lit If community heatin Otherwise if no sto Water storage loss a) If manufacturer Temperature facto	= 1 + 1.76 x = 1 If water usage hot water per person per By Mar Siper day for each of the second	ge in litre usage by r day (all w Apr ach month 98.09 culated mo 128.47 for use (no 19.27 and any so ank in dw er (this in oss facto 2b e, kWh/ye	es per da 5% if the d ater use, I May Vd,m = far 94.08 onthly = 4. 123.27 o hot water 18.49 colar or W velling, e acludes i or is knowear	ay Vd,av lwelling is not and co. Jun ctor from 7 90.08 190 x Vd,r 106.37 storage), 15.96 WHRS enter 110 nstantar	erage = designed to ld) Jul Table 1c x 90.08 m x nm x D 98.57 enter 0 in 14.79 storage 0 litres in neous con/day):	(25 x N) to achieve Aug (43) 94.08 113.11 boxes (46) 16.97 within sa (47) pmbi boil	+ 36 a water us Sep 98.09 114.46 17.17 ame vess ers) ente	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) ₁₁₂ = bles 1b, 1 145.61 m(45) ₁₁₂ = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46) (47) (48) (49)

Hot water storage loss factor from Table 2 (kWh/litre/day)	0 (51)
If community heating see section 4.3	
Volume factor from Table 2a	0 (52)
Temperature factor from Table 2b	0 (53)
Energy lost from water storage, kWh/year	$(47) \times (51) \times (52) \times (53) = 0 \tag{54}$
Enter (50) or (54) in (55)	0 (55)
Water storage loss calculated for each month	$((56)m = (55) \times (41)m$
(56)m= 0 0 0 0 0 0	
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)]	÷ (50), else (57)m = (56)m where (H11) is from Appendix H
(57)m= 0 0 0 0 0 0 0	0 0 0 0 0 (57)
Primary 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 h	
(59)m= 0 0 0 0 0 0	0 0 0 0 (59)
Combi loss calculated for each month (61)m = (60) ÷ 365 ×	(41)m
(61)m= 50.96 46.03 50.96 48.37 47.94 44.42 45	.9 47.94 48.37 50.96 49.32 50.96 (61)
Total heat required for water heating calculated for each mo	onth (62) m = $0.85 \times (45)$ m + (46) m + (57) m + (59) m + (61) m
(62)m= 214.23 188.83 198.32 176.84 171.21 150.8 144	.47 161.05 162.83 184.35 194.92 209.08 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative qu	antity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see	
(63)m= 0 0 0 0 0 0	0 0 0 0 0 (63)
Output from water heater	
(64)m= 214.23 188.83 198.32 176.84 171.21 150.8 144	.47
	Output from water heater (annual) ₁₁₂ 2156.94 (64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (4	5)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]
(65)m= 67.03 58.99 61.74 54.81 52.97 46.47 44	
include (57)m in calculation of (65)m only if cylinder is in	he 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 J	ıl Aug Sep Oct Nov Dec
(66)m= 138.71 138.71 138.71 138.71 138.71 138.71 138.71 138.71	
Lighting gains (calculated in Appendix L, equation L9 or L9a	
(67)m= 29.48 26.18 21.29 16.12 12.05 10.17 10	
Appliances gains (calculated in Appendix L, equation L13 o	
Cooking gains (calculated in Appendix L, equation L15 or L	
(69)m= 36.87 36.87 36.87 36.87 36.87 36.87 36.87 36.87	87 36.87 36.87 36.87 36.87 36.87 (69)
Pumps and fans gains (Table 5a)	
(70)m= 3 3 3 3 3 3 3	3 3 3 (70)
Losses e.g. evaporation (negative values) (Table 5)	
(71)m= -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 -110.97	.97 -110.97 -110.97 -110.97 -110.97 -110.97 (71)
Water heating gains (Table 5)	
(72)m= 90.09 87.78 82.98 76.12 71.2 64.55 59	48 66.66 69.65 76.74 84.37 87.79 (72)

Total internal gai	ns =				(66)m + (6	67)m	+ (68)r	n + (69)m + (70)m + ((71)m + (72)	m		
(73)m= 449.96 44	7.08 430.51	403.86	376.4	350	0.52 334.	.67	342.4	2 357.18	384.06	414.22	436.88		(73)
6. Solar gains:	,			•	•								
Solar gains are calcu	lated using sol	ar flux fron	n Table 6a	and a	ssociated e	equati	ions to	convert to th	e applica	able orientat	ion.		
Orientation: Acce Tabl		Area m²	a		Flux Table 6a	а		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast _{0.9x}	0.77	4.	24	х	11.28		x	0.63	x	0.7	=	14.62	(75)
Northeast 0.9x	0.77	4.	24	х	22.97		x	0.63	x	0.7	=	29.76	(75)
Northeast _{0.9x}	0.77	4.	24	x	41.38		x	0.63	x	0.7	=	53.62	(75)
Northeast _{0.9x}	0.77	4.	24	x	67.96		X	0.63	x	0.7	=	88.06	(75)
Northeast _{0.9x}	0.77	4.	24	х	91.35		X	0.63	x [0.7	=	118.37	(75)
Northeast _{0.9x}	0.77	4.	24	х	97.38		X	0.63	x	0.7	=	126.19	(75)
Northeast _{0.9x}	0.77	4.	24	x	91.1		X	0.63	x [0.7	=	118.05	(75)
Northeast _{0.9x}	0.77	4.	24	х	72.63		X	0.63	x	0.7	=	94.11	(75)
Northeast _{0.9x}	0.77	4.	24	х	50.42		X	0.63	x	0.7	=	65.34	(75)
Northeast _{0.9x}	0.77	4.	24	x	28.07		X	0.63	x	0.7	=	36.37	(75)
Northeast _{0.9x}	0.77	4.	24	Х	14.2		X	0.63	x [0.7	=	18.4	(75)
Northeast _{0.9x}	0.77	4.	24	x	9.21		X	0.63	x	0.7	=	11.94	(75)
East 0.9x	0.77	0.	69	x	19.64		X	0.63	x	0.7	=	4.14	(76)
East 0.9x	0.77	(1	.8	x	19.64		X	0.63	x	0.7	=	10.8	(76)
East 0.9x	0.77	(1.	44	x	19.64		X	0.63	x [0.7	=	8.64	(76)
East 0.9x	0.77	0.	69	x	38.42		X	0.63	x	0.7	=	8.1	(76)
East 0.9x	0.77	(1	.8	x	38.42		X	0.63	x	0.7	=	21.14	(76)
East 0.9x	0.77	1.	44	Х	38.42		X	0.63	x [0.7	=	16.91	(76)
East 0.9x	0.77	0.	69	Х	63.27		X	0.63	x [0.7	=	13.34	(76)
East 0.9x	0.77	1	.8	Х	63.27		X	0.63	x	0.7	=	34.81	(76)
East 0.9x	0.77	1.	44	X	63.27		X	0.63	x	0.7	=	27.85	(76)
East 0.9x	0.77	0.	69	X	92.28		X	0.63	x	0.7	=	19.46	(76)
East 0.9x	0.77	1	.8	Х	92.28		X	0.63	x	0.7	=	50.76	(76)
East 0.9x	0.77	1.	44	x	92.28		X	0.63	x	0.7	=	40.61	(76)
East 0.9x	0.77	0.	69	X	113.09		X	0.63	X	0.7	=	23.85	(76)
East 0.9x	0.77	1	.8	X	113.09		X	0.63	x	0.7	=	62.21	(76)
East 0.9x	0.77	1.	44	X	113.09		X	0.63	x	0.7	=	49.77	(76)
East 0.9x	0.77	0.	69	X	115.77		X	0.63	x	0.7	=	24.41	(76)
East 0.9x	0.77	(1	.8	Х	115.77		X	0.63	x [0.7	=	63.69	(76)
East 0.9x	0.77	1.	44	х	115.77		X	0.63	x [0.7	=	50.95	(76)
East 0.9x	0.77	0.	69	x	110.22		x	0.63	x	0.7	=	23.24	(76)
East 0.9x	0.77	(1	.8	x	110.22		x	0.63	x [0.7	=	60.63	(76)
East 0.9x	0.77	1.	44	x	110.22		x	0.63	x [0.7	=	48.51	(76)
East 0.9x	0.77	0.	69	x	94.68		x	0.63	x	0.7	=	19.96	(76)

East 0.9x 0.77 x 1.8 x 94.88 x 0.83 x 0.7 = 52.08 778 East 0.9x 0.77 x 0.68 x 73.59 x 0.63 x 0.7 = 44.68 78 East 0.9x 0.77 x 1.8 x 73.59 x 0.63 x 0.7 = 45.52 78 East 0.9x 0.77 x 1.8 x 73.59 x 0.63 x 0.7 = 44.68 78 East 0.9x 0.77 x 1.8 x 73.59 x 0.63 x 0.7 = 44.68 78 East 0.9x 0.77 x 0.68 x 73.59 x 0.63 x 0.7 = 45.52 78 East 0.9x 0.77 x 0.68 x 45.59 x 0.63 x 0.7 = 98.1 (6) East 0.9x 0.77 x 1.8 x 4.55 9 x 0.63 x 0.7 = 98.1 (7) East 0.9x 0.77 x 1.8 x 4.55 9 x 0.63 x 0.7 = 98.1 (7) East 0.9x 0.77 x 0.68 x 24.49 x 0.63 x 0.7 = 98.1 (7) East 0.9x 0.77 x 1.8 x 24.49 x 0.63 x 0.7 = 10.7 (7) East 0.9x 0.77 x 1.8 x 1.8 x 24.49 x 0.63 x 0.7 = 10.7 (7) East 0.9x 0.77 x 1.8 x 1.8 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) East 0.9x 0.77 x 1.8 x 1.8 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) East 0.9x 0.77 x 1.8 x 1.8 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) East 0.9x 0.77 x 1.8 x 1.8 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) East 0.9x 0.77 x 1.8 x 1.4 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) East 0.9x 0.77 x 1.8 x 1.4 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.8 x 1.4 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.8 x 1.4 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 (1.4 x 0.62 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.8 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.1 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.1 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.1 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.1 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.1 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.1 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.1 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.1 (1.15 x 0.63 x 0.7 = 10.7 (7) Southeast 0.9x 0.77 x 1.4 x 1.4 x 1.1 (1.	_												
East	East 0.9x	0.77	X	1.8	X	94.68	X	0.63	X	0.7	=	52.08	(76)
East	East 0.9x	0.77	X	1.44	x	94.68	X	0.63	X	0.7	=	41.67	(76)
East	East 0.9x	0.77	X	0.69	X	73.59	X	0.63	X	0.7	=	15.52	(76)
East	East 0.9x	0.77	X	1.8	X	73.59	X	0.63	X	0.7	=	40.48	(76)
East	East 0.9x	0.77	X	1.44	X	73.59	X	0.63	X	0.7] =	32.39	(76)
East	East 0.9x	0.77	X	0.69	X	45.59	X	0.63	X	0.7	=	9.61	(76)
East	East 0.9x	0.77	X	1.8	x	45.59	X	0.63	x	0.7	=	25.08	(76)
East	East 0.9x	0.77	x	1.44	x	45.59	X	0.63	x	0.7	=	20.06	(76)
East 0.9% 0.77 x 0.69 x 1.44 x 22.49 x 0.63 x 0.7 = 10.78 76 East 0.9% 0.77 x 1.8 x 1.44 x 16.15 x 0.63 x 0.7 = 3.41 76 East 0.9% 0.77 x 1.8 x 16.15 x 0.63 x 0.7 = 3.41 76 East 0.9% 0.77 x 1.8 x 16.15 x 0.63 x 0.7 = 8.88 76 East 0.9% 0.77 x 1.44 x 36.79 x 0.63 x 0.7 = 7.11 76 Southeast 0.9% 0.77 x 2.44 x 36.79 x 0.63 x 0.7 = 16.19 77 Southeast 0.9% 0.77 x 2.44 x 36.79 x 0.63 x 0.7 = 22.69 77 Southeast 0.9% 0.77 x 2.44 x 8.575 x 0.63 x 0.7 = 27.58 77 Southeast 0.9% 0.77 x 1.44 x 8.575 x 0.63 x 0.7 = 50.57 77 Southeast 0.9% 0.77 x 1.44 x 8.575 x 0.63 x 0.7 = 60.57 77 Southeast 0.9% 0.77 x 1.44 x 8.575 x 0.63 x 0.7 = 60.57 77 Southeast 0.9% 0.77 x 1.44 x 8.575 x 0.63 x 0.7 = 60.57 77 Southeast 0.9% 0.77 x 1.44 x 106.25 x 0.63 x 0.7 = 60.57 77 Southeast 0.9% 0.77 x 1.44 x 106.25 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.19 1 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 1.44 x 118.19 1 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 1.44 x 118.19 1 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.19 1 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.19 1 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.19 1 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.19 1 x 0.63 x 0.7 = 60.19 77 Southeast 0.9% 0.77 x 2.264 x 118.19 1	East 0.9x	0.77	x	0.69	x	24.49	X	0.63	x	0.7	=	5.16	(76)
East	East 0.9x	0.77	x	1.8	x	24.49	x	0.63	x	0.7	=	13.47	(76)
East 0.9x 0.77 x 1.8 x 16.15 x 0.63 x 0.7 = 8.88 769 Southeast 0.9x 0.77 x 1.44 x 36.79 x 0.63 x 0.7 = 7.11 (76) Southeast 0.9x 0.77 x 1.44 x 36.79 x 0.63 x 0.7 = 16.19 (77) Southeast 0.9x 0.77 x 1.44 x 62.67 x 0.63 x 0.7 = 29.69 (77) Southeast 0.9x 0.77 x 1.44 x 62.67 x 0.63 x 0.7 = 29.69 (77) Southeast 0.9x 0.77 x 1.44 x 62.67 x 0.63 x 0.7 = 50.57 (77) Southeast 0.9x 0.77 x 1.44 x 85.75 x 0.63 x 0.7 = 50.57 (77) Southeast 0.9x 0.77 x 1.44 x 106.25 x 0.63 x 0.7 = 69.19 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 69.19 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 69.19 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0	East 0.9x	0.77	x	1.44	x	24.49	X	0.63	x	0.7] =	10.78	(76)
East 0.9x 0.77 x 1.44 x 36.79 x 0.63 x 0.7 = 7.11 (76) Southeast 0.9x 0.77 x 2.64 x 36.79 x 0.63 x 0.7 = 16.19 (77) Southeast 0.9x 0.77 x 2.64 x 36.79 x 0.63 x 0.7 = 29.69 (77) Southeast 0.9x 0.77 x 2.64 x 62.67 x 0.63 x 0.7 = 27.58 (77) Southeast 0.9x 0.77 x 2.64 x 62.67 x 0.63 x 0.7 = 37.74 (77) Southeast 0.9x 0.77 x 2.64 x 62.67 x 0.63 x 0.7 = 37.74 (77) Southeast 0.9x 0.77 x 1.44 x 86.57 x 0.63 x 0.7 = 37.74 (77) Southeast 0.9x 0.77 x 2.64 x 86.75 x 0.63 x 0.7 = 37.74 (77) Southeast 0.9x 0.77 x 2.64 x 106.25 x 0.63 x 0.7 = 69.19 (77) Southeast 0.9x 0.77 x 2.64 x 106.25 x 0.63 x 0.7 = 69.19 (77) Southeast 0.9x 0.77 x 2.64 x 106.25 x 0.63 x 0.7 = 69.19 (77) Southeast 0.9x 0.77 x 2.64 x 106.25 x 0.63 x 0.7 = 69.19 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.53 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 69.02 (77) Southeast 0.9x	East 0.9x	0.77	x	0.69	x	16.15	X	0.63	x	0.7	=	3.41	(76)
Southeast 0 sx	East 0.9x	0.77	x	1.8	x	16.15	X	0.63	x	0.7] =	8.88	(76)
Southeast 0.9x	East 0.9x	0.77	x	1.44	x	16.15	x	0.63	x	0.7] =	7.11	(76)
Southeast 0.9x	Southeast _{0.9x}	0.77	x	1.44	x	36.79	x	0.63	x	0.7	=	16.19	(77)
Southeast 0.9x	Southeast _{0.9x}	0.77	x	2.64	x	36.79	X	0.63	x	0.7] =	29.69	(77)
Southeast 0.9x 0.77 x 1.44 x 85.75 x 0.63 x 0.7 = 37.74 (77) Southeast 0.9x 0.77 x 2.64 x 85.75 x 0.63 x 0.7 = 69.19 (77) Southeast 0.9x 0.77 x 1.44 x 106.25 x 0.63 x 0.7 = 46.76 (77) Southeast 0.9x 0.77 x 2.64 x 106.25 x 0.63 x 0.7 = 85.73 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 96.02 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 96.02 (77) Southeast 0.9x 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 193.99 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 55.89 (77)	Southeast _{0.9x}	0.77	x	1.44	x	62.67	X	0.63	x	0.7	=	27.58	(77)
Southeast 0.9x 0.77 x 2.64 x 85.75 x 0.63 x 0.7 = 66.19 (77) Southeast 0.9x 0.77 x 1.44 x 106.25 x 0.63 x 0.7 = 46.76 (77) Southeast 0.9x 0.77 x 2.64 x 106.25 x 0.63 x 0.7 = 85.73 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 96.02 (77) Southeast 0.9x 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 74.91 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 74.91 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 191.93 (77) Southeast 0.9x 0.77 x 1.44 x 11.44 utheast _{0.9x}	0.77	x	2.64	x	62.67	x	0.63	x	0.7	=	50.57	(77)	
Southeast 0.9x	Southeast _{0.9x}	0.77	x	1.44	x	85.75	x	0.63	x	0.7	=	37.74	(77)
Southeast 0.9x	Southeast _{0.9x}	0.77	x	2.64	x	85.75	X	0.63	x	0.7	=	69.19	(77)
Southeast 0.9x 0.77 x 1.44 x 119.01 x 0.63 x 0.7 = 52.37 (77) Southeast 0.9x 0.77 x 2.64 x 119.01 x 0.63 x 0.7 = 96.02 (77) Southeast 0.9x 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 52 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7	Southeast _{0.9x}	0.77	x	1.44	x	106.25	x	0.63	x	0.7	=	46.76	(77)
Southeast 0.9x	Southeast _{0.9x}	0.77	X	2.64	x	106.25	X	0.63	x	0.7	=	85.73	(77)
Southeast 0.9x 0.77 x 1.44 x 118.15 x 0.63 x 0.7 = 52 (77) Southeast 0.9x 0.77 x 2.64 x 118.15 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 <t< td=""><td>Southeast _{0.9x}</td><td>0.77</td><td>x</td><td>1.44</td><td>x</td><td>119.01</td><td>X</td><td>0.63</td><td>x</td><td>0.7</td><td>] =</td><td>52.37</td><td>(77)</td></t<>	Southeast _{0.9x}	0.77	x	1.44	x	119.01	X	0.63	x	0.7] =	52.37	(77)
Southeast 0.9x 0.77 x 2.64 x 118.15 x 0.63 x 0.7 = 95.33 (77) Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7	Southeast _{0.9x}	0.77	x	2.64	x	119.01	x	0.63	x	0.7	=	96.02	(77)
Southeast 0.9x 0.77 x 1.44 x 113.91 x 0.63 x 0.7 = 50.13 (77) Southeast 0.9x 0.77 x 2.64 x 113.91 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 74.91 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 <	Southeast _{0.9x}	0.77	x	1.44	x	118.15	x	0.63	x	0.7	=	52	(77)
Southeast 0.9x 0.77 x 2.64 x 113.91 x 0.63 x 0.7 = 91.9 (77) Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 2.64 x 104.39 x 0.63 x 0.7 = 84.22 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 <	Southeast _{0.9x}	0.77	x	2.64	x	118.15	X	0.63	x	0.7	=	95.33	(77)
Southeast 0.9x 0.77 x 1.44 x 104.39 x 0.63 x 0.7 = 45.94 (77) Southeast 0.9x 0.77 x 2.64 x 104.39 x 0.63 x 0.7 = 84.22 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 74.91 (77) Southeast 0.9x 0.77 x 2.64 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 <	Southeast _{0.9x}	0.77	x	1.44	x	113.91	x	0.63	x	0.7	=	50.13	(77)
Southeast 0.9x 0.77 x 2.64 x 104.39 x 0.63 x 0.7 = 84.22 (77) Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 74.91 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 2.64 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 <t< td=""><td>Southeast _{0.9x}</td><td>0.77</td><td>x</td><td>2.64</td><td>x</td><td>113.91</td><td>X</td><td>0.63</td><td>x</td><td>0.7</td><td>=</td><td>91.9</td><td>(77)</td></t<>	Southeast _{0.9x}	0.77	x	2.64	x	113.91	X	0.63	x	0.7	=	91.9	(77)
Southeast 0.9x 0.77 x 1.44 x 92.85 x 0.63 x 0.7 = 40.86 (77) Southeast 0.9x 0.77 x 2.64 x 92.85 x 0.63 x 0.7 = 74.91 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 2.64 x 69.27 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 <td< td=""><td>Southeast _{0.9x}</td><td>0.77</td><td>x</td><td>1.44</td><td>x</td><td>104.39</td><td>x</td><td>0.63</td><td>x</td><td>0.7</td><td>=</td><td>45.94</td><td>(77)</td></td<>	Southeast _{0.9x}	0.77	x	1.44	x	104.39	x	0.63	x	0.7	=	45.94	(77)
Southeast 0.9x 0.77 x 2.64 x 92.85 x 0.63 x 0.7 = 74.91 (77) Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 2.64 x 69.27 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 13.86 (77) Northwest 0.9x 0.77 x 8.66 x 11.28 x 0.63 x 0.7 = 29.86 (81) Northwest 0.9x 0.77 x 8.66 x </td <td>Southeast 0.9x</td> <td>0.77</td> <td>x</td> <td>2.64</td> <td>x</td> <td>104.39</td> <td>x</td> <td>0.63</td> <td>x</td> <td>0.7</td> <td>=</td> <td>84.22</td> <td>(77)</td>	Southeast 0.9x	0.77	x	2.64	x	104.39	x	0.63	x	0.7	=	84.22	(77)
Southeast 0.9x 0.77 x 1.44 x 69.27 x 0.63 x 0.7 = 30.48 (77) Southeast 0.9x 0.77 x 2.64 x 69.27 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 2.64 x 44.07 x 0.63 x 0.7 = 13.86 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Northwest 0.9x 0.77 x 8.66 x 11.28 x 0.63 x 0.7	Southeast _{0.9x}	0.77	x	1.44	x	92.85	X	0.63	x	0.7] =	40.86	(77)
Southeast 0.9x 0.77 x 2.64 x 69.27 x 0.63 x 0.7 = 55.89 (77) Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 2.64 x 44.07 x 0.63 x 0.7 = 35.56 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Northwest 0.9x 0.77 x 8.66 x 11.28 x 0.63 x 0.7 = 29.86 (81) Northwest 0.9x 0.77 x 8.66 x 22.97 x 0.63 x 0.7 = 60.78 (81)	Southeast _{0.9x}	0.77	x	2.64	x	92.85	X	0.63	x	0.7	=	74.91	(77)
Southeast 0.9x 0.77 x 1.44 x 44.07 x 0.63 x 0.7 = 19.39 (77) Southeast 0.9x 0.77 x 2.64 x 44.07 x 0.63 x 0.7 = 35.56 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Northwest 0.9x 0.77 x 8.66 x 11.28 x 0.63 x 0.7 = 29.86 (81) Northwest 0.9x 0.77 x 8.66 x 22.97 x 0.63 x 0.7 = 60.78 (81)	Southeast _{0.9x}	0.77	x	1.44	x	69.27	X	0.63	x	0.7] =	30.48	(77)
Southeast 0.9x 0.77 x 2.64 x 44.07 x 0.63 x 0.7 = 35.56 (77) Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Northwest 0.9x 0.77 x 8.66 x 11.28 x 0.63 x 0.7 = 29.86 (81) Northwest 0.9x 0.77 x 8.66 x 22.97 x 0.63 x 0.7 = 60.78 (81)	Southeast _{0.9x}	0.77	x	2.64	x	69.27	x	0.63	x	0.7] =	55.89	(77)
Southeast 0.9x 0.77 x 1.44 x 31.49 x 0.63 x 0.7 = 13.86 (77) Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Northwest 0.9x 0.77 x 8.66 x 11.28 x 0.63 x 0.7 = 29.86 (81) Northwest 0.9x 0.77 x 8.66 x 22.97 x 0.63 x 0.7 = 60.78 (81)	Southeast _{0.9x}	0.77	X	1.44	x	44.07	X	0.63	x	0.7] =	19.39	(77)
Southeast 0.9x 0.77 x 2.64 x 31.49 x 0.63 x 0.7 = 25.4 (77) Northwest 0.9x 0.77 x 8.66 x 11.28 x 0.63 x 0.7 = 29.86 (81) Northwest 0.9x 0.77 x 8.66 x 22.97 x 0.63 x 0.7 = 60.78 (81)	Southeast 0.9x	0.77	x	2.64	x	44.07	x	0.63	x	0.7] =	35.56	(77)
Northwest 0.9x	Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.63	x	0.7] =	13.86	(77)
Northwest 0.9x 0.77 x 8.66 x 22.97 x 0.63 x 0.7 = 60.78 (81)	Southeast _{0.9x}	0.77	x	2.64	x	31.49	x	0.63	x	0.7] =	25.4	(77)
	Northwest _{0.9x}	0.77	x	8.66	x	11.28	×	0.63	x	0.7] =	29.86	(81)
Northwest 0.9x 0.77 x 8.66 x 41.38 x 0.63 x 0.7 = 109.51 (81)	Northwest _{0.9x}	0.77	x	8.66	x	22.97	x	0.63	x	0.7] =	60.78	(81)
	Northwest _{0.9x}	0.77	X	8.66	x	41.38	x	0.63	x	0.7] =	109.51	(81)

					_			_								
Northwest 0.9x	0.77	X	8.6	66	X	67	7.96	X		0.63	X	0.7		= [179.85	(81)
Northwest 0.9x	0.77	×	8.6	66	x	9	1.35	X		0.63	x [0.7		= [241.76	(81)
Northwest 0.9x	0.77	X	8.6	66	x	97	7.38	X		0.63	x	0.7		= [257.74	(81)
Northwest 0.9x	0.77	X	8.6	66	x	9	1.1	X		0.63	x [0.7		= [241.11	(81)
Northwest 0.9x	0.77	X	8.6	66	x	72	2.63	X		0.63	x [0.7		= [192.21	(81)
Northwest 0.9x	0.77	X	8.6	66	x	50	0.42	x		0.63	x	0.7		= [133.44	(81)
Northwest 0.9x	0.77	X	8.6	66	x	28	8.07	x		0.63	x [0.7		= [74.28	(81)
Northwest 0.9x	0.77	X	8.6	66	x	1	4.2	x		0.63	x	0.7		= [37.57	(81)
Northwest 0.9x	0.77	X	8.6	66	x	9	.21	x		0.63	x	0.7		= [24.39	(81)
Solar gains ir	watts, ca	alculated	for eac	h month				(83)m	= Su	um(74)m .	(82)m					
(83)m= 113.95	214.84	346.05	511.23	644.35	67	0.3	633.57	530).2	402.94	251.78	140.33	94.9	9		(83)
Total gains –	internal a	and solar	(84)m =	= (73)m ·	+ (83	3)m ,	watts					-	-			
(84)m= 563.91	661.91	776.57	915.09	1020.75	102	20.81	968.24	872	.62	760.12	635.84	554.56	531.8	37		(84)
7. Mean inte	rnal tem	perature	(heating	season)											
Temperature	•		`		/	rea fi	rom Tab	ole 9.	Th	1 (°C)				Г	21	(85)
Utilisation fa	_	٠.			-			,	,	. (•)				L		
Jan	Feb	Mar	Apr	May	È.	lun	Jul	Δ	ug	Sep	Oct	Nov	De			
(86)m= 1	1	0.99	0.98	0.95	┝	.87	0.77	0.8	-	0.94	0.99	1	1	\dashv		(86)
				<u> </u>	<u> </u>			<u> </u>				1				, ,
Mean intern		i		· `		i					10.01	10.04	100	$\overline{}$		(07)
(87)m= 18.35	18.55	18.94	19.53	20.09	20	.58	20.81	20.	76	20.35	19.64	18.94	18.3	8		(87)
Temperature	e during h	neating p	eriods ir	rest of	dwe	elling	from Ta	ble 9	9, Th	n2 (°C)						
(88)m= 19.08	19.09	19.11	19.16	19.17	19	.22	19.22	19.	23	19.2	19.17	19.15	19.1	3		(88)
Utilisation fa	ctor for g	ains for i	rest of d	welling,	h2,n	n (se	e Table	9a)								
(89)m= 1	0.99	0.99	0.97	0.91	$\overline{}$.77	0.55	0.6	3	0.89	0.98	0.99	1			(89)
Mean intern	al temper	ature in	the rect	of dwelli	na 1	T2 /fc	llow etc	ne 3	to 7	' in Tahl	o 0c)					
(90)m= 16.78	16.99	17.38	18.01	18.56	Ť	0.02	19.18	19.	$\overline{}$	18.83	18.13	17.42	16.8	4		(90)
(00)	1 .0.00			1 .0.00					<u> </u>			ng area ÷ (4		┧	0.33	(91)
												·9 ··· · · (.,	L	0.33	
Mean intern		ature (fo	r the wh	ole dwe	lling) = fL	A × T1	+ (1	– fL	A) × T2				_		
(92)m= 17.31		17.9	18.52	19.07		.54	19.72	19.		19.34	18.64	17.93	17.3	5		(92)
Apply adjust	1	he mear	interna	l temper			m Table	4e,	whe	re appro	priate			_		
(93)m= 17.31	17.51	17.9	18.52	19.07	19	.54	19.72	19.	.7	19.34	18.64	17.93	17.3	5		(93)
8. Space he	ating requ	uirement														
Set Ti to the					ed a	at ste	p 11 of	Tabl	e 9b	, so tha	t Ti,m=	(76)m an	d re-c	alcı	ulate	
the utilisatio	1			I	Γ.	. 1		г.	1	_		1	г_	_		
Jan	Feb	Mar	Apr	May	J	un	Jul	A	ug	Sep	Oct	Nov	De	С		
Utilisation fa		· ·				1						1	Ε.	_		(04)
(94)m= 1	0.99	0.98	0.96	0.91	0.	79	0.63	0.6	59	0.89	0.98	0.99	1			(94)
Useful gains		· `	<u> </u>		00-	7.45	000.00	004	I	000 00	000.4	T 550 00	T 500 5	,,,		(OE)
(95)m= 561.15		763.93	879.73	925.66		7.15	608.08	604	.58	680.22	620.4	550.38	529.7	7		(95)
Monthly ave	T	1	·	ı		- 1	10.0		<u>, I</u>	44.	40.0	1 - 1		_		(06)
(96)m= 4.3	4.9	6.5	8.9	11.7		4.6	16.6	16.		14.1	10.6	7.1	4.2			(96)
Heat loss ra				 	_		-	`	′ 			0570 74	10470			(07)
(97)m= 3244.6	3120.06	2198.46	2208.34	1724.31	111	5.56	705.15	739	.24	1198.75	1880.84	2573.71	3176.	20		(97)

98)m= 1996.53 1655.51	1513.7	999.8	594.2	0	0	0	0	937.77	1456.8	1968.99		
						Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	11123.29	(98)
Space heating requirer	ment in	kWh/m²	/year								106.86	(99)
a. Energy requirement	s – Indi	vidual h	eating sy	⁄stems i	ncluding	micro-C	HP)					
Space heating:	f==========		ما مسامل							Г		7,001
Fraction of space heat				mentary	•	(202) = 1 -	_ (201) =			Ļ	0	(201
Fraction of space heat		•	. ,			(204) = (204)	, ,	(203)] =		F	1	(202
Fraction of total heating	-	•				(204) - (20	02) ^ [1 -	(200)] -		Ļ	1	╡`
Efficiency of main space				a oveton	. 0/.					L	90.3	(206
Efficiency of secondary										L	0	(208
Jan Feb Space heating requirer	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	∍ar
· — — — —	1513.7	999.8	594.2	0	0	0	0	937.77	1456.8	1968.99		
211)m = {[(98)m x (204					Ů			007.11	1 100.0	1000.00		(211
·	1676.3	1107.19	658.02	0	0	0	0	1038.51	1613.29	2180.5		(21
						Tota	l (kWh/yea	ı ar) =Sum(2	211),5,1012	=	12318.15	(21
Space heating fuel (se	condary	y), kWh/	month							_		
= {[(98)m x (201)] } x 10	0 ÷ (20	8)										
215)m= 0 0	0	0	0	0	0	0	0	0	0	0		
						Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215
Vater heating	, .											
Output from water heate	er (calcu 198.32	ulated al	oove) 171.21	150.8	144.47	161.05	162.83	184.35	194.92	209.08		
Efficiency of water heat		170.01		100.0		101.00	102.00	101.00	101.02	200.00	81	(216
217)m= 89.31 89.25	89.11	88.77	88.04	81	81	81	81	88.63	89.09	89.32		` (217
Fuel for water heating, k	ـــــــــــد «Wh/mc	nth										
$(64)m = (64)m \times 100$			104.47	100.17	470.00	400.00	004.00	000.04	040.70	004.00		
219)m= 239.88 211.57	222.54	199.22	194.47	186.17	178.36	198.83	201.03 I = Sum(2	208.01	218.79	234.09	2402.05	7,046
annual totals						Tota	T Guill(2		Wh/year	. L	2492.95 kWh/yea	(219
Space heating fuel used	d, main	system	1					N.	wii/yeai	Г	12318.15	<u>'</u>
· Vater heating fuel used		-								L T	2492.95	╡
lectricity for pumps, fai		electric	keep-ho	t						L		
central heating pump:			1							30		(230
otal electricity for the a	ibove k	:Wh/vea	r			sum	of (230a).	(230g) =			30	(23
2.3. 2.23.13.13 101 110 0	, 1	, y oa	•				/-	. 3/		Ļ		=
Electricity for lighting											520.56	(23

Energy kWh/year

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Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.216	=	2660.72	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	538.48	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3199.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	270.17	(268)
Total CO2, kg/year	sum	of (265)(271) =		3484.94	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		33.48	(273)
El rating (section 14)				69	(274)

Sasessor Name: Chris Hocknell Stroma Number: STRO016363				Hoor) otoilo:						
Address: Flat 05, 51 Calthorpe Street, LONDON, WC1X 0HH I. Overall dwelling dimensions: Area(m*)		_			Strom Softwa	re Ve	rsion:				
Area(m²)	Address :	Flat 05_51 Calthor					-Baselin	e			
Aradim Fine		·	po ou ooi	, LOND	514, 775	17. 01 11 1					
Dwelling volume Sapitation rate: Sapitation r					<u> </u>	(1a) x		• , ,	(2a) =		(3a)
Number of chimneys	Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1	e)+(1r	٦) 7	75.09	(4)					
Number of chimneys	Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	.(3n) =	180.22	(5)
Number of chimneys	2. Ventilation rate:		_								-
Number of passive vents 0	•	heating + [heating 0	-] + [0	<u> </u>	0			0	J
Number of flueless gas fires	Number of intermittent fa	ans				, E	3	x ·	10 =	30	(7a)
Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	Number of passive vent	S				F	0	x	10 =	0] (7b)
Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	Number of flueless gas	fires				F	0	X 4	40 =	0] [(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	_					L					J
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 hou 	ır -
Number of storeys in the dwelling (ns)		•							÷ (5) =	0.17	(8)
Additional infiltration			aea, procee	a to (17), t	otnerwise (ontinue m	om (9) to ((16)		1	1 (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	•	are arreaning (ne)						[(9)	-1]x0.1 =		4
If no draught lobby, enter 0.05, else enter 0 0.05 (13)	if both types of wall are producting areas of open	oresent, use the value corre ings); if equal user 0.35	esponding to	the great	er wall are	a (after	ruction				.
Window infiltration $0.25 - [0.2 \times (14) + 100] = 0.248$ (15) Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0.81446690788273$ (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 $(18) = (16)$ 0.81 (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 $(20) = 1 - [0.075 \times (19)] = 0.92$ (20) Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.75$ (21) Infiltration rate modified for monthly wind speed 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	•		,	`	,,						╡
Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = (8) + (10) + (11) + (12) + (13) + (15) = (8) + (10) + (11) + (12) + (13) + (15) = (8) + (10) + (11) + (12) + (13) + (15) = (8) + (10) + (11) + (12) + (13) + (15) = (8) + (10) + (11) + (12) + (13) + (15) = (8) + (10) + (11) + (12) + (13) + (15) = (8) + (10) + (11) + (12) + (13) + (15) = (8) + (10) + (11) + (12) + (13) + (15) = (8) + (10) + (11) + (12) + (13) + (15) = (15) + (14) + (14) + (15) + (15) = (16) + (17) + (18	Percentage of windov	vs and doors draught s	stripped							1	(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)] = 0.92 (20) Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.75 (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	Window infiltration				0.25 - [0.2	x (14) ÷ 1	00] =			0.248	(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 $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ Monthly average wind speed from Table 7 $(22) = 5.1 + 5 + 4.9 + 4.4 + 4.3 + 3.8 + 3.8 + 3.8 + 3.7 + 4 + 4.3 + 4.5 + 4.7$	Infiltration rate				(8) + (10)	+ (11) + (1	(13)	+ (15) =	(0.814466907882736	(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 - $[0.075 \times (19)]$ = 0.92 (20) Infiltration rate incorporating shelter factor (21) = $(18) \times (20)$ = 0.75 (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	•	·		•	•	•	etre of e	envelope	area	0	(17)
Number of sides sheltered Shelter factor $ (20) = 1 - [0.075 \times (19)] = $	·	•					ta ta ta a c			0.81	(18)
Shelter factor			as been dor	ie or a deg	gree air pei	теарину	is being u	sea		1	1 (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					(20) = 1 -	0.075 x (1	19)] =				4
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	Infiltration rate incorpora	ating shelter factor			(21) = (18	x (20) =				0.75	(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	Infiltration rate modified	for monthly wind spee	ed								-
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	Monthly average wind s	peed from Table 7									
Wind Factor (22a)m = (22)m ÷ 4	(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	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		' 1 1	0.95	0.95	0.92	1	1.08	1.12	1.18]	

Adjusted infiltr	ation rate (allow	ina for st	nelter an	ıd wind s	:need) =	(21a) x	(22a)m					
0.96	0.94 0.92	0.83	0.81	0.72	0.72	0.7	0.75	0.81	0.85	0.89		
	tive air change	rate for t	he appli	cable ca	se	<u> </u>	ļ.	ļ	<u> </u>	<u>!</u>		
If mechanica											0	
	eat pump using App) = (23a)			0	(23b)
	heat recovery: effi	-	_								0	(23c)
· ·	d mechanical v	1	i		- ` `	- ^ `	í `	 	- ´ -	- ` ´	÷ 100]	
(24a)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24a)
· ·	d mechanical v	1	i		 	ЛV) (24b	ŕ	 	- 		ı	
(24b)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24b)
,	ouse extract ve		•	•				E v (00h	. \			
<u> </u>	$0.5 \times (23b),$	nen (24)	(230)	o); otner	wise (24)	C = (22)	0) m + 0	.5 × (230	0	0		(24c)
, ,						<u> </u>						(240)
,	ventilation or wh n = 1, then (24d			•				0.5]				
(24d)m= 0.96	0.94 0.93	0.84	0.83	0.76	0.76	0.74	0.78	0.83	0.86	0.89		(24d)
Effective air	change rate - e	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)					
(25)m= 0.96	0.94 0.93	0.84	0.83	0.76	0.76	0.74	0.78	0.83	0.86	0.89		(25)
3. Heat losse	s and heat loss	paramet	er:									
ELEMENT	Gross	Openin		Net Ar	ea	U-valı	ue	AXU		k-value)	ΑΧk
	area (m²)	'n		A ,r	m²	W/m2	!K	(W/I	K)	kJ/m²·l		kJ/K
Doors				1.98	X	1.6	=	3.168				(26)
Windows Type	: 1			4.24	x1.	/[1/(1.6)+	0.04] =	6.38				(27)
Windows Type	2			2.03	x1.	/[1/(1.6)+	0.04] =	3.05				(27)
Floor				75.09) x	0.55	=	41.2995	5			(28)
Walls Type1	52.54	8.3		44.24	x 4	0.55	=	24.33				(29)
Walls Type2	8.28	1.98	3	6.3	x	0.14	<u> </u>	0.9			\neg	(29)
Roof	9.64	0		9.64	X	0.18	-	1.74			=	(30)
Total area of e	lements, m²			145.5	5							(31)
Party wall				40.53	3 x	0		0			٦Γ	(32)
Party ceiling				65.45	5						7 F	(32b)
	roof windows, use as on both sides of i				ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	3.2	
	ss, W/K = S (A x		is and pan	illions		(26)(30)) + (32) =				83.9	92 (33)
Heat capacity	•	. • ,				, , , ,		(30) + (32	2) + (32a).	(32e) =	16157	
	parameter (TM	P = Cm +	÷ TFA) ir	n kJ/m²K				itive Value:	, , ,	(/	25	
For design assess	ments where the d	etails of the	,			ecisely the				able 1f	23	<u>, </u>
	ad of a detailed cald		uoina An	nandiy l	,							(00)
_	es:S (L x Y) ca al bridging are not k		• .	•	`						21.8	(36)
Total fabric he		10WII (30) =	- U.UU X (3	1)			(33) +	(36) =			105.	.75 (37)
	nt loss calculate	d monthl	y					= 0.33 × (25)m x (5))	100.	
Jan	Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	L	•				<u>_</u>	· · ·					

(38)m= 57.17 56.11 55.06 50.16 49.24 44.97 44.97 44.18 46.61 49.24 51.1 53.04 (38) Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)m= 162.92 161.86 160.81 155.91 154.99 150.72 150.72 149.93 152.36 154.99 156.85 158.79 Average = Sum(39) ₁₁₂ /12= 155.9 (39)
(39)m= 162.92 161.86 160.81 155.91 154.99 150.72 150.72 149.93 152.36 154.99 156.85 158.79 Average = Sum(39) ₁₁₂ /12= 155.9 (39)
Average = $Sum(39)_{112}/12=$ 155.9 (39)
Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)
(40)m= 2.17 2.16 2.14 2.08 2.06 2.01 2.01 2 2.03 2.06 2.09 2.11
Average = $Sum(40)_{112}/12=$ 2.08 (40) Number of days in month (Table 1a)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(41)m= 31 28 31 30 31 30 31 30 31 30 31 (41)
4. Water heating energy requirement: kWh/year:
Assumed occupancy, N 2.36 if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9) if TFA £ 13.9, N = 1
Annual average hot water usage in litres per day Vd, average = $(25 \times N) + 36$ 90.32 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of
not more that 125 litres per person per day (all water use, hot and cold)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)
(44)m= 99.36 95.74 92.13 88.52 84.9 81.29 81.29 84.9 88.52 92.13 95.74 99.36 Total = Sum(44) ₁₁₂ = 1083.89 (44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)
(45)m= 147.34 128.87 132.98 115.93 111.24 95.99 88.95 102.07 103.29 120.38 131.4 142.69
Total = Sum(45) ₁₁₂ = 1421.15 (45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)
(46)m= 22.1 19.33 19.95 17.39 16.69 14.4 13.34 15.31 15.49 18.06 19.71 21.4 (46) Water storage loss:
Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)
If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:
a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)
Temperature factor from Table 2b 0 (49) Energy lost from water storage, kWh/year $(48) \times (49) = 0$ (50)
Energy lost from water storage, kWh/year (48) x (49) = 0 (50) b) If manufacturer's declared cylinder loss factor is not known:
Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)
If community heating see section 4.3
Volume factor from Table 2a 0 (52) Temperature factor from Table 2b 0 (53)
Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) = 0$ (54) Enter (50) or (54) in (55)
Water storage loss calculated for each month $((56)m = (55) \times (41)m)$
(56)m= 0 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 =

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= 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= 50.63 44.07 46.95 43.65 43.27 40.09 41.43 43.27 43.65 46.95	47.22 50.63 (61)
Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)$ m +	- (46)m + (57)m + (59)m + (61)m
(62)m= 197.97 172.93 179.93 159.59 154.51 136.08 130.38 145.34 146.94 167.33	
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)	,
(63)m= 0 0 0 0 0 0 0 0 0	0 0 (63)
Output from water heater	
(64)m= 197.97 172.93 179.93 159.59 154.51 136.08 130.38 145.34 146.94 167.33	178.62 193.32
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= 61.65 53.87 55.95 49.46 47.8 41.94 39.93 44.76 45.26 51.76	55.49 60.1 (65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is	
	morn community neating
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	T., T.
Jan Feb Mar Apr May Jun Jul Aug Sep Oct	Nov Dec
(66)m= 118.16 118.16 118.16 118.16 118.16 118.16 118.16 118.16 118.16 118.16	118.16 118.16 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 26.31 23.37 19 14.39 10.75 9.08 9.81 12.75 17.11 21.73	25.36 27.04 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 208.87 211.04 205.58 193.95 179.27 165.48 156.26 154.1 159.56 171.18	185.86 199.66 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	, , , , , , , , , , , , , , , , , , ,
(69)m= 34.82 34.82 34.82 34.82 34.82 34.82 34.82 34.82 34.82 34.82 34.82	34.82 34.82 (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= -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52	-94.52 -94.52 (71)
Water heating gains (Table 5)	· · · · · · · · · · · · · · · · · · ·
(72)m= 82.86 80.16 75.21 68.7 64.25 58.25 53.67 60.16 62.86 69.57	77.08 80.78 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m + (69)m + (60)m$	(71)m + (72)m
(73)m= 379.49 376.01 361.23 338.48 315.73 294.25 281.19 288.45 300.98 323.94	349.75 368.93 (73)
6. Solar gains:	
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applica-	able orientation.
Orientation: Access Factor Area Flux g_	FF Gains
Table 6d m ² Table 6a Table 6b	Table 6c (W)
Northeast 0.9x 0.77 x 4.24 x 11.28 x 0.63 x	0.7 = 14.62 (75)
Northeast 0.9x 0.77 x 4.24 x 22.97 x 0.63 x	0.7 = 29.76 (75)

_		_									_			_		_
Northeast _{0.9x}	0.77	X	4.2	.4	X	4	1.38	X		0.63	X	0.7	=	= <u>L</u>	53.62	(75)
Northeast _{0.9x}	0.77	X	4.2	24	X	6	7.96	X	(0.63	X	0.7	=	= [88.06	(75)
Northeast _{0.9x}	0.77	X	4.2	.4	X	9	1.35	X		0.63	X	0.7	=	= [118.37	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	9	7.38	X		0.63	X	0.7	=	= [126.19	(75)
Northeast _{0.9x}	0.77	X	4.2	24	X	Ç	91.1	X		0.63	X	0.7	-	= [118.05	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	7	2.63	X	(0.63	X	0.7	=	- [94.11	(75)
Northeast 0.9x	0.77	X	4.2	24	x	5	0.42	x		0.63	X	0.7	-	= [65.34	(75)
Northeast _{0.9x}	0.77	X	4.2	.4	x	2	8.07	X		0.63	X	0.7	-	- [36.37	(75)
Northeast _{0.9x}	0.77	x	4.2	.4	x		14.2	X		0.63	X	0.7	-	= [18.4	(75)
Northeast _{0.9x}	0.77	X	4.2	.4	x	Ç	9.21	X		0.63	X	0.7	-	- [11.94	(75)
Southwest _{0.9x}	0.77	X	2.0	13	X	3	6.79			0.63	X	0.7	-	= [45.65	(79)
Southwest _{0.9x}	0.77	X	2.0	13	X	6	2.67			0.63	X	0.7	-	= [77.76	(79)
Southwest _{0.9x}	0.77	X	2.0	3	x	8	5.75			0.63	x	0.7		= [106.4	(79)
Southwest _{0.9x}	0.77	×	2.0	3	x	10	06.25	ĺ		0.63	x	0.7		- Ī	131.84	(79)
Southwest _{0.9x}	0.77	X	2.0	3	x	1	19.01	ĺ		0.63	x	0.7	一:	- [147.67	(79)
Southwest _{0.9x}	0.77	X	2.0	3	x	1	18.15	ĺ		0.63	x	0.7	╡:	- [146.6	(79)
Southwest _{0.9x}	0.77	X	2.0	3	x	1	13.91	j		0.63	x	0.7		• Ī	141.34	(79)
Southwest _{0.9x}	0.77	X	2.0	3	x	10	04.39	j		0.63	x	0.7	<u> </u>	• [129.53	(79)
Southwest _{0.9x}	0.77	X	2.0	13	x	9	2.85	j		0.63	×	0.7	= -	- Ī	115.21	(79)
Southwest _{0.9x}	0.77	X	2.0	3	x	6	9.27	j		0.63	x	0.7		• Ī	85.95	(79)
Southwest _{0.9x}	0.77	X	2.0	13	X	4	4.07	j		0.63	x	0.7		- Ī	54.68	(79)
Southwest _{0.9x}	0.77	X	2.0	13	x	3	1.49	j		0.63	×	0.7	= -	- Ī	39.07	(79)
_		_												_		_
Solar gains in	watts, calcu	lated	for eacl	n month				(83)m	ı = Sur	n(74)m	(82)m					
(83)m= 60.27	107.52 16	0.02	219.89	266.03	27	72.79	259.39	223	.64	180.54	122.32	73.08	51.01	1		(83)
Total gains – ir	nternal and	solar	(84)m =	(73)m	+ (8	33)m	, watts									
(84)m= 439.76	483.54 52	1.25	558.37	581.76	56	67.04	540.58	512	.09	481.52	446.2	422.83	419.9	4		(84)
7. Mean inter	nal tempera	ture ((heating	seasor)											
Temperature	during heat	ing p	eriods ir	the livi	ng	area 1	from Tab	ole 9	, Th1	(°C)				Γ	21	(85)
Utilisation fac	tor for gains	for l	iving are	ea, h1,m	ı (s	ee Ta	ble 9a)							_		_
Jan	Feb N	Mar	Apr	May		Jun	Jul	Α	ug	Sep	Oct	Nov	Dec	С		
(86)m= 1	1 0.	.99	0.99	0.97	().92	0.84	0.8	37	0.96	0.99	1	1			(86)
Mean interna	l temperatur	e in I	iving are	ea T1 (f	ollo	w ste	ps 3 to 7	in T	able	9c)		•	•			
(87)m= 18.59		0.08	19.57	20.06	1	0.52	20.77	20.		20.36	19.74	19.12	18.61			(87)
Temperature	during hoat	ina n	oriode ir	rost of	طىد	olling	from To	bla (Th'	I		ļ	l			
(88)m= 19.22		0.24	19.28	19.29	1	9.33	19.33	19.		19.31	19.29	19.27	19.26	\Box		(88)
` ′	l l							<u> </u>	·		10.20	10.27	1 .0.20			(/
Utilisation fac				welling, 0.95	1	m (se	e lable	r –	, ₁	0.04	0.00	0.00	1	\neg		(89)
(00)	<u> </u>	.99	0.98					0.7		0.91	0.98	0.99	1	Ш		(09)
Mean interna					Ť	<u> </u>		<u> </u>		1				_		(00)
(90)m= 17.12	17.29 17	7.62	18.14	18.62	1	9.08	19.27	19.	25	18.93	18.32		17.16			(90)
										Ť	LA = LI\	ring area ÷ (4	+) =	L	0.36	(91)

					\ 6		. /4 6	A) TO					
Mean intern (92)m= 17.65		18.14	r tne wn 18.65	19.14	19.6	LA × 11		- ´ 	10.02	10.0	17.68		(92)
` '							19.78	19.45	18.83	18.2	17.00		(92)
Apply adjust (93)m= 17.65	17.81	18.14	18.65	19.14	19.6	19.81	19.78	19.45	18.83	18.2	17.68		(93)
8. Space he			10.00	13.14	13.0	15.01	13.70	13.43	10.00	10.2	17.00		(00)
Set Ti to the			mneratuu	re obtain	ed at st	an 11 of	Table 0	h so tha	t Ti m=(76)m an	d re calc	ulate	
the utilisatio					ieu ai sii	ер птог	I able 9	0, 50 tila	it 11,111–(10)III ali	u re-caic	uiate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fa	ctor for g	ains, hm											
(94)m= 0.99	0.99	0.99	0.97	0.94	0.86	0.72	0.76	0.92	0.98	0.99	1		(94)
Useful gains	, hmGm	, W = (94	1)m x (84	4)m									
(95)m= 437.42	479.82	514.62	544.26	548.56	489.3	390.98	391.68	442.32	436.51	419.44	418.06		(95)
Monthly ave	rage exte	ernal tem	perature	from Ta	able 8								
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	te for me	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]				
(97)m= 2174.9	1 2090.35	1872.18	1520.27	1152.57	752.99	483.48	507.35	814.56	1275.5	1741.07	2140.47		(97)
Space heati	ng requir	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m= 1292.6	9 1082.27	1010.02	702.72	449.39	0	0	0	0	624.2	951.57	1281.47		_
							Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	7394.35	(98)
Space heati	ng requir	ement in	kWh/m²	² /year							Ī	98.47	(99)
9a. Energy re	auiremei	nts – Indi	vidual h	eating s	vstems i	ncludina	micro-C	CHP)			l		
Space heat					, 5.55 .			, ,					
Fraction of s	•	at from se	econdar	y/supple	mentary	system						0	(201)
Fraction of s	naca har										l l		
	pace ne	at irom m	ıain syst	em(s)			(202) = 1	- (201) =				1	(202)
	•		-	. ,				, ,	(203)] =				(202)
Fraction of t	otal heati	ng from	main sys	stem 1				- (201) = 02) × [1 -	(203)] =			1	(204)
Fraction of t Efficiency of	otal heati main spa	ng from lace heat	main sys	stem 1 em 1	a avatam			, ,	(203)] =			90.3	(204)
Fraction of t	otal heati main spa	ng from i	main sys	stem 1 em 1 y heating	g systen	ո, %	(204) = (2	02) × [1 –	(203)] =			90.3	(204) (206) (208)
Fraction of t Efficiency of Efficiency of Jan	otal heati main spa seconda Feb	ng from lace heating/supplement	main sys ing syste ementar Apr	stem 1 em 1 y heating May	Jun			, ,	(203)] =	Nov	Dec	90.3	(204) (206) (208)
Fraction of t Efficiency of Efficiency of Jan Space heati	otal heati main spa seconda Feb ng requir	ng from in ace heating in ace heating in acceptance in acc	main systementar Apr alculate	em 1 em 1 y heating May d above	Jun	n, % Jul	(204) = (2 Aug	02) × [1 –	Oct			90.3	(204) (206) (208)
Fraction of t Efficiency of Efficiency of Jan Space heati	otal heati main spa seconda Feb	ng from in ace heating in ace heating in acceptance in acc	main systementar Apr alculate	stem 1 em 1 y heating May	Jun	ո, %	(204) = (2	02) × [1 –		Nov 951.57	Dec 1281.47	90.3	(204) (206) (208)
Fraction of the Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(9	otal heati main spanis seconda Feb ng requir 9 1082.27	ng from acce heating/supplement (compared to 1010.02	main system system alculated 702.72	stem 1 em 1 y heating May d above 449.39	Jun) 0	n, % Jul	(204) = (2 Aug	02) × [1 –	Oct 624.2	951.57	1281.47	90.3	(204) (206) (208)
Fraction of the Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(9	otal heati main spanseconda seconda Feb ng requir 9 1082.27	ng from acce heating/supplement (compared to 1010.02	main system system alculated 702.72	stem 1 em 1 y heating May d above	Jun	n, % Jul	(204) = (2 Aug 0	02) × [1 – Sep 0	Oct 624.2	951.57 1053.79	1281.47	90.3	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(9	otal heati main spanis seconda Feb ng requir 9 1082.27	ng from acce heating/supplement (compared to 1010.02	main system system alculated 702.72	stem 1 em 1 y heating May d above 449.39	Jun) 0	n, % Jul 0	(204) = (2 Aug 0	02) × [1 –	Oct 624.2	951.57 1053.79	1281.47	90.3	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(9 1431.5)]	otal heati main spanse seconda Feb ng requir 9 1082.27 8)m x (20 5 1198.53	mg from acce heating heat heat heat heat heat heat heat heat	main systementar Apr alculater 702.72 00 ÷ (20 778.21	May d above 449.39 497.66	Jun) 0	n, % Jul 0	(204) = (2 Aug 0	02) × [1 – Sep 0	Oct 624.2	951.57 1053.79	1281.47	1 90.3 0 kWh/ye	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(9 1431.5)	otal heati main spanse seconda Feb ng requir 9 1082.27 8)m x (20 5 1198.53 ng fuel (second) } x 1	mg from mace heating mary/supplement (continuous) Mar	main systementar Apr alculated 702.72 00 ÷ (20 778.21	May dabove 449.39 497.66 month	Jun) 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – 0	Oct 624.2 691.26 ar) =Sum(2	951.57 1053.79 211) _{15,1012}	1281.47 1419.13 =	1 90.3 0 kWh/ye	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(9 1431.5)]	otal heati main spanse seconda Feb ng requir 9 1082.27 8)m x (20 5 1198.53	mg from acce heating heat heat heat heat heat heat heat heat	main systementar Apr alculater 702.72 00 ÷ (20 778.21	May d above 449.39 497.66	Jun) 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 –	Oct 624.2 691.26 ar) = Sum(2	951.57 1053.79 211) _{15,1012}	1281.47 1419.13 =	1 90.3 0 kWh/ye	(204) (206) (208) (211) (211)
Fraction of the Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(9 1431.5)	otal heati main spanse seconda Feb ng requir 9 1082.27 8)m x (20 5 1198.53 ng fuel (second) } x 1	mg from mace heating mary/supplement (continuous) Mar	main systementar Apr alculated 702.72 00 ÷ (20 778.21	May dabove 449.39 497.66 month	Jun) 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – 0	Oct 624.2 691.26 ar) = Sum(2	951.57 1053.79 211) _{15,1012}	1281.47	1 90.3 0 kWh/ye	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(98)m x (2(215)m=0]] 0} Water heating Efficiency of the Effic	otal heati main spanis seconda Feb ng requir 9 1082.27 8)m x (20 5 1198.53 ng fuel (s 201)] } x 1	ng from ace heatingly supplement (conditions) 1010.02 1010.02 1118.52 1118.52 1118.52	main systementar Apr alculater 702.72 00 ÷ (20 778.21 y), kWh/8) 0	stem 1 em 1 y heating May d above 449.39 06) 497.66 month	Jun) 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 –	Oct 624.2 691.26 ar) = Sum(2	951.57 1053.79 211) _{15,1012}	1281.47	1 90.3 0 kWh/ye	(204) (206) (208) (211) (211)
Fraction of the Efficiency of Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(9) 1431.5]} Space heating 1292.6 (215)m = 0 Water heating Output from the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of the Efficiency of Efficiency	otal heati main spanis seconda Feb ng requir 9 1082.27 8)m x (20 5 1198.53 ng fuel (s	mg from mace heating/supplement (color) Mar ement (color) 1010.02 (4)] } x 1 1118.52 econdar (00 ÷ (20) 0	main systementar Apr alculated 702.72 00 ÷ (20 778.21 y), kWh/8) 0	stem 1 em 1 y heating May d above 449.39 06) 497.66 month 0	Jun 0 0 0	o 0	(204) = (2 Aug 0 Tota 0 Tota	02) × [1 – 0	Oct 624.2 691.26 ar) =Sum(2	951.57 1053.79 211) _{15,1012} 0	1281.47	1 90.3 0 kWh/ye	(204) (206) (208) (211) (211)
Fraction of the Efficiency of Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(98)m x (2015)m=0]} Water heating Output from the 197.97	otal heati main spanis seconda Feb ng requir 9 1082.27 8)m x (20 5 1198.53 ng fuel (second)] } x 1 0 eg vater heati	mg from mace heating mary/supplement (c 1010.02 04)] } x 1 1118.52 econdary 00 ÷ (20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	main systementar Apr alculater 702.72 00 ÷ (20 778.21 y), kWh/8) 0	stem 1 em 1 y heating May d above 449.39 06) 497.66 month	Jun) 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 –	Oct 624.2 691.26 ar) = Sum(2	951.57 1053.79 211) _{15,1012}	1281.47	1 90.3 0 kWh/ye	(204) (206) (208) (211) (211) (215)
Fraction of the Efficiency of Efficiency of Jan Space heating 1292.6 (211)m = {[(9) 1431.5]} Space heating 1292.6 (215)m = 0 Water heating Output from the Space heating 197.97 Efficiency of the Efficiency of the Space heating 197.97	otal heati main spanse seconda Feb ng requir 9 1082.27 8)m x (20 5 1198.53 ng fuel (second) } x 1 0 ng water heati	ng from ace heating/supplement (color) 1010.02 104)] } x 1 1118.52 econdary 00 ÷ (20 0 ter (calcol) 179.93 ater	main systementar Apr alculated 702.72 00 ÷ (20 778.21 y), kWh/8) 0	May dabove 449.39 497.66 month 0	Jun) 0 0	o 0 130.38	(204) = (2 Aug 0 Tota 145.34	02) × [1 – Sep 0 0 I (kWh/yea 146.94	Oct 624.2 691.26 ar) =Sum(2 0 ar) =Sum(2	951.57 1053.79 211) _{15,1012} 0 215) _{15,1012}	1281.47 1419.13 = 0 =	1 90.3 0 kWh/ye	(204) (206) (208) (211) (211) (215)
Fraction of the Efficiency of Efficiency of Efficiency of 1292.6 (211)m = {[(9) 1431.5} Space heating the Efficiency of 197.97 Efficiency of 1297.97 Efficiency of 1297.97 (217)m= 88.94	otal heati main spanis seconda Feb ng requir 9 1082.27 8)m x (20 5 1198.53 ng fuel (second)] } x 1 0 ng vater heati	mg from mace heating mace heati	main systementar Apr alculated 702.72 778.21 y), kWh/8) 0 ulated al 159.59	stem 1 em 1 y heating May d above 449.39 06) 497.66 month 0	Jun 0 0 0	o 0	(204) = (2 Aug 0 Tota 0 Tota	02) × [1 – 0	Oct 624.2 691.26 ar) =Sum(2	951.57 1053.79 211) _{15,1012} 0	1281.47	1 90.3 0 kWh/ye	(204) (206) (208) (211) (211) (215)
Fraction of the Efficiency of Efficiency of Efficiency of 1292.6 (211)m = {[(9] 1431.5]} Space heating the Efficiency of 1292.6 (215)m = 0 Water heating the Efficiency of 1297.97 (217)m = 88.94 (217)m = 88.94	otal heati main spanse secondar Feb ng requir 9 1082.27 8)m x (20 5 1198.53 ng fuel (s 201)] } x 1 0 eg vater heating r heating r heating	ng from ace heatingly supplement (conditions) Mar ement (conditions) x 1 1118.52 econdary 00 ÷ (20 0 o tter (calcingly 179.93 atter 88.76 kWh/modern kWh/modern 180.00 kWh/modern 180.00 kwh/modern 180.00 conditions 180.00 cond	main systementar Apr alculated 702.72 00 ÷ (20 778.21 y), kWh/8) 0 ulated al 159.59 88.42 onth	May dabove 449.39 497.66 month 0	Jun) 0 0	o 0 130.38	(204) = (2 Aug 0 Tota 145.34	02) × [1 – Sep 0 0 I (kWh/yea 146.94	Oct 624.2 691.26 ar) =Sum(2 0 ar) =Sum(2	951.57 1053.79 211) _{15,1012} 0 215) _{15,1012}	1281.47 1419.13 = 0 =	1 90.3 0 kWh/ye	(204) (206) (208) (211) (211) (215)
Fraction of the Efficiency of Efficiency of Incomplete	otal heating the property of t	ng from ace heatingly supplement (conditions) Mar ement (conditions) x 1 1118.52 econdary 00 ÷ (20 0 o tter (calcingly 179.93 atter 88.76 kWh/modern kWh/modern 180.00 kWh/modern 180.00 kwh/modern 180.00 conditions 180.00 cond	main systementar Apr alculated 702.72 00 ÷ (20 778.21 y), kWh/8) 0 ulated al 159.59 88.42 onth	May dabove 449.39 497.66 month 0	Jun) 0 0	o 0 130.38	(204) = (2 Aug 0 Tota 145.34	02) × [1 – Sep 0 0 I (kWh/yea 146.94	Oct 624.2 691.26 ar) =Sum(2 0 ar) =Sum(2	951.57 1053.79 211) _{15,1012} 0 215) _{15,1012}	1281.47 1419.13 = 0 =	1 90.3 0 kWh/ye	(204) (206) (208) (211) (211) (215)
Fraction of the Efficiency of Efficiency of Idan Space heating 1292.6 (211)m = {[(98)m x (26)215)m=0} Water heating Output from the Idan Space heating 197.97 Efficiency of the Idan Space heating 197.	otal heating the property of t	mg from mace heating mace heating mary/supplement (c 1010.02 04)] } x 1 1118.52 econdary 00 ÷ (20 179.93 eter 88.76 kWh/mc 0 ÷ (217)	main systementar Apr alculated 702.72 00 ÷ (20 778.21 y), kWh/8) 0 ulated al 159.59 88.42 onth m	May dabove 449.39 (6) 497.66 (month 0) 154.51	Jun) 0 0 136.08	o 0 130.38	(204) = (2 Aug 0 Tota 145.34 81	02) × [1 – Sep 0 0 0 I (kWh/yea 146.94	Oct 624.2 691.26 0 ar) = Sum(2 167.33 88.16	951.57 1053.79 211) _{15,1012} 0 215) _{15,1012} 178.62	1281.47 1419.13 = 0 = 193.32 88.96	1 90.3 0 kWh/ye	(204) (206) (208) (211) (211) (215)

DER WorkSheet: Existing dwelling (SAP)

Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot		kWh/yea	ar	kWh/year 8188.65 2274.76	
central heating pump:			30]	(230c)
Total electricity for the above, kWh/year	sum	of (230a)(230g) =		30	(231)
Electricity for lighting				464.59	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHF				
	Energy kWh/year	Emission fa kg CO2/kWh		Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	=	1768.75	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	491.35	(264)
Space and water heating	(261) + (262) + (263) +	(264) =		2260.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	241.12	(268)
Total CO2, kg/year		sum of (265)(271) =		2516.79	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		33.52	(273)

El rating (section 14)

(274)

		User D	etails: -						
Access Names	Chris Hasknall			a Ni	bes.		STD0	016262	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012		Strom Softwa	_				016363 on: 1.0.4.26	
- Contract of the state of the		Property A							
Address :	Flat 06, 51 Calthorpe Stree	t, LOND(ON, WC	IX 0HH					
1. Overall dwelling dime	ensions:	_							
Ground floor			a(m²) 3.21	(1a) x		ight(m) 2.2	(2a) =	Volume(m ³	3) (3a)
	a) (1h) (1a) (1d) (1a) (1					2.2	(2a) -	117.06	(Ja)
·	a)+(1b)+(1c)+(1d)+(1e)+(1	11)5	3.21	(4)	\.(2-\.(2-	4) . (2 -) .	(25) -		_
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	117.06	(5)
2. Ventilation rate:	main seconda	rv	other		total			m³ per hou	ır
Number of chimneys	heating heating	-, □ + □] ₌ [40 =		_
•		╛┊┝	0]	0		20 =	0	(6a)
Number of open flues			0	Ţ	0		10 =	0	(6b)
Number of intermittent fa				Ļ	2			20	(7a)
Number of passive vents				Ļ	0		10 =	0	(7b)
Number of flueless gas fi	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	20		÷ (5) =	0.17	(8)
If a pressurisation test has b	peen carried out or is intended, procee	ed to (17), o	otherwise o	continue fr	om (9) to			-	``
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration	.25 for steel or timber frame o	r 0 35 foi	r masoni	v constr	ruction	[(9)	-1]x0.1 =	0	(10)
	resent, use the value corresponding t			•	detion			0	(11)
deducting areas of openii	ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or 0) 1 (coala	nd) also	ontor O					7(40)
If no draught lobby, en	,	. i (Scale	<i>u)</i> , eise	enter o				0	(12)
-	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 metro	•		•	etre of e	envelope	area	5	(17)
·	lity value, then $(18) = [(17) \div 20] + (18)$ if a pressurisation test has been do				is heina u	sed		0.42	(18)
Number of sides sheltere		ne or a acg	gree an pe	meability	io being a	ocu		2	(19)
Shelter factor			(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporat	•		(21) = (18) x (20) =				0.36	(21)
Infiltration rate modified f	- 1 	1	Ι.		T _	1	I _	1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		1	1 2 7	4	1 42	1 45	1 4 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	ation rate	(allowi	ng for sh	nelter an	ıd wind s	speed) =	(21a) x	(22a)m					
0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42]	
Calculate effec		•	rate for t	he appli	cable ca	se			l				
If mechanica			andiv N. (O	2h) - (22	a) v Emy (4	aguatian (N	VEVV otho	muiaa (22h	\ - (22a)			0	(23a)
If exhaust air h) = (23a)			0	(23b)
If balanced with		-	-	_					2l= \ /	006) [4 (00-)	0	(23c)
a) If balance (24a)m= 0	ed mechai	nicai ve	entilation 0	with he	at recov	ery (IVIVI	$\frac{\exists R)(248)}{0}$	$\frac{1}{0} = \frac{2}{2}$	2b)m + (0	23b) × [1 - (23c)) ÷ 100]]	(24a)
b) If balance			<u> </u>								0	J	(244)
(24b)m= 0			0	0	0	0	0	0	0	0	0	1	(24b)
c) If whole h	الــــــــــــــــــــــــــــــــــــ		<u> </u>									J	(= .0)
,	n < 0.5 ×			•	•				5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24c)
d) If natural	ventilatior	n or wh	ole hous	e positi	ve input	ventilatio	on from	loft	ļ		!	1	
	n = 1, the								0.5]			_	
(24d)m= 0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]	(24d)
Effective air	change r	ate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(25)
3. Heat losse	s and hea	at loss i	paramet	er:									
ELEMENT	Gross	3	Openin	gs	Net Ar		U-val		AXU		k-value		AXk
D	area (m²)	m	l²	A ,r	_	W/m2	— ı	(W/I	K)	kJ/m²·	K	kJ/K
Doors					1.98		1	= [1.98	_			(26)
Windows Type					4.95	=	/[1/(1.4)+	l.	6.56	_			(27)
Windows Type	e 2 				1.67	x1.	/[1/(1.4)+	0.04] =	2.21	ᆜ .			(27)
Walls Type1	29.77		8.29		21.48	3 X	0.18	=	3.87	_			(29)
Walls Type2	11.99)	1.98		10.0	1 x	0.18	= [1.8				(29)
Roof	38.74		0		38.74	x	0.13	=	5.04				(30)
Total area of e	elements,	m²			80.5								(31)
Party wall					39.44	x	0	= [0				(32)
Party floor					53.2	1							(32a)
Party ceiling					14.48	3							(32b)
* for windows and ** include the area						lated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragrapl	h 3.2	
Fabric heat los				o ana par	iniono		(26) (30) + (32) =				23.67	7 (33)
Heat capacity		•	•,					((28)	(30) + (32	2) + (32a)	(32e) =	7125.6	
Thermal mass	,	,	P = Cm ÷	- TFA) ir	n kJ/m²K			,	tive Value	, , ,	(= = 7	250	(35)
For design assess	•	•		,			ecisely the				able 1f		(00)
can be used inste													<u>-</u>
Thermal bridge	,	,		• .	•	K						4.03	(36)
if details of therma Total fabric he		re not kn	own (36) =	= 0.05 x (3	11)			(33) ±	(36) =				(07)
Ventilation hea		lculated	l monthly	.,				. ,	= 0.33 × ('25)m v (5)	١	27.7	(37)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
Jail	I i en	iviai	l \\hi	iviay	l Juli	l Jui	_I Aug	l geh	l Oct	INOV	l Dec]	

(00)							T aa	0.1-0	00.45				(00)
(38)m= 23.33	23.18	23.02	22.31	22.17	21.55	21.55	21.43	21.79	22.17	22.44	22.73		(38)
Heat transfer of			E0 01	40.07	40.05	40.05	10.12	· · ·	= (37) + (37)	_	E0 42		
(39)m= 51.03	50.88	50.72	50.01	49.87	49.25	49.25	49.13	49.49	49.87	50.14 Sum(39) ₁	50.43	50.01	(39)
Heat loss para	meter (I	HLP), W/	m²K				_		= (39)m ÷		12 / 12-	30.01	
(40)m= 0.96	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.93	0.94	0.94	0.95		_
Number of day	s in mo	nth (Tab	le 1a)					/	Average =	Sum(40) ₁	12 /12=	0.94	(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	rement:								kWh/yea	ır:	
Assumed occu	ıpancv.	N								1	78		(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		10		(/
if TFA £ 13.9 Annual averag	•	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		76	5.59		(43)
Reduce the annua	al average	hot water	usage by	5% if the a	lwelling is	designed i			se target o				` '
not more that 125					ı		Ι ,						
Jan Hot water usage ii	Feb	Mar dav for ea	Apr ach month	May <i>Vd.m = fa</i>	Jun ctor from 7	Jul Table 1c x	(43)	Sep	Oct	Nov	Dec		
(44)m= 84.25	81.18	78.12	75.06	71.99	68.93	68.93	71.99	75.06	78.12	81.18	84.25		
(11)	• • • • • • • • • • • • • • • • • • • •			1	30.00	00.00	1			m(44) _{1 12} =	\vdash	919.05	(44)
Energy 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)		_
(45)m= 124.94	109.27	112.76	98.3	94.32	81.39	75.42	86.55	87.58	102.07	111.42	120.99		_
If instantaneous w	ater heati	ng at point	of use (no	o hot water	storage),	enter 0 in	boxes (46		Γotal = Su	m(45) _{1 12} =		1205.02	(45)
(46)m= 18.74	16.39	16.91	14.75	14.15	12.21	11.31	12.98	13.14	15.31	16.71	18.15		(46)
Water storage	loss:			<u> </u>	<u> </u>	<u> </u>	<u> </u>			<u> </u>			, ,
Storage volum	e (litres)) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	_			_			. ,	oro) onto	or 'O' in /	47)			
Otherwise if no Water storage		not wate	er (uns ii	iciudes i	nstantar	ieous cc	ווטט וטוווע	ers) erite	er U III (47)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature fa	actor fro	m Table	2b								0		(49)
Energy lost fro		_	-				(48) x (49)) =			0		(50)
b) If manufactHot water stora			-								0		(51)
If community h	•			IC 2 (IVV	11/110/00	· y /					0		(31)
Volume factor	from Ta	ble 2a									0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (. , .	•	or ooob	month			((EG)m = (EE) ~ (44).	_		0		(55)
Water storage						ı	((56)m = ((FC)
(56)m= 0 If cylinder contains	0 s dedicate	0 d solar sto	0 rage. (57)	0 m = (56)m	0 x [(50) – (0 H11)l÷(5	0 0), else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Appendix	Н	(56)
	0	0	0	· · ·	0	0	0	0	0	0	0		(57)
(57)m= 0				0				U					(01)

Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m	0 (58)
(modified by factor from Table H5 if there is solar water heating and a cylinder therm	
(59)m= 0 0 0 0 0 0 0 0 0	0 0 (59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m	<u></u>
(61)m= 42.93 37.37 39.81 37.01 36.69 33.99 35.13 36.69 37.01 39.81	40.04 42.93 (61)
Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m +	+ (46)m + (57)m + (59)m + (61)m
(62)m= 167.87 146.64 152.56 135.32 131.01 115.39 110.55 123.24 124.6 141.88	3 151.45 163.92 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribu	ution 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= 167.87 146.64 152.56 135.32 131.01 115.39 110.55 123.24 124.6 141.88	3 151.45 163.92
Output from water heat	ter (annual) _{1 12} 1664.43 (64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)n	n + (57)m + (59)m]
(65)m= 52.27 45.67 47.44 41.94 40.53 35.56 33.86 37.95 38.38 43.89	47.06 50.96 (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= 89.24 89.24 89.24 89.24 89.24 89.24 89.24 89.24 89.24 89.24 89.24 89.24	89.24 89.24 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 14.55 12.92 10.51 7.95 5.95 5.02 5.42 7.05 9.46 12.02	14.02 14.95 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 155.56 157.18 153.11 144.45 133.52 123.24 116.38 114.76 118.83 127.49) 138.42 148.7 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 31.92 31.92 31.92 31.92 31.92 31.92 31.92 31.92 31.92 31.92 31.92 31.92	31.92 31.92 (69)
Pumps and fans gains (Table 5a)	01.02
(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	3 3 (70)
	3 3
Losses e.g. evaporation (negative values) (Table 5) (71)m= -71.39 -71.39 -71.39 -71.39 -71.39 -71.39 -71.39 -71.39 -71.39 -71.39	71.39 -71.39 (71)
	71.39 -71.39 (71)
Water heating gains (Table 5)	(70)
(72)m= 70.26 67.97 63.77 58.25 54.48 49.39 45.51 51.01 53.3 58.99	
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m$	· · · · · · · · · · · · · · · · · · ·
(73)m= 293.14 290.83 280.15 263.42 246.72 230.42 220.08 225.59 234.37 251.27	7 270.57 284.92 (73)
6. Solar gains:	
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applications of the convert to the	
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b	FF Gains Table 6c (W)
Northeast 0.9x 0.77 x 4.95 x 11.28 x 0.63 x	0.7 = 17.07 (75)
Northeast 0.9x 0.77 x 4.95 x 22.97 x 0.63 x	0.7 = 34.74 (75)
	, ,

Northeast _{0.9x}							٦						(7.5)
<u>L</u>	0.77	X	4.9		× L	41.38	」 X ¬	0.63	X	0.7	=	62.6	(75)
Northeast _{0.9x}	0.77	X	4.9	_	× L	67.96	X	0.63	X	0.7	=	102.8	(75)
Northeast 0.9x	0.77	X	4.9)5	× L	91.35	X	0.63	×	0.7	=	138.19	(75)
Northeast _{0.9x}	0.77	X	4.9	5	× L	97.38	X	0.63	×	0.7	=	147.32	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x L	91.1	X	0.63	×	0.7	=	137.82	(75)
Northeast _{0.9x}	0.77	X	4.9	5	× L	72.63	X	0.63	X	0.7	=	109.87	(75)
Northeast 0.9x	0.77	X	4.9	15	x	50.42	X	0.63	X	0.7	=	76.28	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x	28.07	X	0.63	X	0.7	=	42.46	(75)
Northeast 0.9x	0.77	X	4.9	15	x	14.2	X	0.63	X	0.7	=	21.48	(75)
Northeast 0.9x	0.77	X	4.9	5	x [9.21	X	0.63	X	0.7	=	13.94	(75)
Northwest 0.9x	0.77	X	1.6	57	x	11.28	X	0.63	X	0.7	=	11.52	(81)
Northwest 0.9x	0.77	X	1.6	57	x	22.97	X	0.63	X	0.7	=	23.44	(81)
Northwest 0.9x	0.77	X	1.6	57	x \Box	41.38	X	0.63	X	0.7	=	42.24	(81)
Northwest 0.9x	0.77	X	1.6	57	x \lceil	67.96	X	0.63	x	0.7	=	69.37	(81)
Northwest 0.9x	0.77	X	1.6	57	x $\overline{}$	91.35	X	0.63	X	0.7	=	93.24	(81)
Northwest 0.9x	0.77	X	1.6	57	x F	97.38	X	0.63	x	0.7	= =	99.4	(81)
Northwest 0.9x	0.77	X	1.6	57	х Г	91.1	X	0.63	x	0.7	=	92.99	(81)
Northwest 0.9x	0.77	X	1.6	7	x F	72.63	X	0.63	x	0.7	=	74.13	(81)
Northwest 0.9x	0.77	X	1.6	57	x F	50.42] x	0.63	x	0.7	-	51.47	(81)
Northwest 0.9x	0.77	X	1.6	57	x F	28.07	X	0.63	x	0.7		28.65	(81)
Northwest 0.9x	0.77	X	1.6		x 📙	14.2] X	0.63	×	0.7		14.49	(81)
Northwest 0.9x	0.77	X	1.6		x F	9.21]]	0.63	×	0.7	=	9.41	(81)
L					_		J						
Solar gains in	watts, ca	lculated	for eacl	n month			(83)m	n = Sum(74)m	(82)m				
(83)m= 28.59	58.19	104.83	172.17	231.43	246	.73 230.81	18	4 127.74	71.1	35.97	23.34		(83)
Total gains – i	nternal ar	nd solar	(84)m =	(73)m ·	+ (83	B)m , watts				•			
(84)m= 321.72	349.02	384.99	435.59	478.14	477	.15 450.89	409	9.6 362.11	322.3	8 306.54	308.26		(84)
7. Mean inter	nal temp	erature	(heating	season)								
Temperature						ea from Tal	ble 9	, Th1 (°C)				21	(85)
Utilisation fac	ctor for ga	ains for I	iving are	ea, h1,m	(see	e Table 9a)		, ,					
Jan	Feb	Mar	Apr	May	r	un Jul	A	ug Sep	Oc	Nov	Dec]	
(86)m= 1	1	0.99	0.96	0.84	0.6	64 0.48	0.5	0.83	0.98	1	1		(86)
Mean interna	l temners	ature in l	livina ar	ے 2a T1 (fo	ال	stens 3 to 1	7 in T	able 9c)	!		!	ı	
(87)m= 20.03	20.14	20.35	20.65	20.89	20.	- i	20.		20.63	3 20.28	20.01]	(87)
	ļ. ļ	!				<u> </u>	<u> </u>	ļ				J	` ,
Temperature							1		T 20.4	00.40	20.40	1	(90)
(88)m= 20.12	20.12	20.12	20.13	20.14	20.		20.	15 20.14	20.14	20.13	20.13	J	(88)
Utilisation fac	1 1											1	
(89)m= 1	0.99	0.99	0.94	8.0	0.5	0.39	0.4	15 0.76	0.97	0.99	1		(89)
Mean interna	l tempera	ature in t	the rest	of dwelli	ng T	2 (follow ste	eps 3	to 7 in Tal	ole 9c)			_	
(90)m= 18.81	18.98	19.29	19.72	20.03	20.	13 20.14	20.	15 20.08	19.69	19.19	18.8		(90)
									fLA = Li	ving area ÷ (4) =	0.43	(91)
													_

Maan internal	tompor	atura (fo	r tha wh	مام طبیرما	lina) – f	I A v T1	. /1 fl	۸ \ ی T ع					
Mean internal (92)m= 19.34	19.48	19.75	20.13	20.4	20.5	20.52	+ (1 – 1L 20.51	20.45	20.1	19.67	19.32		(92)
Apply adjustme								l		10.01	10.02		(/
(93)m= 19.34	19.48	19.75	20.13	20.4	20.5	20.52	20.51	20.45	20.1	19.67	19.32		(93)
8. Space heati	ing requ	irement											
Set Ti to the m	nean inte	ernal ten	•		ed at st	ep 11 of	Table 9l	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		
Utilisation factor	or for ga	ains, hm	:	-				-					
(94)m= 1	0.99	0.98	0.94	0.81	0.6	0.43	0.49	0.79	0.97	0.99	1		(94)
Useful gains, h	hmGm ,	W = (94	1)m x (84	4)m				•					
` '	346.75	378.55	409.38	387.93	284.71	192.14	200.67	285.85	311.13	304.3	307.37		(95)
Monthly average						ī							(0.0)
(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	T T									000.44	700 7		(07)
(97)m= 767.65	741.8	672.05	561.47	433.97	290.7	192.81	202.14	314.14	473.73	630.14	762.7		(97)
Space heating (98)m= 332.65	require 265.48	218.36	r eacn m 109.5	34.25	/vn/mon	tn = 0.02	4 X [(97)m – (95 0)m] X (4 ²	1)M 234.6	338.77		
(96)111- 332.03	200.40	210.30	109.5	34.23	U							1654 50	(98)
							Tota	i per year	(kWh/year) = Sum(9	8)15,912 =	1654.58	Ⅎ``
Space heating	require	ment in	kWh/m²	/year								31.1	(99)
9a. Energy reqι	uiremen	ts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space heating	_												_
Fraction of spa	ace hea	t from se	econdar	y/supple	mentary	system						0	(201)
Fraction of spa	ana haa												=
•	ace nea	t from m	ain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction of total			•	, ,				- (201) = 02) × [1 -	(203)] =		ļ	1	(202)
•	al heatir	ng from r	main sys	stem 1				, ,	(203)] =				=
Fraction of total	al heatir nain spa	ng from r ce heati	main sys	stem 1 em 1	g systen			, ,	(203)] =			1	(204)
Fraction of total	al heatir nain spa	ng from r ce heati	main sys	stem 1 em 1	g system Jun		(204) = (2	02) × [1 –	(203)] =	Nov	Dec	93.4 0	(204) (206) (208)
Efficiency of m	al heatir nain spa econdar Feb	ng from r ce heati ry/supple Mar	main sys ing syste ementar Apr	stem 1 em 1 y heating May	Jun	n, %		, ,	` '-	Nov	Dec	1 93.4	(204) (206) (208)
Efficiency of m Efficiency of se Jan Space heating	al heatir nain spa econdar Feb	ng from r ce heati ry/supple Mar	main sys ing syste ementar Apr	stem 1 em 1 y heating May	Jun	n, %	(204) = (2	02) × [1 –	` '-	Nov 234.6	Dec 338.77	93.4 0	(204) (206) (208)
Efficiency of m Efficiency of se Jan Space heating	al heatir nain spa econdar Feb g require 265.48	ng from r ce heati ry/supple Mar ment (co	main systementary Apr alculated	em 1 em 1 y heating May d above) 34.25	Jun	n, %	(204) = (2 Aug	02) × [1 –	Oct			93.4 0	(204) (206) (208)
Fraction of total Efficiency of modern Efficiency of Service Jan Space heating 332.65 (211)m = {[(98)]	al heatir nain spa econdar Feb g require 265.48	ng from r ce heati ry/supple Mar ment (co	main systementary Apr alculated	em 1 em 1 y heating May d above) 34.25	Jun	n, %	(204) = (2 Aug	02) × [1 –	Oct			93.4 0	(204) (206) (208) ear
Fraction of total Efficiency of management of Section 1. Efficiency of Section 2. Efficiency 2. Ef	al heatir nain spa econdar Feb g require 265.48 m x (204	ng from r ce heati ry/supple Mar ment (co 218.36	main systementar Apr alculatee 109.5 00 ÷ (20	stem 1 em 1 y heating May d above) 34.25	Jun) 0	1, % Jul 0	Aug 0	02) × [1 – Sep 0	Oct 120.97	234.6 251.18	338.77 362.7	93.4 0	(204) (206) (208) ear
Fraction of total Efficiency of management of Section 1. Efficiency of Section 2. Efficiency 2. Ef	al heatir nain spa econdar Feb g require 265.48 m x (204	mg from rece heating/supplement (content and 218.36 4)] } x 1	Apr alculated 109.5 00 ÷ (20	stem 1 em 1 y heating May d above) 34.25 6) 36.67	Jun) 0	1, % Jul 0	Aug 0	02) × [1 – Sep 0	Oct 120.97	234.6 251.18	338.77 362.7	1 93.4 0 kWh/ye	(204) (206) (208) ear (211)
Fraction of total Efficiency of management Efficiency of Security Jan Space heating 332.65 (211)m = {[(98)]	al heating and heating require 265.48 m x (204 284.24 green fuel (see	mg from rece heating/supplement (company 218.36 4)] } x 1	main systementary Apr alculated 109.5 00 ÷ (20 117.24	stem 1 em 1 y heating May d above) 34.25 6) 36.67	Jun) 0	1, % Jul 0	Aug 0	02) × [1 – Sep 0	Oct 120.97	234.6 251.18	338.77 362.7	1 93.4 0 kWh/ye	(204) (206) (208) ear (211)
Fraction of total Efficiency of management of Section 1. Efficiency of Section 2. Space heating 332.65 (211)m = {[(98)i 356.16]	al heating and heating require 265.48 m x (204 284.24 green fuel (see	mg from rece heating/supplement (company 218.36 4)] } x 1	main systementary Apr alculated 109.5 00 ÷ (20 117.24	stem 1 em 1 y heating May d above) 34.25 6) 36.67	Jun) 0	1, % Jul 0	Aug 0	02) × [1 – Sep 0	Oct 120.97	234.6 251.18	338.77 362.7	1 93.4 0 kWh/ye	(204) (206) (208) ear (211)
Fraction of total Efficiency of management of the Efficiency of second Jan Space heating 332.65 (211)m = {[(98)(356.16)] Space heating = {[(98)m x (2001)] Space heating = {[(98	al heatinnain spa econdar Feb grequire 265.48 m x (204 284.24 g fuel (se	mar Mar Mar Man (c. 218.36 4)] } x 1 233.79	main systementary Apr alculated 109.5 00 ÷ (20 117.24 y), kWh/8	stem 1 em 1 y heating May d above) 34.25 6) 36.67 month	Jun 0 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – Sep 0 I (kWh/yea	Oct 120.97 129.52 ar) =Sum(2	234.6 251.18 211) _{15,10. 12}	338.77	1 93.4 0 kWh/ye	(204) (206) (208) ear (211)
Fraction of total Efficiency of management of the Efficiency of second Jan Space heating 332.65 (211)m = {[(98)(356.16)] Space heating = {[(98)m x (2001)] Space heating = {[(98	al heatinnain spa econdar Feb grequire 265.48 m x (204 284.24 g fuel (se	mar Mar Mar Man (c. 218.36 4)] } x 1 233.79	main systementary Apr alculated 109.5 00 ÷ (20 117.24 y), kWh/8	stem 1 em 1 y heating May d above) 34.25 6) 36.67 month	Jun 0 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – Sep 0 I (kWh/yea	Oct 120.97 129.52 ar) =Sum(2	234.6 251.18 211) _{15,10. 12}	338.77	1 93.4 0 kWh/ye	(204) (206) (208) ear (211) (211)
Fraction of total Efficiency of moderate Efficiency of second Space heating 332.65 (211)m = {[(98)n 356.16]} Space heating = {[(98)m x (207 (215)m= 0]} Water heating Output from wa	al heatinnain spa econdar Feb grequire 265.48 m x (204 284.24 g fuel (se 1)] } x 10 0	mar Mar Mar Mar Mar Mar Mar Mar Mar Mar M	main systementary Apr alculated 109.5 00 ÷ (20 117.24 y), kWh/ 8) 0	stem 1 em 1 y heating May d above) 34.25 6) 36.67 month 0	Jun 0 0	n, % Jul 0	(204) = (2 Aug 0 Tota 0 Tota	02) × [1 – 0	Oct 120.97 129.52 ar) =Sum(2	234.6 251.18 211) _{15,10. 12}	338.77 362.7 = 0	1 93.4 0 kWh/ye	(204) (206) (208) ear (211)
Fraction of total Efficiency of management of the Efficiency of second Jan Space heating 332.65 (211)m = {[(98)n 356.16]} Space heating = {[(98)m x (207 (215)m= 0]} Water heating Output from wa 167.87	al heatinnain sparecondar Feb grequire 265.48 m x (204 284.24 gfuel (set) 1)] } x 10 0 atter heat	mg from rece heating/supplement (content and content a	main systementary Apr alculated 109.5 00 ÷ (20 117.24 y), kWh/ 8) 0	stem 1 em 1 y heating May d above) 34.25 66) 36.67 month	Jun 0 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – Sep 0 I (kWh/yea	Oct 120.97 129.52 ar) =Sum(2	234.6 251.18 211) _{15,10. 12}	338.77	1 93.4 0 kWh/ye	(204) (206) (208) (208) ear (211) (211)
Fraction of total Efficiency of modern Efficiency of second Jan Space heating 332.65 (211)m = {[(98)m x (207 (215)m= 0]] Water heating Output from water	require 265.48 m x (204 284.24 diter heat 146.64 ater heat	Mar ment (calculation) econdary o econdary o econdary o econdary o econdary o econdary o econdary o econdary o econdary o econdary o econdary o econdary o econdary o econdary o econdary	Apr alculated 109.5 00 ÷ (20 117.24 y), kWh/ 8) 0	stem 1 em 1 y heating May d above) 34.25 6) 36.67 month 0	Jun 0 0 0 115.39	1, % Jul 0 0	(204) = (2 Aug 0 Tota 123.24	02) × [1 – Sep 0 0 I (kWh/yea 124.6	Oct 120.97 129.52 ar) = Sum(2 0 141.88	234.6 251.18 211) _{15,10. 12} 0 215) _{15,10. 12}	338.77 362.7 = 0 =	1 93.4 0 kWh/ye	(204) (206) (208) (208) ear (211) (211) (215)
Fraction of total Efficiency of modern Efficiency of second Jan Space heating 332.65 (211)m = {[(98)n 356.16]} Space heating = {[(98)m x (207 (215)m= 0]} Water heating Output from wa 167.87 Efficiency of wa (217)m= 86.74	al heatinnain sparecondar Feb require 265.48 m x (204 284.24 g fuel (set) 0 atter heat 146.64 atter heat 86.53	ment (calcute 152.56 ter 85.95	main systementary Apr alculated 109.5 00 ÷ (20 117.24 y), kWh/8) 0	stem 1 em 1 y heating May d above) 34.25 6) 36.67 month 0	Jun 0 0	n, % Jul 0	(204) = (2 Aug 0 Tota 0 Tota	02) × [1 – 0	Oct 120.97 129.52 ar) =Sum(2	234.6 251.18 211) _{15,10. 12}	338.77 362.7 = 0	1 93.4 0 kWh/ye	(204) (206) (208) (208) ear (211) (211)
Fraction of total Efficiency of moderate Efficiency of second I an	al heating along require 265.48 m x (204 284.24 decended atter heat 146.64 atter heat 86.53 meating,	ment (calculate (calcu	main systementary Apr alculated 109.5 00 ÷ (20 117.24 y), kWh/8) 0 ulated al 135.32 84.52 onth	stem 1 em 1 y heating May d above) 34.25 6) 36.67 month 0	Jun 0 0 0 115.39	1, % Jul 0 0	(204) = (2 Aug 0 Tota 123.24	02) × [1 – Sep 0 0 I (kWh/yea 124.6	Oct 120.97 129.52 ar) = Sum(2 0 141.88	234.6 251.18 211) _{15,10. 12} 0 215) _{15,10. 12}	338.77 362.7 = 0 =	1 93.4 0 kWh/ye	(204) (206) (208) (208) ear (211) (211) (215)
Fraction of total Efficiency of moderate Efficiency of second Jan Space heating 332.65 (211)m = {[(98)m x (207 (215)m= 0]] Water heating Output from wa 167.87 Efficiency of water heating of the second part of the second p	al heating along require 265.48 m x (204 284.24 decended atter heat 146.64 atter heat 86.53 meating,	ment (calculate (calcu	main systementary Apr alculated 109.5 00 ÷ (20 117.24 y), kWh/8) 0 ulated al 135.32 84.52 onth	stem 1 em 1 y heating May d above) 34.25 6) 36.67 month 0	Jun 0 0 0 115.39	1, % Jul 0 0	(204) = (2 Aug 0 Tota 123.24	02) × [1 – Sep 0 0 I (kWh/yea 124.6	Oct 120.97 129.52 ar) = Sum(2 0 141.88	234.6 251.18 211) _{15,10. 12} 0 215) _{15,10. 12}	338.77 362.7 = 0 =	1 93.4 0 kWh/ye	(204) (206) (208) (208) ear (211) (211) (215)
Fraction of total Efficiency of moderate Efficiency of second Space heating 332.65 (211)m = {[(98)m x (20^2 (215)m=0]} Water heating Output from wa 167.87 Efficiency of water heating Fuel for water he (219)m = (64)m	require 265.48 m x (204 284.24 deter heat 146.64 ater heat 86.53 meating, m x 100	mg from rece heating/supplement (c. 218.36 4)] } x 1 233.79 econdary 00 ÷ (200 152.56 ter 85.95 kWh/mc ÷ (217)	main systementary Apr alculated 109.5 00 ÷ (20 117.24 y), kWh/8) 0 ulated al 135.32 84.52 onth m	stem 1 em 1 y heating May d above) 34.25 66) 36.67 month 0	Jun 0 0 115.39 80.3	1, % Jul 0 0 110.55	O Tota 123.24 80.3	02) × [1 – Sep 0 0 I (kWh/yea 124.6 80.3	Oct 120.97 129.52 ar) =Sum(2 141.88 84.65	234.6 251.18 211) _{15,10. 12} 0 215) _{15,10. 12}	338.77 362.7 = 0 =	1 93.4 0 kWh/ye	(204) (206) (208) (208) ear (211) (211) (215)

Annual totals		kWh/yea	ır	kWh/yea	r
Space heating fuel used, main system 1		-		1771.5	
Water heating fuel used				1982.14	
Electricity for pumps, fans and electric keep-hot					
central heating pump:			30		(230c)
boiler with a fan-assisted flue			45	Ī	(230e)
Total electricity for the above, kWh/year	sum of (230a) (230g) =		75	(231)
Electricity for lighting				256.89	(232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
12a. CO2 emissions – Individual heating systems	Energy kWh/year	Emission factoring the Emission factoring factoring the Emission factoring factoring factoring factoring factoring		Emissions kg CO2/ye	
12a. CO2 emissions – Individual heating systems Space heating (main system 1)	Energy				
	Energy kWh/year	kg CO2/kWh		kg CO2/ye	ar
Space heating (main system 1)	Energy kWh/year	kg CO2/kWh	=	kg CO2/ye	ar (261)
Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	kg CO2/kWh 0.216 0.519	=	kg CO2/ye	ar (261) (263)
Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	kg CO2/kWh 0.216 0.519	=	kg CO2/ye 382.64 0 428.14	(261) (263) (264)
Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	kg CO2/kWh 0.216 0.519 0.216	= =	kg CO2/ye 382.64 0 428.14 810.79	(261) (263) (264) (265)

TER =

18.47

(273)

		User D	etails: -						
Access Name	Chris Hocknell	– USE I L		o Nives	ber:		STDO	016363	
Assessor Name: Software Name:	Stroma FSAP 2012		Strom Softwa					on: 1.0.4.26	
- Contract of the state of the		roperty i	Address				1 0.0.0		
Address :	Flat 07, 51 Calthorpe Stree	t, LOND(ON, WC	1X 0HH					
1. Overall dwelling dime	ensions:	_							
Ground floor			a(m²) 33.73	(1a) x		ight(m) 2.2	(2a) =	Volume(m ²	3) (3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1] •		2.2	(Zu) –	140.21	(oa)
·	a)+(1b)+(1c)+(1u)+(1e)+(1	(1)	33.73	(4)	\\(\20\\\\20	4) . (20) .	(2n) -		
Dwelling volume				(3a)+(3b)+(30)+(30	d)+(3e)+	.(311) =	140.21	(5)
2. Ventilation rate:	main seconda	rv	other		total			m³ per hou	ır
Number of chimneys	heating heating	, +				x 4	40 =	-	_
•		_	0]	0		20 =	0	(6a)
Number of open flues		」	0	┙╶┟	0			0	(6b)
Number of intermittent fa				Ļ	2		10 =	20	(7a)
Number of passive vents					0		10 =	0	(7b)
Number of flueless gas fi	ires				0	X 4	40 =	0	(7c)
							Air ch	nanges per he	our
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	Γ	20		÷ (5) =	0.14	(8)
If a pressurisation test has b	peen carried out or is intended, procee	ed to (17), o	otherwise o	continue fr			, ,		``
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration	OF for atoal or timber from a	. 0 25 fo		m / aanatu		[(9)-	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o resent, use the value corresponding t			•	ruction			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								0	(13)
Window infiltration	s and doors draught stripped		0.25 - [0.2	9 x (14) ÷ 1	1001 =			0	(14)
Infiltration rate			(8) + (10)	. ,	_	+ (15) =		0	(15)
	q50, expressed in cubic metro	es per ho	. , , ,			, ,	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$		•	•				0.39	(18)
Air permeability value applie	es if a pressurisation test has been do	ne or a deg	gree air pe	rmeability	is being u	sed			
Number of sides sheltere	ed		(00)	FO 075 //	40)1			1	(19)
Shelter factor	Vana ala di an fantan		(20) = 1 -	•	19)] =			0.92	(20)
Infiltration rate incorporat	•		(21) = (18) X (20) =				0.36	(21)
Infiltration rate modified f	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
Monthly average wind sp	1 ' 1 ' 1	<u> Jul</u>	Aug	Тоер	1 001	INOV	Dec	J	
(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 3 1 3.0	1	<u> </u>	<u> </u>	1	<u> </u>	I	J	
Wind Factor (22a)m = (2		1		Ι.	T	T		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 infiltration rate (a	llowing for shelter a	nd wind sr	peed) = (;	21a) x	(22a)m					
· ·	44 0.4 0.39	0.35	0.35	0.34	0.36	0.39	0.41	0.43]	
Calculate effective air chai	•	licable cas	se					!	J	
If mechanical ventilation		o > = /			. (00)	\ (00 \			0	(23a)
If exhaust air heat pump using) = (23a)			0	(23b)
If balanced with heat recovery									0	(23c)
a) If balanced mechanic	1		- 		, ,	 		```) ÷ 100] 1	(0.4-)
()	0 0	0	0	0	0	0	0	0		(24a)
b) If balanced mechanic					, ,	<u> </u>			1	(0.41-)
` '	0 0	0	0	0	0	0	0	0		(24b)
c) If whole house extract	•	•				E v (22h	. \			
if $(22b)m < 0.5 \times (23)$	0 0 0	$\frac{1}{0}$	0 T	0 - (221	0	0 × (230	0	0	1	(24c)
()						U			J	(240)
d) If natural ventilation o if (22b)m = 1, then (•	•				0.5]				
(24d)m= 0.61 0.6 0	6 0.58 0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(24d)
Effective air change rate	- enter (24a) or (24	4b) or (24c) or (24d) in box	(25)					
(25)m= 0.61 0.6 0	6 0.58 0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59		(25)
3. Heat losses and heat lo	oss parameter:									
ELEMENT Gross area (m²	Openings) m²	Net Are A ,m		U-valı W/m2		A X U (W/I	〈)	k-value kJ/m²·		A X k kJ/K
Doors	,	1.98	П _х Г	1	.` = [1.98	, 	10/111		(26)
Windows Type 1		3.4		1/(1.4)+		4.51	=			(27)
Windows Type 2		1.8	=	1/(1.4)+	L	2.39				(27)
Windows Type 3		2.07	=	1/(1.4)+	L		_			(27)
Malla Trus 4	10.07		=		= [2.74	ᆿ ,			
<u>-</u>	10.87	40.82		0.18	믁	7.35	႕ ¦		╡	(29)
Walls Type2 9.19	1.98	7.21	×	0.18	=	1.3	ᆗ ¦		Ⅎ ⊨	(29)
Roof 63.73	0	63.73	× L	0.13	= [8.28				(30)
Total area of elements, m ²		124.61	ᆗ -							(31)
Party wall		28.69	×	0	= [0			╛┕	(32)
Party floor		63.73								(32a)
Party ceiling		14.48								(32b)
* for windows and roof windows, ** include the areas on both sides			ted using fo	formula 1	[(1/U-valu	ıe)+0.04] a	is given in	paragraph	n 3.2	
Fabric heat loss, W/K = S	(A x U)		(2	26) (30)	+ (32) =				33.32	(33)
Heat capacity Cm = S(A x	k)				((28)	(30) + (32	2) + (32a)	(32e) =	8126.0	4 (34)
Thermal mass parameter (TMP = Cm ÷ TFA)	in kJ/m²K			Indica	tive Value:	Medium		250	(35)
For design assessments where to can be used instead of a detailed		ction are not	known pred	cisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridges : S (L x Y		Appendix K							6.23	(36)
if details of thermal bridging are r	_									
Total fabric heat loss					(33) +	(36) =			39.55	(37)

/entila	tion hea	nt loss ca	alculated	monthly	y				(38)m	= 0.33 × (25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
38)m=	28.09	27.9	27.71	26.83	26.66	25.89	25.89	25.75	26.19	26.66	27	27.35		(38
leat tr	ansfer c	oefficier	nt, W/K						(39)m	= (37) + (38)m			
39)m=	67.65	67.45	67.27	66.38	66.21	65.44	65.44	65.3	65.74	66.21	66.55	66.9		_
leat Ic	oss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷	Sum(39) ₁ (4)	12 /12=	66.38	(39
40)m=	1.06	1.06	1.06	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.05		
lumbe	er of day	s in mor	nth (Tab	le 1a)		-		-	,	Average =	Sum(40) ₁	12 /12=	1.04	(4
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
11)m=	31	28	31	30	31	30	31	31	30	31	30	31		(4
4. Wa	ater heat	ing ener	rgy requi	irement:								kWh/ye	ar:	
ssum	ned occu	inancy I	N								2	.08		(4
if TF	A > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (TFA -13		.06		(-
	A £ 13.9	,						(O.F. N.I.)	. 00					
								(25 x N) to achieve		se target o		5.72		(4
		_	person per			_	_			J				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot wate	er usage in	n litres per	day for ea			ctor from T	Table 1c x		· ·	Į.				
4)m=	92.09	88.74	85.39	82.04	78.69	75.34	75.34	78.69	82.04	85.39	88.74	92.09		
						I.					m(44) _{1 12} =	_	1004.6	(4
nergy (content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x C	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
l5)m=	136.56	119.44	123.25	107.45	103.1	88.97	82.44	94.61	95.74	111.57	121.79	132.25		_
inetan	taneous w	rator hoatii	na at noint	of use (no	hot water	r storaga)	enter () in	boxes (46		Total = Su	m(45) _{1 12} =	- L	1317.18	(4
			· ·	·			i	` `	·	40.74	40.07	10.04		()
-6)m= √ater	20.48 storage	17.92 loss:	18.49	16.12	15.47	13.35	12.37	14.19	14.36	16.74	18.27	19.84		(4
	_		includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(4
_		` '	nd no ta				•							
	-	•			_			mbi boil	ers) ente	er '0' in (47)			
	storage													
•			eclared l		or is kno	wn (kWh	n/day):					0		(4
empe	erature fa	actor fro	m Table	2b								0		(4
			storage	-				(48) x (49)) =			0		(5
			eclared of factor fr	-								0		(5
			ee secti		C 2 (KVV	11/11(10/00	· y /					0		(-
comi	e factor	_										0		(5
		actor fro	m Table	2b								0		(5
olum	erature fa													
olum empe			storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(5
olumo empe nergy		m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(5 (5
olumo empe nergy enter	/ lost fro (50) or (m water [54) in (5	storage	_				(47) x (51) ((56)m = (

If cylinder cor	ntains dedicate	ed 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		(57)
Primary cir	cuit loss (ar	nnual) fro	m Table	e 3			•	•			0		(58)
-	cuit loss ca	•			59)m = ((58) ÷ 36	65 × (41)	m				'	
(modifie	d 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		(59)
Combi loss	calculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m= 46	93 40.84	43.51	40.46	40.1	37.16	38.39	40.1	40.46	43.51	43.76	46.93		(61)
Total heat	required for	water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 183	.49 160.28	166.76	147.91	143.21	126.13	120.84	134.71	136.2	155.09	165.55	179.18		(62)
Solar DHW in	put calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	r heating)	•	
(add additi	onal lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0		(63)
Output fror	n water hea	iter											
(64)m= 183	.49 160.28	166.76	147.91	143.21	126.13	120.84	134.71	136.2	155.09	165.55	179.18		_
							Outp	out from wa	ater heate	r (annual)₁	12	1819.34	(64)
Heat gains	from water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61)m	א 0.8 + [ר	((46)m	+ (57)m	+ (59)m]	
(65)m= 57	14 49.92	51.86	45.84	44.31	38.87	37.01	41.48	41.95	47.98	51.44	55.71		(65)
include (57)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	eating	
5. Interna	al gains (see	e Table 5	and 5a):									
Metabolic	gains (Table	e 5). Wat	ts										
	an Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 104	.24 104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24		(66)
Lighting ga	ins (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m= 16	75 14.87	12.1	9.16	6.85	5.78	6.24	8.12	10.9	13.83	16.15	17.21		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Tal	ble 5	•		•	
(68)m= 182	.25 184.14	179.37	169.23	156.42	144.38	136.34	134.45	139.22	149.36	162.17	174.21		(68)
Cooking ga	ains (calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5	•		'	
(69)m= 33.	42 33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42		(69)
Pumps and	d fans gains	(Table 5	Ба)					•		•		'	
(70)m=	3 3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g	. evaporatio	on (nega	tive valu	es) (Tab	le 5)		Į.			l.		l	
(71)m= -83	3.4 -83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4		(71)
Water hea	ting gains (rable 5)								l		l	
(72)m= 76	 	69.7	63.67	59.55	53.99	49.75	55.76	58.26	64.48	71.44	74.87		(72)
Total inter	nal gains =	<u></u>		<u> </u>	(66)	ım + (67)m	ı + (68)m +	⊦ (69)m + ((70)m + (7	1)m + (72)	m	l	
(73)m= 333	`	318.45	299.33	280.09	261.42	249.61	255.6	265.64	284.95	307.03	323.57		(73)
6. Solar g	ains:												
	are calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to co	nvert to th	e applicab	ole orientat	ion.		
Orientation	: Access F		Area		Flu			g_		FF		Gains	
	Table 6d		m²		Tal	ole 6a	Т	able 6b	Ta	able 6c		(W)	

Northeast _{0.9x}	0.77	X	3.4	x	11	.28	X		0.63	x	0.7	=	1	1.72	(75)
Northeast _{0.9x}	0.77	X	3.4	x	22	.97	x		0.63	x	0.7	=	2	3.86	(75)
Northeast _{0.9x}	0.77	X	3.4	X	41	.38	x		0.63	x	0.7	=		43	(75)
Northeast _{0.9x}	0.77	×	3.4	x	67	.96	x		0.63	×	0.7	=	7	0.61	(75)
Northeast _{0.9x}	0.77	x	3.4	x	91	.35	x		0.63	×	0.7		94	4.92	(75)
Northeast _{0.9x}	0.77	x	3.4	x	97	.38	x		0.63	×	0.7	=	10)1.19	(75)
Northeast 0.9x	0.77	×	3.4	x	91	.1	x		0.63	×	0.7		94	4.66	(75)
Northeast _{0.9x}	0.77	×	3.4	x	72	.63	x		0.63	×	0.7	=	7:	5.47	(75)
Northeast _{0.9x}	0.77	×	3.4	X	50	.42	x		0.63	×	0.7	=	5:	2.39	(75)
Northeast 0.9x	0.77	×	3.4	j×	28	.07	x		0.63	×	0.7		2	9.16	(75)
Northeast _{0.9x}	0.77	×	3.4	x	14	.2	x		0.63	×	0.7	=	14	4.75	(75)
Northeast _{0.9x}	0.77	×	3.4	X	9.:	21	x		0.63	×	0.7	=	9).57	(75)
Northwest _{0.9x}	0.77	×	1.8	X	11	.28	X		0.63	x	0.7		1	8.62	(81)
Northwest _{0.9x}	0.77	×	2.07	X	11	.28	x		0.63	x	0.7	=	7	'.14	(81)
Northwest _{0.9x}	0.77	×	1.8	×	22	.97	X		0.63	x	0.7	=	3	37.9	(81)
Northwest _{0.9x}	0.77	×	2.07	j×	22	.97	x		0.63	×	0.7	=	1	4.53	(81)
Northwest _{0.9x}	0.77	×	1.8	x	41	.38	x		0.63	×	0.7	=	6	8.29	(81)
Northwest _{0.9x}	0.77	x	2.07	x	41	.38	x		0.63	×	0.7		20	6.18	(81)
Northwest _{0.9x}	0.77	x	1.8	X	67	.96	x		0.63	×	0.7		11	12.15	(81)
Northwest _{0.9x}	0.77	x	2.07	×	67	.96	x		0.63	×	0.7	=	4:	2.99	(81)
Northwest _{0.9x}	0.77	X	1.8	X	91	.35	x		0.63	x	0.7	=	15	0.75	(81)
Northwest _{0.9x}	0.77	X	2.07	x	91	.35	X		0.63	x	0.7	=	5	7.79	(81)
Northwest _{0.9x}	0.77	X	1.8	X	97	.38	x		0.63	×	0.7	=	16	60.71	(81)
Northwest _{0.9x}	0.77	x	2.07	X	97	.38	X		0.63	x	0.7	=	6	1.61	(81)
Northwest _{0.9x}	0.77	X	1.8	X	91	.1	X		0.63	x	0.7	=	15	50.35	(81)
Northwest _{0.9x}	0.77	X	2.07	X	91	.1	X		0.63	x [0.7	=	5	7.63	(81)
Northwest _{0.9x}	0.77	X	1.8	X	72	.63	X		0.63	x [0.7	=	11	19.86	(81)
Northwest _{0.9x}	0.77	X	2.07	X	72	.63	X		0.63	x	0.7	=	4	5.95	(81)
Northwest 0.9x	0.77	X	1.8	X	50	.42	X		0.63	X	0.7	=	8	3.21	(81)
Northwest 0.9x	0.77	X	2.07	X	50	.42	X		0.63	x	0.7	=	3	31.9	(81)
Northwest _{0.9x}	0.77	X	1.8	X	28	.07	X		0.63	x	0.7	=	4	6.32	(81)
Northwest _{0.9x}	0.77	X	2.07	X	28	.07	X		0.63	x [0.7	=	1	7.76	(81)
Northwest 0.9x	0.77	X	1.8	X	14	.2	X		0.63	x	0.7	=	2:	3.43	(81)
Northwest _{0.9x}	0.77	X	2.07	X	14	.2	X		0.63	x	0.7	=	8	3.98	(81)
Northwest _{0.9x}	0.77	X	1.8	X	9.	21	X		0.63	X	0.7	=	1:	5.21	(81)
Northwest _{0.9x}	0.77	X	2.07	X	9.	21	X		0.63	X	0.7	=	5	5.83	(81)
Solar gains in w				-	00 54 T		`		m(74)m	(82)m	1 47 40	1 00 04	7		(92)
(83)m= 37.48 Total gains – int		37.46	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			302.64	241	.27	167.5	93.24	47.16	30.61			(83)
		55.91	525.08 583.5	<u> </u>	 _	552.25	496	86	433.14	378.19	354.19	354.18	٦		(84)
` '					1.01	002.20	100	.00	100.11	070.10	1 30 11 13	1 00 11 10			(0.1)
7. Mean interna	•				area f	om Tok		Th4	(°C)					24	7(05)
Temperature d	•	•		_			л е 9,	, 1111	()					21	(85)
Utilisation facto	 _			Ť			Δ,	ug	Sep	Oct	Nov	Dec	7	_	
Stroma FSA 2012	Version: 1.0	<u>U.4.26 (</u> \$	SAP 197.92] - http://	<i>P</i> WWW.	.stromal.c	omui		ч ⊌	- CCP		1 1404	l Dec	_	Page 5	of 7

(86)m=	1	1	0.99	0.96	0.87	0.68	0.51	0.59	0.86	0.98	1	1		(86)
Mean	interna	I temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Table	e 9c)				•	
(87)m=	19.86	19.98	20.22	20.55	20.83	20.97	20.99	20.99	20.88	20.52	20.14	19.84		(87)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	ble 9, Ti	h2 (°C)				•	
(88)m=	20.03	20.03	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.04		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)					•	
(89)m=	1	1	0.99	0.95	0.82	0.59	0.41	0.48	0.8	0.97	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	e 9c)	•			
(90)m=	18.51	18.68	19.03	19.52	19.89	20.04	20.06	20.06	19.96	19.48	18.93	18.49		(90)
			!						f	LA = Livin	g area ÷ (4	4) =	0.47	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	llina) = fl	LA × T1	+ (1 – fL	A) × T2					_
(92)m=	19.14	19.29	19.58	20	20.33	20.48	20.5	20.49	20.39	19.97	19.5	19.13		(92)
Apply	adjustr	nent to t	he mear	interna	temper	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	19.14	19.29	19.58	20	20.33	20.48	20.5	20.49	20.39	19.97	19.5	19.13		(93)
			uirement											
			ternal ter or gains	•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
uic ui	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm		iviay	Ouri	<u> </u>	7.09	ОСР		1101			
(94)m=	1	0.99	0.99	0.95	0.84	0.63	0.46	0.53	0.83	0.97	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (8	4)m	Į.	Į.			<u> </u>	ļ.			
(95)m=	369.43	404.66	449.45	498.23	487.98	370.52	253.12	263.26	357.63	367.86	352.14	353.34		(95)
Mont	nly 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)
			an intern			1			<u> </u>	ī —			İ	(07)
	1004.15		880.13	737.04	571.61	384.49	255.08	267.38	413.57	620.52	824.95	998.49		(97)
Spac (98)m=	e neatin 472.23	g require 380.45	ement fo 320.43	r each n 171.94	62.22	/vn/mon	$\ln = 0.02$	24 X [(97)m – (95 0	187.98	1)m 340.43	479.99		
(30)111-	472.23	300.43	320.43	17 1.34	02.22				l per year				2415.67	(98)
Cnaa	- h tin	~ ~~~		14\ A / la / ma 2	2/1.000			Tota	ii pei yeai	(KVVIII yCai) – Odin(o	O J15,912 —		╣
•		•	ement in										37.9	(99)
			nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatir	•	at from s	econdar	v/supple	mentary	system						0	(201)
			at from m			memary	-	(202) = 1 -	- (201) =				1	(202)
			ng from	•	` ,				02) × [1 –	(203)] =				(204)
			•	-				(204) - (2	02) [1 —	(200)] -			1	╡ .
	-	•	ace heat				- 0/						93.4	(206)
Eπicie	ency of s		ry/suppl	ementar	y neating	g systen	1, % 			1		1	0	(208)
_	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Spac		g require 380.45	ement (c	alculate	d above;	0	0	0	0	187.98	340.43	479.99		
(0.4.4)	472.23	<u> </u>						U	U	107.98	340.43	479.99		(0.1.1)
(211)n	n = {[(98 505.6)m x (20 407.34	(4)] } x 1	00 ÷ (20 184.09	66.61	0	0	0	0	201.26	364.48	513.91		(211)
	303.6	407.34	J43.07	104.09	00.01				l (kWh/yea				2586.37	(211)
								. 5.0	, , 50	,(-	/ 15,10. 12		2000.37	

215)m= 0 0 0 0 0	0 0	0	0	0	0	0		
	•	Total	(kWh/yea	ar) =Sum(2		=	0	(21
Vater heating								
Dutput from water heater (calculated above) 183.49 160.28 166.76 147.91 143.21 1.	26.13 120.84	134.71	136.2	155.09	165.55	179.18		
Efficiency of water heater		1 1		.00.00		1	80.3	(21
217)m= 87.33 87.15 86.67 85.43 83.11	80.3 80.3	80.3	80.3	85.54	86.83	87.41		(21
Fuel for water heating, kWh/month 219)m = (64)m x 100 ÷ (217)m	•							
	57.07 150.48	167.76	169.61	181.31	190.67	204.99		
		Total	= Sum(2	19a) ₁₁₂ =			2153.77	(21
Annual totals				k۱	Nh/year	,	kWh/yeaı	
Space heating fuel used, main system 1							2586.37	╛
Vater heating fuel used							2153.77	
Electricity for pumps, fans and electric keep-hot								
central heating pump:						30		(23
boiler with a fan-assisted flue						45		(23
Total electricity for the above, kWh/year		sum o	of (230a)	(230g) =			75	(23
Electricity for lighting						Ī	295.76	(23
12a. CO2 emissions – Individual heating system	s including mi	cro-CHP				L		_
	Energy			Emice	ion fac	tor	Emissions	
				kg CO2		loi	kg CO2/ye	
	kWh/year					_		(26
Space heating (main system 1)	kWh/year			0.21	16	=	558.66	
Space heating (main system 1) Space heating (secondary)	·			0.21		= [0	(26
Space heating (secondary)	(211) x				19	L		_
Space heating (secondary) Vater heating	(211) x (215) x		264) =	0.51	19	= [0	(26
Space heating (secondary) Vater heating Space and water heating	(211) x (215) x (219) x		(64) =	0.51	19	= [0 465.22	(26
	(211) x (215) x (219) x (261) + (262)		264) =	0.5	19	= [0 465.22 1023.87](26](26](26

TER =

(273)

19.09

		User Details:				
A N	Obside I I a alva all			OTDO	040000	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	Stroma Nur Software Ve			016363 n: 1.0.4.26	
Software Name.		roperty Address: Flat 0		VEISIO	11. 1.0.4.20	
Address :	Flat 08, 51 Calthorpe Street					
Overall dwelling dime	•					
		Area(m²)	Av. Height(m)	Volume(m³)	
Ground floor		7.67 (1a) x	2.5	(2a) =	19.18	(3a)
First floor		138.42 (1b) x	2.5	(2b) =	346.05	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1r	1) 146.09 (4)				_
Dwelling volume		(3a)+(3	3b)+(3c)+(3d)+(3e)+.	(3n) =	365.22	(5)
2. Ventilation rate:						
	main secondar heating heating	y other	total		m³ per hour	•
Number of chimneys	0 + 0	+ 0 =	0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent far	ns		4	x 10 =	40	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fin	res		0	x 40 =	0	(7c)
		·		مام سنگ		-
Infiltration due to chimne	(a. fluor and fano = (62)±(6b)±(7	2)±/7h)±/7c) =		-	anges per ho	_
•	rs, flues and fans = (6a)+(6b)+(7 een carried out or is intended, proceed		40 from (9) to (16)	÷ (5) =	0.11	(8)
Number of storeys in th	•	· //	, , , ,		0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber frame or	0.35 for masonry cons	truction		0	(11)
if both types of wall are pr deducting areas of openin	esent, use the value corresponding to	the greater wall area (after		•		_
- · · · · · · · · · · · · · · · · · · ·	loor, enter 0.2 (unsealed) or 0.	1 (sealed), else enter 0)	Г	0	(12)
If no draught lobby, ent	,	, ,,		ļ	0	(13)
Percentage of windows	and doors draught stripped			į	0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷	100] =	Ì	0	(15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	Ī	0	(16)
Air permeability value,	q50, expressed in cubic metre	s per hour per square r	metre of envelop	e area	5	(17)
If based on air permeabili	ty value, then (18) = [(17) ÷ 20]+(8	3), otherwise (18) = (16)		Ī	0.36	(18)
Air permeability value applies	s if a pressurisation test has been don	e or a degree air permeabilit	y is being used			
Number of sides sheltere	d				0	(19)
Shelter factor		(20) = 1 - [0.075 x]	(19)] =		1	(20)
Infiltration rate incorporat	ing shelter factor	(21) = (18) x (20) =			0.36	(21)
Infiltration rate modified for	or monthly wind speed					
Jan Feb	Mar Apr May Jun	Jul Aug Sep	Oct Nov	Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4.3

4.5

4.7

Wind Factor (22a)m = (22)m =	- 4								
(22a)m= 1.27 1.25 1.23	1.1 1.0	8 0.95	0.95	0.92	1	1.08	1.12	1.18	
Adjusted infiltration rate (allow	ing for shelter	and wind s	eneed) -	(21a) v	(22a)m	!	!	!	
0.46 0.45 0.44	0.4 0.3		0.34	0.33	0.36	0.39	0.4	0.42	
Calculate effective air change	1 1								
If mechanical ventilation:									0 (23a)
If exhaust air heat pump using App	, ,	, , ,	•		,) = (23a)			0 (23b)
If balanced with heat recovery: effi	-	_				- ,			0 (23c)
a) If balanced mechanical v	1	heat recov	ery (MVF	HR) (24a	ŕ	r ´ `	23b) × [* 	i i	÷ 100] (24a)
(1)					0	0 2h\m + ('	<u> </u>	0	(24a)
b) If balanced mechanical v				0	$\int_{0}^{\infty} \int_{0}^{\infty} dx = (2x)^{2}$	20)m + (<i>i</i>	230)	0	(24b)
c) If whole house extract ve									(240)
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 ventilation or w	nole house po	sitive input	ventilatio	on from l	oft			ı	
if (22b)m = 1, then (24d						0.5]			
(24d)m= 0.61 0.6 0.6	0.58 0.5	7 0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)
Effective air change rate - e	nter (24a) or (24b) or (24	c) or (24	d) in box	(25)				1
(25)m= 0.61 0.6 0.6	0.58 0.5	7 0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)
3. Heat losses and heat loss	parameter:								
3. Heat losses and heat loss ELEMENT Gross area (m²)	Openings m ²	Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²·ł	
ELEMENT Gross	Openings		m²				K)		
ELEMENT Gross area (m²)	Openings	A ,r	m² x	W/m2	K =	(W/I	K)		K kJ/K
ELEMENT Gross area (m²) Doors	Openings	A ,r	m ² x x1/	W/m2	= 0.04] =	(W/I	K)		K kJ/K (26)
ELEMENT Gross area (m²) Doors Windows Type 1	Openings	A ,r 1.98	m ² x x1/ x1/	W/m2 1 /[1/(1.4)+	0.04] = 0.04] =	1.98 1.92	K)		(kJ/K (26) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2	Openings	A ,r 1.98 1.45 3.21	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] = 0.04] =	1.98 1.92 4.26	K)		(26) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3	Openings	A ,r 1.98 1.45 3.21 1.56	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+	$ \begin{array}{c} \mathbf{K} \\ \hline \\ 0.04 = \\ 0.04 = \\ 0.04 = \\ 0.04 = \\ 0.04 = \\ \end{array} $	(W/I 1.98 1.92 4.26 2.07	K)		(26) (27) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1	Openings	A ,r 1.98 1.45 3.21 1.56 1.38	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7) +	$ \begin{array}{c} \mathbf{K} \\ \hline \\ 0.04 = \\ 0.04 = \\ 0.04 = \\ 0.04 = \\ 0.04 = \\ \end{array} $	(W/I 1.98 1.92 4.26 2.07 2.346			(26) (27) (27) (27) (27) (27b)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2	Openings	A ,r 1.98 1.45 3.21 1.56 1.38	x1/ x1/ x1/ x1/ x1/ x1/ x1/	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7) + /[1/(1.7)	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	(W/I 1.98 1.92 4.26 2.07 2.346 2.244			(26) (27) (27) (27) (27) (27b) (27b)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor	Openings m ²	A ,r 1.98 1.45 3.21 1.56 1.38 1.32	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7)+ /[1/(1.7)+ 0.13	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	(W/I 1.98 1.92 4.26 2.07 2.346 2.244 2.1892			(26) (27) (27) (27) (27b) (27b) (28)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24	Openings m²	A ,r 1.98 1.45 3.21 1.56 1.38 1.32 16.84	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7)+ /[1/(1.7)+ 0.13 0.18	0.04] = 0.04]	1.98 1.92 4.26 2.07 2.346 2.244 2.1892 9.92			(26) (27) (27) (27) (27b) (27b) (28) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56	Openings m² 3.12 1.98	A ,r 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7)+ /[1/(1.7)+ 0.13 0.18 0.18	0.04] = 0.04]	(W/I 1.98 1.92 4.26 2.07 2.346 2.244 2.1892 9.92 5.14			(26) (27) (27) (27) (27b) (27b) (28) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68	3.12 1.98	A ,r 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7) + /[1/(1.7) + 0.13 0.18 0.18	0.04] = 0.04]	(W/I 1.98 1.92 4.26 2.07 2.346 2.244 2.1892 9.92 5.14 11.46			(26) (27) (27) (27) (27b) (27b) (28) (29) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95	3.12 1.98 0 16.57	A ,r 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.56 63.68 5.38	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7)+ /[1/(1.7)+ 0.13 0.18 0.18 0.18 0.18	0.04] = 0.04]	(W/I 1.98 1.92 4.26 2.07 2.346 2.244 2.1892 9.92 5.14 11.46 0.97			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25	3.12 1.98 0 16.57 2.7	A ,r 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38	m² x 1/ x1/ x1/ x1/ 4 x 2 x 3 x 3 x 5 x x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7)+ /[1/(1.7)+ 0.13 0.18 0.18 0.18 0.18 0.18	0.04] = 0.04]	1.98 1.92 4.26 2.07 2.346 2.244 2.1892 9.92 5.14 11.46 0.97			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25 Roof Type2 6.05	3.12 1.98 0 16.57 2.7	A ,r 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.5	m² x1/ x1/ x1/ x1/ x1/ x2 x x x x x x x x x x x x x x x x x x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7)+ /[1/(1.7)+ 0.13 0.18 0.18 0.18 0.18 0.18	0.04] = 0.04]	1.98 1.92 4.26 2.07 2.346 2.244 2.1892 9.92 5.14 11.46 0.97			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30) (30)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25 Roof Type2 6.05 Total area of elements, m²	3.12 1.98 0 16.57 2.7	A ,r 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.56 63.66 5.38 107.5	m²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7)+ /[1/(1	0.04] = 0.04]	(W/I 1.98 1.92 4.26 2.07 2.346 2.244 2.1892 9.92 5.14 11.46 0.97 13.98 0.79			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30) (30) (31)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25 Roof Type2 6.05 Total area of elements, m² Party wall	3.12 1.98 0 16.57 2.7	A ,r 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.5 6.05	m² x 1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1/ x1	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ /[1/(1.4)+ /[1/(1.7)+ /[1/(1	0.04] = 0.04]	(W/I 1.98 1.92 4.26 2.07 2.346 2.244 2.1892 9.92 5.14 11.46 0.97 13.98 0.79			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30) (30) (31)

* 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 Fabric heat loss, W/K = S (A x U) (26) (30) + (32) =(33)76.84 Heat capacity $Cm = S(A \times k)$ ((28) (30) + (32) + (32a) (32e) =(34)15227.24 Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium (35)250 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 15.38 (36)if details of thermal bridging are not known (36) = $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)92.21 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Jan Feb Mar Apr Mav Jun Jul Oct Nov Dec Aug Sen (38)72.43 71.95 69.69 67.29 67.29 66.93 68.05 70.12 71.02 (38)m=72.92 69.26 69.26 Heat transfer coefficient, W/K (39)m = (37) + (38)m 161.48 162.33 165.14 164.65 164.17 161.9 161.48 159 51 159.51 159 14 160.27 163.23 (39)m =(39)Average = $Sum(39)_{1}$ /12= 161.9 Heat loss parameter (HLP), W/m2K (40)m = (39)m ÷ (4)(40)m=1.13 1.13 1.12 1.11 1.09 1.09 1.09 1.11 1.12 11 1 11 (40)Average = $Sum(40)_{1/12}/12=$ 1.11 Number of days in month (Table 1a) Feb Mar May Aug Jan Jun .lul Sep Oct Nov Dec Apr 31 30 31 (41)(41)m=4. Water heating energy requirement: kWh/vear: Assumed occupancy, N 2.93 (42)if TFA > 13.9, N = 1 + 1.76 x [1 - $\exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 103.74 (43)Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Oct Jan Feb Mar Apr May Jun Jul Aug Sep Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) 114.11 109.96 105.81 101.66 97.51 93.36 93.36 97.51 101.66 105.81 109.96 114.11 (44)Total = $Sum(44)_{1}$ 12 = 1244.85 Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m=169.22 148 152.73 133.15 127.76 110.25 102.16 117.23 118.63 138.25 150.92 163.88 1632.19 (45)Total = $Sum(45)_{1}$ 12 = If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 22.2 22.91 20.74 24.58 (46)(46)m=25.38 19 97 19 16 16 54 15.32 17 58 17 79 22 64 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)n Temperature factor from Table 2b 0 (49)

Energy lost from water storage, k	Nh/year			(48) x (49)) =			0		(50)
b) If manufacturer's declared cylin									1	
Hot water storage loss factor from If community heating see section		n/iitre/da	iy)					0		(51)
Volume factor from Table 2a	1.0							0]	(52)
Temperature factor from Table 2b								0		(53)
Energy lost from water storage, k	Nh/year			(47) x (51)) x (52) x (53) =		0]	(54)
Enter (50) or (54) in (55)								0		(55)
Water storage loss calculated for	each month			((56)m = (55) × (41)ı	m				
(56)m= 0 0 0	0 0	0	0	0	0	0	0	0		(56)
If cylinder contains dedicated solar storage	e, (57)m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m= 0 0 0	0 0	0	0	0	0	0	0	0		(57)
Primary circuit loss (annual) from	Table 3							0		(58)
Primary circuit loss calculated for		59)m = ((58) ÷ 36	65 × (41)	m				1	
(modified by factor from Table I	15 if there 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 calculated for each me	onth (61)m =	(60) ÷ 36	65 × (41)m						
	9.32 49.69	46.04	47.58	49.69	49.32	50.96	49.32	50.96		(61)
Total heat required for water heat	ng calculated	l for eacl	h month	(62)m =	0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
	32.47 177.45	156.29	149.74	166.92	167.95	189.21	200.23	214.84		(62)
Solar DHW input calculated using Append	ix G or Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contributi	ion to wate	er heating)	ı	
(add additional lines if FGHRS an	d/or WWHRS	applies	, see Ap	pendix (G)					
(63)m= 0 0 0	0 0	0	0	0	0	0	0	0		(63)
Output from water heater				•				•	•	
(64)m= 220.18 194.03 203.69 18	32.47 177.45	156.29	149.74	166.92	167.95	189.21	200.23	214.84		
	-			Outp	out from w	ater heate	r (annual) ₁	•		
Heat gains from water heating, kV	//- / O O				out iroin wa		(41111441)	12	2223.01	(64)
	vn/montn U.2	5 ´ [0.85	× (45)m	ı + (61)m						(64)
(65)m= 69.01 60.72 63.52 5	66.6 54.9	5 ´ [0.85 48.17	× (45)m 45.86	+ (61)m						(64) (65)
(65)m= 69.01 60.72 63.52 5 include (57)m in calculation of (56.6 54.9	48.17	45.86	51.4	1] + 0.8 x	58.71	+ (57)m 62.51	+ (59)m 67.23]	J
	66.6 54.9 65)m only if c	48.17	45.86	51.4	1] + 0.8 x	58.71	+ (57)m 62.51	+ (59)m 67.23]	J
include (57)m in calculation of (5. Internal gains (see Table 5 ar	66.6 54.9 65)m only if c	48.17	45.86	51.4	1] + 0.8 x	58.71	+ (57)m 62.51	+ (59)m 67.23]	J
include (57)m in calculation of (5. Internal gains (see Table 5 ar Metabolic gains (Table 5), Watts	66.6 54.9 65)m only if c	48.17	45.86	51.4	1] + 0.8 x	58.71	+ (57)m 62.51	+ (59)m 67.23]	J
include (57)m in calculation of (5. Internal gains (see Table 5 ar Metabolic gains (Table 5), Watts Jan Feb Mar	66.6 54.9 65)m only if c	48.17 ylinder is	45.86 s in the 0	51.4 dwelling	51.77 or hot w	58.71 ater is fr	+ (57)m 62.51 rom com	+ (59)m 67.23 munity h]	J
include (57)m in calculation of (5. Internal gains (see Table 5 and Metabolic gains (Table 5), Watts Jan Feb Mar	66.6 54.9 65)m only if cond 5a): Apr May 66.39 146.39	48.17 ylinder is Jun 146.39	45.86 s in the o	51.4 dwelling Aug 146.39	51.77 or hot w Sep	58.71 ater is fr	+ (57)m 62.51 om com	+ (59)m 67.23 munity h]	(65)
include (57)m in calculation of (5. Internal gains (see Table 5 ar Metabolic gains (Table 5), Watts Jan Feb Mar (66)m= 146.39 146.39 146.39 14 Lighting gains (calculated in Appe	66.6 54.9 65)m only if cond 5a): Apr May 66.39 146.39	48.17 ylinder is Jun 146.39	45.86 s in the o	51.4 dwelling Aug 146.39	51.77 or hot w Sep	58.71 ater is fr	+ (57)m 62.51 om com	+ (59)m 67.23 munity h]	(65)
include (57)m in calculation of (5. Internal gains (see Table 5 ar Metabolic gains (Table 5), Watts Jan Feb Mar (66)m= 146.39 146.39 146.39 14 Lighting gains (calculated in Appe	66.6 54.9 65)m only if cond 5a): Apr May 6.39 146.39 ndix L, equati 6.14 12.07	48.17 ylinder is Jun 146.39 ion L9 or 10.19	Jul 146.39 r L9a), a	Aug 146.39 Iso see	Sep 146.39 Table 5	((46)m 58.71 ater is fr Oct 146.39	+ (57)m 62.51 om com Nov 146.39	+ (59)m 67.23 munity h Dec 146.39]	(65)
include (57)m in calculation of (5. Internal gains (see Table 5 ar Metabolic gains (Table 5), Watts Jan Feb Mar (66)m= 146.39 146.39 146.39 14 Lighting gains (calculated in Appel (67)m= 29.52 26.22 21.32 1 Appliances gains (calculated in Apple 146.39 146	66.6 54.9 65)m only if cond 5a): Apr May 6.39 146.39 ndix L, equati 6.14 12.07	48.17 ylinder is Jun 146.39 ion L9 or 10.19	Jul 146.39 r L9a), a	Aug 146.39 Iso see	Sep 146.39 Table 5	((46)m 58.71 ater is fr Oct 146.39	+ (57)m 62.51 om com Nov 146.39	+ (59)m 67.23 munity h Dec 146.39]	(65)
include (57)m in calculation of (5. Internal gains (see Table 5 ar Metabolic gains (Table 5), Watts Jan Feb Mar (66)m= 146.39 146.39 146.39 14 Lighting gains (calculated in Appel (67)m= 29.52 26.22 21.32 1 Appliances gains (calculated in A (68)m= 316.24 319.52 311.25 26	6.6 54.9 65)m only if cond 5a): Apr May 6.39 146.39 ndix L, equati 6.14 12.07 opendix L, eq 03.64 271.42	Jun 146.39 ion L9 or 10.19 uation L	Jul 146.39 r L9a), a 11.01 13 or L1 236.58	Aug 146.39 Iso see 14.31 3a), also 233.3	Sep 146.39 Table 5 19.21 see Ta	Oct 146.39 24.39 ble 5 259.17	+ (57)m 62.51 om com Nov 146.39	+ (59)m 67.23 munity h Dec 146.39]	(65) (66) (67)
include (57)m in calculation of (5. Internal gains (see Table 5 are Metabolic gains (Table 5), Watts Jan Feb Mar (66)m= 146.39 146.39 146.39 14 Lighting gains (calculated in Appel (67)m= 29.52 26.22 21.32 1 Appliances gains (calculated in Appel (68)m= 316.24 319.52 311.25 26 Cooking gains (calculated in Appel	6.6 54.9 65)m only if cond 5a): Apr May 6.39 146.39 ndix L, equati 6.14 12.07 opendix L, eq 03.64 271.42	Jun 146.39 ion L9 or 10.19 uation L	Jul 146.39 r L9a), a 11.01 13 or L1 236.58	Aug 146.39 Iso see 14.31 3a), also 233.3	Sep 146.39 Table 5 19.21 see Ta	Oct 146.39 24.39 ble 5 259.17	+ (57)m 62.51 om com Nov 146.39	+ (59)m 67.23 munity h Dec 146.39]	(65) (66) (67)
include (57)m in calculation of (5. Internal gains (see Table 5 are Metabolic gains (Table 5), Watts Jan Feb Mar (66)m= 146.39 146.39 146.39 14 Lighting gains (calculated in Appel (67)m= 29.52 26.22 21.32 1 Appliances gains (calculated in Appel (68)m= 316.24 319.52 311.25 26 Cooking gains (calculated in Appel	66.6 54.9 65)m only if cond 5a): Apr May 6.39 146.39 ndix L, equat 6.14 12.07 Dependix L, equat 03.64 271.42 Endix L, equat	Jun 146.39 ion L9 or 10.19 uation L 250.54	Jul 146.39 r L9a), a 11.01 13 or L1 236.58 or L15a	Aug 146.39 Iso see 14.31 3a), also 233.3), also se	Sep 146.39 Table 5 19.21 See Table 241.57	Oct 146.39 24.39 ble 5 259.17	+ (57)m 62.51 om com Nov 146.39 28.46	+ (59)m 67.23 munity h Dec 146.39 30.34]	(65) (66) (67) (68)
include (57)m in calculation of (5. Internal gains (see Table 5 are Metabolic gains (Table 5), Watts Jan Feb Mar (66)m= 146.39 146.39 146.39 14 Lighting gains (calculated in Appel (67)m= 29.52 26.22 21.32 1 Appliances gains (calculated in Appel (68)m= 316.24 319.52 311.25 29 Cooking gains (calculated in Appel (69)m= 37.64 37.64 37.64 37.64 3	66.6 54.9 65)m only if cond 5a): Apr May 6.39 146.39 ndix L, equat 6.14 12.07 Dependix L, equat 03.64 271.42 Endix L, equat	Jun 146.39 ion L9 or 10.19 uation L 250.54	Jul 146.39 r L9a), a 11.01 13 or L1 236.58 or L15a	Aug 146.39 Iso see 14.31 3a), also 233.3), also se	Sep 146.39 Table 5 19.21 See Table 241.57	Oct 146.39 24.39 ble 5 259.17	+ (57)m 62.51 om com Nov 146.39 28.46	+ (59)m 67.23 munity h Dec 146.39 30.34]	(65) (66) (67) (68)
include (57)m in calculation of (5. Internal gains (see Table 5 are Metabolic gains (Table 5), Watts Jan Feb Mar (66)m= 146.39 146.39 146.39 14 Lighting gains (calculated in Appel (67)m= 29.52 26.22 21.32 1 Appliances gains (calculated in Appel (68)m= 316.24 319.52 311.25 26 Cooking gains (calculated in Appel (69)m= 37.64	66.6 54.9 65)m only if cond 5a): Apr May 6.39 146.39 ndix L, equati 6.14 12.07 Dependix L, equati 7.64 37.64 3 3	Jun 146.39 ion L9 or 10.19 uation L 250.54 ion L15 37.64	Jul 146.39 r L9a), a 11.01 13 or L1 236.58 or L15a 37.64	Aug 146.39 Iso see 14.31 3a), also 233.3), also se 37.64	Sep 146.39 Table 5 19.21 See Tale 241.57 ee Table 37.64	Oct 146.39 24.39 ble 5 259.17 5 37.64	+ (57)m 62.51 om com Nov 146.39 28.46 281.4	+ (59)m 67.23 munity h Dec 146.39 30.34 302.28]	(65) (66) (67) (68)
include (57)m in calculation of (5. Internal gains (see Table 5 ar Metabolic gains (Table 5), Watts Jan Feb Mar (66)m= 146.39 146.39 146.39 14 Lighting gains (calculated in Appel (67)m= 29.52 26.22 21.32 1 Appliances gains (calculated in Appel (68)m= 316.24 319.52 311.25 29 Cooking gains (calculated in Appel (69)m= 37.64	66.6 54.9 65)m only if cond 5a): Apr May 6.39 146.39 ndix L, equati 6.14 12.07 Dependix L, equati 7.64 37.64 3 3	Jun 146.39 ion L9 or 10.19 uation L 250.54 ion L15 37.64	Jul 146.39 r L9a), a 11.01 13 or L1 236.58 or L15a 37.64	Aug 146.39 Iso see 14.31 3a), also 233.3), also se 37.64	Sep 146.39 Table 5 19.21 See Tale 241.57 See Table 37.64	Oct 146.39 24.39 ble 5 259.17 5 37.64	+ (57)m 62.51 om com Nov 146.39 28.46 281.4	+ (59)m 67.23 munity h Dec 146.39 30.34 302.28]	(65) (66) (67) (68)

Water		g gains (T				_		1					1	7	
(72)m=	92.75	90.35	85.38	78.61	73.8		66.9	61.64	69.	09 71.91	78.91	86.82	90.36]	(72)
Total i		l gains =				_			·	3)m + (69)m + (· , , , , ,		7	
(73)m=	508.43		487.87	458.32	427.2	3	97.54	379.15	386	.62 402.6	432.3	9 466.6	492.91		(73)
	ar gair			. C C	T-51- 0-					ttt			u		
•			•		rable 6a	and		·	tions	to convert to the	e applic		tion.	Caina	
Onenta	ation:	Access F Table 6d	actor	Area m²			Flu Ta	x ble 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northea	st _{0.9x}	0.77	X	1.5	66	X	_	1.28	X	0.63	x	0.7	=	10.76	(75)
Northea	st _{0.9x}	0.77	X	1.5	6	X	2	22.97	x	0.63	×	0.7	=	21.9	(75)
Northea	st _{0.9x}	0.77	x	1.5	66	X		1.38	x	0.63	×	0.7	=	39.46	(75)
Northea	st _{0.9x}	0.77	x	1.5	6	X	6	7.96	x	0.63	×	0.7	=	64.8	(75)
Northea	ıst _{0.9x}	0.77	X	1.5	66	X	9	1.35	x	0.63	×	0.7	=	87.1	(75)
Northea	ıst _{0.9x}	0.77	X	1.5	6	X	9	7.38	x	0.63	×	0.7	=	92.86	(75)
Northea	ıst _{0.9x}	0.77	X	1.5	66	X		91.1	x	0.63	x	0.7	=	86.87	(75)
Northea	ıst _{0.9x}	0.77	X	1.5	66	X	7	2.63	x	0.63	×	0.7	=	69.25	(75)
Northea	ıst _{0.9x}	0.77	X	1.5	6	X		50.42	X	0.63	x	0.7	=	48.08	(75)
Northea	ıst _{0.9x}	0.77	X	1.5	66	X	2	28.07	X	0.63	x	0.7	=	26.76	(75)
Northea	st _{0.9x}	0.77	X	1.5	66	X		14.2	X	0.63	x	0.7		13.54	(75)
Northea	ıst _{0.9x}	0.77	X	1.5	6	X		9.21	X	0.63	x	0.7	=	8.79	(75)
Southea	ast _{0.9x}	0.77	X	1.4	.5	X	3	86.79	X	0.63	x	0.7		114.13	(77)
Southea	ast _{0.9x}	0.77	X	1.4	.5	X	6	32.67	X	0.63	x	0.7		194.41	(77)
Southea	ast _{0.9x}	0.77	X	1.4	·5	X	8	35.75	X	0.63	×	0.7		266	(77)
Southea	ast _{0.9x}	0.77	X	1.4	·5	X	1	06.25	X	0.63	x	0.7		329.59	(77)
Southea	ast _{0.9x}	0.77	X	1.4	·5	X	1	19.01	X	0.63	x	0.7	-	369.17	(77)
Southea	ast _{0.9x}	0.77	X	1.4	·5	X	1	18.15	X	0.63	x	0.7		366.5	(77)
Southea	ast _{0.9x}	0.77	X	1.4	.5	X	1	13.91	X	0.63	x	0.7	=	353.34	(77)
Southea	ast _{0.9x}	0.77	X	1.4	.5	X	1	04.39	x	0.63	x	0.7	=	323.82	(77)
Southea	ast _{0.9x}	0.77	X	1.4	.5	X	(2.85	x	0.63	x	0.7	=	288.02	(77)
Southea	ast _{0.9x}	0.77	X	1.4	.5	X	(9.27	x	0.63	X	0.7	=	214.87	(77)
Southea	ast <mark>0.9</mark> x	0.77	X	1.4	.5	X		4.07	x	0.63	x	0.7	=	136.71	(77)
Southea	ast _{0.9x}	0.77	X	1.4	.5	X	3	31.49	x	0.63	x	0.7	=	97.67	(77)
Northwe	est _{0.9x}	0.77	X	3.2	1	X	_	1.28	X	0.63	x	0.7	-	22.14	(81)
Northwe	est 0.9x	0.77	X	3.2	!1	X	2	22.97	x	0.63	×	0.7	=	45.06	(81)
Northwe	est _{0.9x}	0.77	X	3.2	21	X		1.38	x	0.63	X	0.7	=	81.19	(81)
Northwe	est _{0.9x}	0.77	X	3.2	21	X		7.96	x	0.63	X	0.7	=	133.33	(81)
Northwe	est _{0.9x}	0.77	X	3.2	1	X		1.35	x	0.63	X	0.7	=	179.22	(81)
Northwe	est _{0.9x}	0.77	X	3.2	11	X		7.38	x	0.63	X	0.7	=	191.07	(81)
Northwe	est _{0.9x}	0.77	X	3.2	1	X		91.1	x	0.63	X	0.7	=	178.74	(81)
Northwe	est _{0.9x}	0.77	X	3.2	11	X	-	2.63	x	0.63	X	0.7	=	142.5	(81)

Northwes	t _{0.9x}	0.77	х	3.2	1	X	5	0.42	x	0.63	X	0.7	=	98.93	(81)
Northwes	t _{0.9x}	0.77	x	3.2	1	X	2	8.07	x	0.63	x	0.7		55.07	(81)
Northwes	t _{0.9x}	0.77	х	3.2	1	X	_	14.2	x	0.63	x	0.7	=	27.85	(81)
Northwes	t _{0.9x}	0.77	X	3.2	1	X	9	9.21	x	0.63	X	0.7	=	18.08	(81)
Rooflights	6 0.9x	1	x	1.3	8	X		26	x	0.63	X	0.7	=	14.24	(82)
Rooflights	6 0.9x	1	х	1.3	2	X		26	x	0.63	X	0.7	=	13.62	(82)
Rooflights	6 0.9x	1	х	1.3	8	X		54	x	0.63	X	0.7		29.58	(82)
Rooflights	3 0.9x	1	X	1.3	2	X		54	x	0.63	X	0.7	=	28.29	(82)
Rooflights	3 0.9x	1	X	1.3	8	X		96	X	0.63	X	0.7	=	52.58	(82)
Rooflights	6 0.9x	1	X	1.3	2	X		96	x	0.63	X	0.7		50.3	(82)
Rooflights	6 0.9x	1	Х	1.3	8	X		150	x	0.63	X	0.7	=	82.16	(82)
Rooflights	€ 0.9x	1	Х	1.3	2	X		150	x	0.63	X	0.7	=	78.59	(82)
Rooflights	3 0.9x	1	X	1.3	8	X		192	x	0.63	x	0.7	=	105.16	(82)
Rooflights	3 0.9x	1	X	1.3	2	X		192	х	0.63	x	0.7		100.59	(82)
Rooflights	3 0.9x	1	х	1.3	8	X	:	200	x	0.63	х	0.7		109.54	(82)
Rooflights	0.9x	1	х	1.3	2	X		200	x	0.63	x	0.7		104.78	(82)
Rooflights	3 0.9x	1	х	1.3	8	X		189	x	0.63	x	0.7		103.52	(82)
Rooflights	0.9x	1	х	1.3	2	X		189	х	0.63	x	0.7		99.02	(82)
Rooflights	0.9x	1	х	1.3	8	X		157	x	0.63	x	0.7		85.99	(82)
Rooflights	3 0.9x	1	Х	1.3	2	X		157	x	0.63	X	0.7		82.25	(82)
Rooflights	0.9x	1	х	1.3	8	X		115	x	0.63	x	0.7	_ =	62.99	(82)
Rooflights	3 0.9x	1	X	1.3	2	X		115	x	0.63	x	0.7		60.25	(82)
Rooflights	3 0.9x	1	X	1.3	8	X		66	х	0.63	x	0.7	=	36.15	(82)
Rooflights	3 0.9x	1	X	1.3	2	X		66	x	0.63	x	0.7		34.58	(82)
Rooflights	3 0.9x	1	X	1.3	8	X		33	X	0.63	×	0.7	= =	18.07	(82)
Rooflights	3 0.9x	1	X	1.3	2	X		33	x	0.63	x	0.7	=	17.29	(82)
Rooflights	3 0.9x	1	X	1.3	8	X		21	x	0.63	x	0.7		11.5	(82)
Rooflights	3 0.9x	1	x	1.3	2	X		21	X	0.63	×	0.7	= =	11	(82)
	<u> </u>													L	
Solar gai	ins in w	/atts, ca	lculated	for each	n montl	h			(83)m	= Sum(74)m	(82)m			_	
(83)m= 1	174.89	319.24	489.52	688.46	841.24	8	64.75	821.49	703	.81 558.27	367.4	2 213.46	147.04		(83)
Total gai	ns – int	ternal a	nd solar	(84)m =	(73)m	+ (83)m	, watts						_	
(84)m= 6	883.32	825.25	977.39	1146.78	1268.45	5 1:	262.3	1200.64	1090	960.87	799.8	1 680.06	639.95		(84)
7. Mear	n intern	al temp	erature (heating	seaso	n)									
Temper	rature d	luring h	eating pe	eriods in	the liv	ing	area f	rom Tal	ble 9,	Th1 (°C)				21	(85)
Utilisatio	on facto	or for ga	ains for li	ving are	a, h1,r	n (s	ee Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May	\perp	Jun	Jul	A	ug Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.9		0.74	0.57	0.6	4 0.89	0.99	1	1		(86)
Mean ir	nternal	tempera	ature in I	iving are	ea T1 (1	follo	w ste	ps 3 to 7	7 in T	able 9c)		-		_	
	19.66	19.82	20.09	20.45	20.77	_	20.94	20.99	20.		20.42	19.98	19.64	7	(87)
∟ Temner	rature d	lurina h	eating n	eriods in	rest o	f dw	ellina	from Ta	hle (), Th2 (°C)	•		•	_	
	19.98	19.98	19.98	19.99	20	_	20.01	20.01	20.		20	19.99	19.99	7	(88)
` '/							-					1		_	. ,

l Itilicati	ion fact	tor for a	aine for I	rest of di	welling, I	n2 m (se	a Tahla	02)						
(89)m=	1	1	0.99	0.96	0.86	0.65	0.45	0.52	0.83	0.98	1	1		(89)
` ' L		•			of dwelli						<u> </u>			, ,
	18.18	18.41	18.8	19.34	19.76	19.97	20	20	19.86	19.3	18.65	18.15		(90)
(00)			1010	10101					!	LA = Livin	!		0.38	(91)
								. /4 61	A) TO			´ [0.00	
	nternal	18.94	19.29	r the wh	ole dwel	20.34	LA × 11	+ (1 – fL 20.37		19.72	19.15	18.71		(92)
` ′									20.23		19.15	10.71		(92)
· · · · · -	18.73	18.94	19.29	19.76	tempera 20.14	20.34	20.37	20.37	20.23	19.72	19.15	18.71		(93)
` '			uirement		20.14	20.34	20.37	20.37	20.23	19.72	19.13	10.71		(00)
•		·			o obtoin	ad at et	on 11 of	Table O	o so tha	t Ti m=/	76)m an	d re-calc	ulato	
			or gains			eu ai sii	ер птог	Table 31	J, 50 IIIa	ıt 11,111 – (<i>i</i> Ojili ali	u re-caic	uiale	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisati	ion fact	tor for g	ains, hm	:										
(94)m=	1	1	0.99	0.96	0.87	0.68	0.49	0.56	0.85	0.98	1	1		(94)
Useful	gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	682.48	822.49	966.87	1099.75	1099.63	861.01	593.78	615.95	815.26	784.1	678.16	639.39		(95)
Monthl	y avera	ige exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
_					erature, l		=[(39)m	x [(93)m	– (96)m]		-		
(97)m= 2	2383.68	2311.76	2099.37	1757.81	1362.77	914.82	601.94	631.58	982.59	1473.39	1956.22	2368.78		(97)
_					nonth, k\	Vh/mon	th = 0.02	24 x [(97)m – (95			· · · · · · · · · · · · · · · · · · ·		
(98)m= 1	1265.69	1000.79	842.58	473.8	195.78	0	0	0	0	512.83	920.2	1286.67		_
								Tota	l per year	(kWh/year	·) = Sum(9	8) _{15,912} =	6498.34	(98)
Space	heating	g require	ement in	kWh/m²	/year								44.48	(99)
9a. Enei	rgy req	uiremer	nts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space	heatin	g:										_		_
Fractio	n of sp	ace hea	it from s	econdar	y/supple	mentary	system						0	(201)
Fractio	n of sp	ace hea	it from m	nain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fractio	n of tot	al heatii	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =		Ī	1	(204)
Efficier	ncy of n	nain spa	ace heat	ing syste	em 1							Ì	93.4	(206)
Efficier	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	 ear
Space					d above)			1 19					, -	
· -	- i	1000.79	842.58	473.8	195.78	0	0	0	0	512.83	920.2	1286.67		
ــ : 211)m	= {[(98)	m x (20	4)] } x 1	00 ÷ (20)6)					l	l	<u> </u>		(211)
· · · -	1355.13		902.12	507.28	209.61	0	0	0	0	549.07	985.23	1377.59		(= : :)
L								Tota	l I (kWh/yea				6957.54	(211)
Snace	heating	n fuel (e	econdar	v) k\//h/	month				•	•	10,10. 12	L		 ` ′
= {[(98)r		•		• •										
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
L	!						!	Tota	l (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)
												L		_

Water heating									
Output from water heater (calculated abov 220.18 194.03 203.69 182.47 17	e) 7.45 156.29	149.74	166.92	167.95	189.21	200.23	214.84]	
Efficiency of water heater					ļ.			80.3	(216)
(217)m= 88.75 88.59 88.24 87.35 8	5.3 80.3	80.3	80.3	80.3	87.44	88.41	88.8		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m	•		•				•	•	
` '	8.04 194.63	186.47	207.87	209.15	216.4	226.47	241.94		
			Tota	I = Sum(2	19a) ₁₁₂ =			2597.84	(219)
Annual totals					k'	Wh/yeaı	r	kWh/year	7
Space heating fuel used, main system 1								6957.54	_
Water heating fuel used								2597.84	
Electricity for pumps, fans and electric kee	p-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								521.37	(232)
12a. CO2 emissions – Individual heating	systems incl	uding mi	cro-CHF)					
		ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	
Space heating (main system 1)	(21	1) x			0.2	16	=	1502.83	(261)
Space heating (secondary)	(21	5) x			0.5	19	=	0	(263)
Water heating	(21	9) x			0.2	16	=	561.13	(264)
Space and water heating	(26	1) + (262)	+ (263) + (264) =				2063.96	(265)
Electricity for pumps, fans and electric kee	p-hot (23	1) x			0.5	19	=	38.93	(267)
Electricity for lighting	(23)	2) x			0.5	19	=	270.59	(268)
Total CO2, kg/year				sum o	of (265) (2	271) =		2373.48	(272)

TER =

(273)

16.25

Appendix B Energy Assessment 51 Calthorpe Street

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

			Hoor	ataila:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 20)12	User D	Strom Softwa	_				0016363 on: 1.0.4.26	
	FI 104 F4 0 III			Address		-Lean				
Address:	Flat 01, 51 Calthor	rpe Street	, LOND	ON, WC	IX UHH					
Overall dwelling din	iensions.		۸ra	a(m²)		۸۷ H۵	ight(m)		Volume(m ³	a
Ground floor					(1a) x		2.7	(2a) =	193.32) (3a)
Total floor area TFA = ((1a)+(1b)+(1c)+(1d)+(1	le)+(1r	1)	71.6	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	(3n) =	193.32	(5)
2. Ventilation rate:										
	heating	secondar 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	fans				Ī	3	X	10 =	30	(7a)
Number of passive ven	ts				Ē	0	x	10 =	0	(7b)
Number of flueless gas	fires				F	0	X 4	40 =	0	(7c)
Transaction and the second second					L					(, o)
								Air ch	nanges per ho	our
Infiltration due to chimn	eys, flues and fans =	(6a)+(6b)+(7	'a)+(7b)+(7c) =	Γ	30		÷ (5) =	0.16	(8)
If a pressurisation test has	s been carried out or is inten	ded, procee	d to (17), d	otherwise o	continue fr	om (9) to	(16)			-
Number of storeys in	the dwelling (ns)								0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timbe present, use the value corre				•	uction			0	(11)
	nings); if equal user 0.35	esponding to	ine great	ei waii aie	a (anei					
If suspended wooder	n floor, enter 0.2 (unse	aled) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, e	enter 0.05, else enter 0)							0	(13)
-	ws and doors draught	stripped							0	(14)
Window infiltration				0.25 - [0.2	` '	•	(4-)		0	(15)
Infiltration rate	50 1:			(8) + (10)					0	(16)
If based on air permeal	e, q50, expressed in cu		•	-	•	etre of e	envelope	area	5	(17)
·	lies if a pressurisation test h					is beina u	sed		0.41	(18)
Number of sides shelte	·			, , , .	,	3 .			2	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	 9)] =			0.85	(20)
Infiltration rate incorpor	ating shelter factor			(21) = (18) x (20) =				0.34	(21)
Infiltration rate modified	I for monthly wind spee	ed							_	
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	1	
1.27	0 1.1	0.00	L 3.55	1 3.02		L '	1 '. '2	L ''o	J	

		t t	(anown	119 101 01	icitci ai	d wind s	peeu) –	(2 1a) x	(ZZa)III		1		1	
If mechanical ventilation:			-					0.32	0.34	0.37	0.39	0.4	j	
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) = a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 24b)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			_	ale ioi i	пе аррп	cable ca	3E						0	(23
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) + 100] 24a)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	If exhaust air h	eat pump usir	ng Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)				(23
24a)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	If balanced with	n heat recover	ry: effici	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(23
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) 24b)m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	a) If balance	ed mechani	ical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22	2b)m + (2	23b) × [1 – (23c)	÷ 100]	
24bjm= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) 24c)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	b) If balance	ed mechani	ical ve	ntilation	without	heat red	overy (N	ЛV) (24b)m = (22	2b)m + (2	23b)		•	
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) 24e/m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 d) If natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² × 0.5] 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 Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (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 3. Heat losses and heat loss parameter: ELEMENT Gross area (m²) Paris Net Area W/m²/k (W/k)	24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5] 24d)m = 0.6	,				•	•				5 × (23b))			
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5] 24d)m = 0.6	24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) 25)m=										0.5]		•	•	
3. Heat losses and heat loss parameter: ELEMENT Gross Openings area (m²) Particular (W/K) RJ/m²-K RJ/	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		(24
3. Heat losses and heat loss parameter: ELEMENT Gross Openings Net Area W/m2K (W/K) k-value kJ/m²-K kJ/l Doors 3 x 1.6 = 4.8 Windows Type 1 2.36 x1/[1/(1.6) + 0.04] = 3.55 Windows Type 2 1.93 x1/[1/(1.6) + 0.04] = 2.9 Windows Type 3 1.8 x1/[1/(1.6) + 0.04] = 2.71 Floor 71.6 x 0.12 = 8.592	Effective air	change ra	ite - en	iter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)	-		-	•	
Net Area U-value A X U k-value KJ/m²-K KJ/m²	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
Net Area U-value A X U K-value KJ/m²-K KJ/l	3. Heat losse	s and heat	t loss r	paramete	er:									
Vindows Type 1 Vindows Type 2 1.93 x1/[1/(1.6) + 0.04] = 3.55 Vindows Type 3 1.8 x1/[1/(1.6) + 0.04] = 2.9 Vindows Type 3 1.8 x1/[1/(1.6) + 0.04] = 2.71 Valls Type 1 52.87 13.38 39.49 x 0.23 9.08 Valls Type 2 32.34 0 32.34 x 0.12 3.74 Valls Type 2 32.34 0 32.34 x 0.12 3.74 Valls Type 2 32.34 0 32.34 x 0.12 3.74 Valls Type 2 3.74 Valls Type 2 3.74 Valls Type 2 3.74 Valls Type 3 Valls Type 3 Valls Type 3 Valls Type 3 Valls Type 3 Valls Type 3 Valls Type 4 3.25 Valls Type 5 Valls Type 5 Valls Type 6 Valls Type 6 Valls Type 7 Valls Type 8 Valls Type 9 Valls Typ		Gross	İ	Openin	gs						〈)			A X k kJ/K
Vindows Type 2	oors (3	х	1.6	= [4.8				(26
Simple S	Vindows Type	e 1				2.36	x1.	/[1/(1.6)+	0.04] =	3.55				(27
Total area of elements, m2	Vindows Type	e 2				1.93	x1.	/[1/(1.6)+	0.04] =	2.9				(27
Valls Type 1 52.87 13.38 39.49 × 0.23 = 9.08	Vindows Type	e 3				1.8	x1.	/[1/(1.6)+	0.04] =	2.71				(27
Walls Type2 32.34 0 32.34 \times 0.12 = 3.74	loor					71.6	x	0.12	i 	8.592				(28
Total area of elements, m² 20.9 x 0 = 0 Party ceiling 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 Fabric heat loss, W/K = S (A x U) Heat capacity Cm = S(A x k) (26) (30) + (32) = 41.83 Heat capacity Cm = S(A x k) (128) (30) + (32) + (32a) (32e) = 16100.47 Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f and be used instead of a detailed calculation. Thermal bridges: S (L x Y) calculated using Appendix K 4 details of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss (33) + (36) = 65.35	Valls Type1	52.87		13.3	3	39.49	x	0.23	-	9.08			7 F	(29
Party ceiling 71.6 Party ceiling 82. Par	Valls Type2	32.34	Ħ	0	=	32.34	x	0.12	= i	3.74	=		7 F	(29
Party ceiling 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 Fabric heat loss, W/K = S (A x U) (26) (30) + (32) = (18) (30) + (32) + (32a) (32e) = (18) (30	otal area of e	elements, m	n²			156.8	1							(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 Fabric heat loss, W/K = S (A x U) Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 16100.47 Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f and be used instead of a detailed calculation. Thermal bridges: S (L x Y) calculated using Appendix K If details of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss (33) + (36) = 65.35	arty wall					20.9	x	0		0			$\neg \vdash$	(32
* include the areas on both sides of internal walls and partitions Fabric heat loss, W/K = S (A x U) Heat capacity Cm = S(A x k) Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f than be used instead of a detailed calculation. Thermal bridges: S (L x Y) calculated using Appendix K If details of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss (26) (30) + (32) = 41.83 Indicative Value: Medium 250 23.52 (33) + (36) = 65.35	arty ceiling					71.6							i i	(32
Heat capacity Cm = S(A x k) ((28) $(30) + (32) + (32a)$ $(32e) = 16100.47$ Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f and be used instead of a detailed calculation. Thermal bridges: S (L x Y) calculated using Appendix K If details of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss (33) + (36) = 65.35							ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	1 3.2	
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m²K Indicative Value: Medium 250 For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f an be used instead of a detailed calculation. Thermal bridges: S (L x Y) calculated using Appendix K 23.52 Idetails of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss (33) + (36) = 65.35	abric heat los	ss, W/K = S	S (A x	U)				(26) (30)) + (32) =				41.83	3 (3:
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 **details of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss **(33) + (36) = 65.35	leat capacity	Cm = S(A	xk)						((28)	(30) + (32	2) + (32a)	(32e) =	16100.	47 (34
an be used instead of a detailed calculation. Thermal bridges: S (L x Y) calculated using Appendix K I details of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss (33) + (36) = 65.35	hermal mass	parameter	r (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35
$\frac{1}{2}$ details of thermal bridging are not known (36) = 0.05 x (31) Total fabric heat loss (33) + (36) = 65.35	ŭ				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
(33) + (36) =	hermal bridg	es : S (L x `	Y) cal	culated ı	using Ap	pendix I	<						23.52	2 (3
			e not kn	own (36) =	= 0.05 x (3	1)			(00)	(20)				 1.
remination near ioss calculated monthly (38)m = 0.33 × (25)m × (5)				المائدة مسا					, ,	, ,	0E\#= - (E\		65.35	5 (3
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec								_				<u> </u>	1	

											l	ı	(2.2)
(38)m= 38.05	37.81	37.58	36.48	36.27	35.31	35.31	35.14	35.68	36.27	36.69	37.12		(38)
Heat transfer of							l		= (37) + (37)			1	
(39)m= 103.4	103.16	102.92	101.82	101.62	100.66	100.66	100.48	101.03	101.62	102.03	102.47	404.00	7(20)
Heat loss para	meter (F	HLP), W/	′m²K						4verage = = (39)m ÷	Sum(39) ₁ (4)	12 /12=	101.82	(39)
(40)m= 1.44	1.44	1.44	1.42	1.42	1.41	1.41	1.4	1.41	1.42	1.43	1.43		_
Number of dev	o in moi	ath (Tabl	lo 1a)					,	Average =	Sum(40) ₁	12 /12=	1.42	(40)
Number of day Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30 30	31	30	31		(41)
(41)	20	01		01	00	01		00					(11)
4 10/-1	•										1.3.4.0-7		
4. Water heat	ing ener	gy requi	rement:								kWh/ye	ear:	
Assumed occu											28		(42)
if TFA > 13.9 if TFA £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.	.9)			
Annual averag	•	ater usac	ne in litre	s per da	ıv Vd av	erage =	(25 x N)	+ 36		89	3.45		(43)
Reduce the annua	ıl average	hot water	usage by	5% if the a	welling is	designed t			se target o		1.43		(10)
not more that 125	litres per p	person per	day (all w	ater use, l	not and co	ld)						1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)					ı	
(44)m= 97.3	93.76	90.22	86.68	83.15	79.61	79.61	83.15	86.68	90.22	93.76	97.3		_
Energy content of	hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x E	OTm / 3600			m(44) _{1 12} = ables 1b, 1		1061.44	(44)
(45)m= 144.29	126.2	130.22	113.53	108.94	94	87.11	99.96	101.15	117.88	128.68	139.74		
							<u> </u>	-	Total = Su	m(45) _{1 12} =	·	1391.71	(45)
If instantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)					_
(46)m= 21.64	18.93	19.53	17.03	16.34	14.1	13.07	14.99	15.17	17.68	19.3	20.96		(46)
Water storage		مالم مال مالت			/// IDC	-4			1			` 	
Storage volum	, ,					_		ame ves	sei		0		(47)
If community hotherwise if no	•			•			` '	are) ante	ar 'Ω' in <i>(</i>	47)			
Water storage		not wate	i (uno n	iciuues i	iistaiitai	icous co	ווטט וטוווע	cra) crite	51 0 111 (- 11)			
a) If manufact		eclared le	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature fa	actor fro	m Table	2b								0		(49)
Energy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
b) If manufact			-										
Hot water stora	_			e 2 (kW	h/litre/da	ıy)					0		(51)
If community h Volume factor	•		on 4.3										(50)
Temperature fa			2h								0		(52) (53)
•				oor			(47) v (51)	V (52) V (E2) -				
Energy lost fro Enter (50) or (_	, KVVII/yt	zai			(47) x (51)	, ^ (JZ) X (- -		0		(54) (55)
Water storage	, ,	•	or each	month			((56)m = (55) × (41)ı	m		U .		(55)
					_				ı		_		(EG)
(56)m= 0 If cylinder contains	0 dedicate	0 d solar sto	0 rage (57)	0 m = (56)m	0 x [(50) – (0 H11)] ÷ (5)	0) else (5	0 7)m = (56)	0 m where (0 H11) is fro	0 m Append	ix H	(56)
							· · · · ·						(F3)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(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 thermo	, , , , , , , , , , , , , , , , , , , 	1 (50)
(59)m= 0 0 0 0 0 0 0 0 0	0 0	(59)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m		•
(61)m= 49.58 43.16 45.98 42.75 42.37 39.26 40.57 42.37 42.75 45.98	46.24 49.58	(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= 193.87 169.35 176.2 156.28 151.31 133.26 127.68 142.33 143.9 163.86	174.92 189.32	(62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribut	ion to water heating)	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	1	1
(63)m= 0 0 0 0 0 0 0 0 0	0 0	(63)
Output from water heater	, , , , , , , , , , , , , , , , , , , ,	1
(64)m= 193.87 169.35 176.2 156.28 151.31 133.26 127.68 142.33 143.9 163.86	174.92 189.32	
Output from water heate		1922.28 (64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m	- 	¬ ¯
(65)m= 60.37 52.75 54.79 48.44 46.81 41.07 39.11 43.83 44.32 50.69	54.35 58.86	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is fi	rom community h	neating
5. Internal gains (see Table 5 and 5a):		
Metabolic gains (Table 5), Watts		1
Jan Feb Mar Apr May Jun Jul Aug Sep Oct	Nov Dec	
(66)m= 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22	114.22 114.22	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5		•
(67)m= 19.08 16.95 13.78 10.43 7.8 6.58 7.11 9.25 12.41 15.76	18.4 19.61	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5		,
(68)m= 201 203.09 197.83 186.64 172.52 159.24 150.37 148.29 153.54 164.73	178.86 192.13	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5		_
(69)m= 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42	34.42 34.42	(69)
Pumps and fans gains (Table 5a)		_
(70)m= 3 3 3 3 3 3 3 3 3 3 3 3	3 3	(70)
Losses e.g. evaporation (negative values) (Table 5)		
(71)m= -91.37 -91.37 -91.37 -91.37 -91.37 -91.37 -91.37 -91.37 -91.37	-91.37 -91.37	(71)
Water heating gains (Table 5)		•
(72)m= 81.15 78.5 73.65 67.27 62.92 57.04 52.56 58.91 61.56 68.13	75.48 79.11	(72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m$	71)m + (72)m	
(73)m= 361.49 358.8 345.53 324.61 303.5 283.14 270.31 276.71 287.78 308.89	333 351.12	(73)
6. Solar gains:		
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applical	ole orientation.	
Orientation: Access Factor Area Flux g_ Table 6d m² Table 6a Table 6b T	FF able 6c	Gains (W)
Southeast 0.9x	0.7	53.07 (77)
Southeast 0.9x 0.77 x 2.36 x 62.67 x 0.63 x	0.7	90.41 (77)

Jan	Feb	Mar	1	Apr May	Ť	Jun	Jul	Α	ug	Sep	Oc	t Nov	Dec			
Temperature Utilisation fac	_	_			_			oie 9	, Ih1	i (°C)				L	21	(85)
7. Mean internal temperature (heating season) Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)																
(84)m= 448.12	510.77	565.21		16.5 648.4		33.44	604.76	570	.39	532.27	480.0	2 437.56	424.73	3		(84)
Total gains – ir			·		<u> </u>									_		
(83)m= 86.63	151.98	219.68	1	1.88 344.9		50.31	334.44	293	.68	244.5	171.1	3 104.56	73.61			(83)
Solar gains in	watts, ca	alculate	d for	each mont	h_			(83)m	1 = Su	ım(74)m	(82)m	<u> </u>				
North West U.9X	0.77	x	` <u>L</u>	1.93	X		9.21	X		0.63	X	0.7	=	L	10.87	(81)
Northwest 0.9x	0.77	×	-	1.93	X	-	4.2	l x l v		0.63	」 ×	0.7	=	⁼	16.75	(81)
Northwest 0.9x	0.77	×	\vdash	1.93	X		8.07] X] v		0.63	ן ×	0.7	╡:	F	33.11	(81)
Northwest 0.9x	0.77	×	=	1.93	X	-	0.42	X		0.63	X	0.7	_	F	59.48	(81)
Northwest 0.9x	0.77	×	\vdash	1.93	X	-	2.63	X		0.63	X	0.7	_ -	F	85.68	(81)
Northwest 0.9x	0.77	×	+	1.93	X	_	91.1	X		0.63	X	0.7	_ •	F	107.47	(81)
Northwest 0.9x	0.77	×	-	1.93	X	-	7.38	X		0.63	X	0.7	=	• <u> </u>	114.88	(81)
Northwest 0.9x	0.77	×		1.93	X	9	1.35	X		0.63	X	0.7	•	֓֞֞֞֞֜֞֩֓֞֩֓֞֩֞֩֓֓֓֓֞֜֩֞֩֓֓֡֡֡֡	107.76	(81)
Northwest _{0.9x}	0.77	×		1.93	X	6	7.96	x		0.63	X	0.7	-	• [80.17	(81)
Northwest _{0.9x}	0.77	×		1.93	X	4	1.38	x		0.63	X	0.7		<u> </u>	48.81	(81)
Northwest _{0.9x}	0.77	х		1.93	X	2	2.97	X		0.63	X	0.7	=	• <u>[</u>	27.09	(81)
Northwest _{0.9x}	0.77	х		1.93	X	1	1.28	X		0.63	X	0.7	=	• [13.31	(81)
Southwest _{0.9x}	0.77	х		1.8	X	3	1.49]		0.63	X	0.7	=	• [17.32	(79)
Southwest _{0.9x}	0.77	х		1.8	X	4	4.07]		0.63	X	0.7	=	• [24.24	(79)
Southwest _{0.9x}	0.77	×		1.8	X	6	9.27]		0.63	X	0.7		• [38.1	(79)
Southwest _{0.9x}	0.77	×		1.8	X	9	2.85]		0.63	X	0.7	=	• [51.08	(79)
Southwest _{0.9x}	0.77	Х		1.8	X	10	04.39]		0.63	X	0.7	=		57.43	(79)
Southwest _{0.9x}	0.77	×		1.8	X	1	13.91]		0.63	X	0.7		֓֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֞֡֞֞֞֡	62.66	(79)
Southwest _{0.9x}	0.77	×		1.8	x	1	18.15	j		0.63	X	0.7		֓֞֞֞֞֞֞֞֞֞֞֞֞֜֞֞֞֞֓֓֡֞֞֞֩֓֡֓֞֡֞֩֞֡֡	64.99	(79)
Southwest _{0.9x}	0.77	х		1.8	X	1	19.01	Ī		0.63	x	0.7		• <u> </u>	65.47	(79)
Southwest _{0.9x}	0.77	×		1.8	X	10	06.25	j		0.63	X	0.7	一 -	• [58.45	(79)
Southwest _{0.9x}	0.77	x	F	1.8	X		5.75	ĺ		0.63	X	0.7		<u> </u>	47.17	(79)
Southwest _{0.9x}	0.77	x	H	1.8	X		2.67	,]		0.63	X	0.7	╡:	.	34.48	(79)
Southwest _{0.9x}	0.77	x	⊨	1.8	X	_	6.79]	<u> </u>	0.63	X	0.7	╡:	. 	20.24	(79)
Southeast 0.9x	0.77	^	+	2.36	x		1.49] ^] x		0.63	d x	0.7	_	-	45.42	(77)
Southeast 0.9x	0.77	^	H	2.36	X		4.07] ^] x		0.63		0.7	╣.	늗	63.57	(77)
Southeast 0.9x	0.77	^	⊨	2.36	X		9.27] ^] _x		0.63	-	0.7	╡:	F	99.92	(77)
Southeast 0.9x	0.77	^ ^	\vdash	2.36	X		2.85] ^] x		0.63	 	0.7	╡:	F	133.94](77)
Southeast 0.9x	0.77	^	!=	2.36	X		04.39] ^] x		0.63	-	0.7	╡:	F	150.58	\\ \(\begin{array}{c} \(\begin{array}{c} \(\begin{array}{c} \(\begin{array}{c} \(\begin{array}{c} \(\begin{array}{c} \(\begin{array}{c} \\ \begin{array}{c} \(\begin{array}{c} \\ \end{array} \end{array} \]
Southeast 0.9x	0.77	^	⊨	2.36	X		13.91] ^] _x		0.63	-	0.7	╡:	F	164.31	(77)
Southeast 0.9x	0.77	^	\vdash	2.36	X		18.15] ^] x		0.63	 	0.7	=	L F	170.43](77)
Southeast 0.9x	0.77	^	H	2.36	X		19.01] ^] x	<u> </u>	0.63	-	0.7	╡.	닏	171.67	(77)
Southeast 0.9x	0.77	^	⊨	2.36	X		06.25] ^] _x		0.63	$\frac{1}{x}$	0.7	╡.	F	153.27	(77)
Southeast 0.9x	0.77	Х		2.36	X	0	5.75	x		0.63	X	0.7		Г	123.7	(77)

(86)m=	1	1	0.99	0.97	0.93	0.82	0.67	0.72	0.9	0.98	1	1		(86)
Mean in	iternal t	emper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	' in Tabl	e 9c)					
	19.41	19.56	19.84	20.21	20.57	20.84	20.95	20.93	20.73	20.27	19.77	19.38		(87)
Tempera	ature d	urina h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9 T	h2 (°C)	•	•			
	19.73	19.73	19.73	19.75	19.75	19.76	19.76	19.76	19.75	19.75	19.74	19.74		(88)
Utilisatio	on foots	or for a	nino for i	root of di	volling	h2 m (oc	o Tabla	00)	<u> </u>	<u> </u>		<u> </u>		
(89)m=	1	0.99	0.99	0.96	0.89	0.72	0.51	0.56	0.84	0.97	0.99	1		(89)
								<u> </u>	l	l	1 0.00			()
Mean in		17.87	18.26	the rest	of dwelli 19.31	ng 12 (fo	ollow ste	ps 3 to 19.73	/ in Tabl		18.18	17.6		(90)
(90)m= 1	17.63	17.07	10.20	10.01	19.51	19.00	19.74	19.73		18.9	g area ÷ (4	17.6	0.22	(91)
									'	ILA - LIVIII	ig alca · (-	- ,, –	0.32	(91)
Mean in						· ·			i -				İ	
` ′	18.21	18.42	18.78	19.26	19.72	20.03	20.13	20.12	19.92	19.34	18.7	18.18		(92)
Apply ac										·	107	10.10	Ī	(02)
` ′	18.21	18.42	18.78	19.26	19.72	20.03	20.13	20.12	19.92	19.34	18.7	18.18		(93)
8. Space					o obtain	od at et	on 11 of	Table 0	h co tha	t Ti m-/	76)m an	d ro colo	sulato	
the utilis				•		ieu al Sil	з р 11 01	i able 9i	0, 50 liia	ıt 11,111 – (10)III aII	d re-calc	uiale	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisatio	on facto		ains, hm		,		<u> </u>		· · ·	!				
	0.99	0.99	0.98	0.96	0.89	0.75	0.56	0.61	0.85	0.97	0.99	1		(94)
Useful g	gains, h	mGm ,	W = (94	1)m x (84	4)m								ı	
(95)m= 4	45.83	506.04	554.57	588.83	576.89	473.4	339.77	350.56	451.6	463.37	433.51	422.99		(95)
Monthly	averaç	ge 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 los	ss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			•	
(97)m= 14	138.28	1394.47	1263.44	1055.34	814.8	547.06	355.74	374.06	587.59	888.49	1183.25	1432.61		(97)
Space h	Ť						h = 0.02)m – (95	- `	 		I	
(98)m= 73	38.39	597.02	527.4	335.89	177	0	0	0	0	316.29	539.81	751.15		_
								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	3982.94	(98)
Space h	neating	require	ement in	kWh/m²	/year								55.63	(99)
9a. Energ	gy requ	iremen	ts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space h	neating	j :					J							
Fraction	of spa	ce hea	t from se	econdar	y/supple	mentary	system						0	(201)
Fraction	of spa	ce hea	t from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction	of tota	ıl heatir	ng from	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficienc	cy of m	ain spa	ce heat	ing syste	em 1								90.3	(206)
Efficienc	-	•				a svstem	າ. %						0	(208)
		Feb	Mar			Jun	Jul	Λιια	Son	Oct	Nov	Dec	kWh/ye	
Space h	Jan			Apr	May		Jui	Aug	Sep	Oct	INOV	Dec	Kvvii/ye	ai
· -	Ť	597.02	527.4	335.89	177	0	0	0	0	316.29	539.81	751.15		
										L	1	I		(211)
(211)m =	- i	661.15	4)] } X I 584.05	371.97	196.02	0	0	0	0	350.26	597.79	831.84		(211)
[]		VO 1. 10	004.00	0, 1.91	100.02				_		211) _{15.10. 12}		4410.79	(211)
								. 0.00	(,	1 1/15,10. 12	2	4410.78	(~11)

Space heating fuel (secondary), kWh/month									
= {[(98)m x (201)]} x 100 ÷ (208)			•					1	
(215)m= 0 0 0 0 0	0	0	0 Tota	0 L (k\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	0 ar) =Sum(2	0	0		7(245)
Maker beating			Tota	ii (KVVII/yea	ai) =3uiii(2	213) _{15,10. 12}	2	0	(215)
Water heating Output from water heater (calculated above)									
193.87 169.35 176.2 156.28 151.31	133.26	127.68	142.33	143.9	163.86	174.92	189.32		
Efficiency of water heater								81	(216)
(217)m= 88.19 88.07 87.78 87.12 85.76	81	81	81	81	86.9	87.83	88.26		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m	•						•	•	
(219)m= 219.82 192.3 200.74 179.38 176.43	164.52	157.63	175.72	177.66	188.57	199.15	214.5		
	•		Tota	I = Sum(2	19a) ₁₁₂ =		•	2246.41	(219)
Annual totals					k\	Wh/year	r	kWh/yea	_
Space heating fuel used, main system 1								4410.79	
Water heating fuel used								2246.41	
Electricity for pumps, fans and electric keep-hot								_	
central heating pump:							30		(2300
Total electricity for the above, kWh/year			sum	of (230a)	(230g) =			30	(231)
Electricity for lighting								336.96	(232)
12a. CO2 emissions – Individual heating system	ms includ	ding mi	cro-CHP)					_
	Ene kWł	ergy h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	
Space heating (main system 1)	(211)) X			0.2	16	=	952.73	(261)
Space heating (secondary)	(215)) X			0.5	19	=	0	(263)
Water heating	(219)) x			0.2	16	=	485.23	(264)
Space and water heating	(261)	+ (262) -	+ (263) + (264) =				1437.96	(265)
Electricity for pumps, fans and electric keep-hot	(231)) x			0.5	19	=	15.57	(267)
Electricity for lighting	(232)) x			0.5	19	=	174.88	(268)
Total CO2, kg/year				sum c	of (265) (2	271) =		1628.41	(272)
Dwelling CO2 Emission Rate				(272)	÷ (4) =			22.74	(273)

El rating (section 14)

			Jser Detai	S:					
Assessor Name:	Chris Hocknell			oma Nur				016363	
Software Name:	Stroma FSAP 2	_		tware Ve			Versio	n: 1.0.4.26	
	FI 1 00 54 0 W		·	ess: Flat 0					
Address:	Flat 02, 51 Caltho	orpe Street, L	LONDON,	WC1X 0HF	1				
Overall dwelling dime	HSIOHS.		Area(m ²	١	Av. Heig	aht(m)		Volume(m³)	
Ground floor			68.42	(1a) x	3.1	• • •	(2a) =	214.15	(3a)
First floor			29.89	(1b) x	2.:	2	(2b) =	65.76	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1n)	98.31	(4)					
Dwelling volume				(3a)+(3	b)+(3c)+(3d)	+(3e)+	.(3n) =	279.91	(5)
2. Ventilation rate:							•		_
	main heating	secondary heating	oth	er	total			m³ per hour	•
Number of chimneys	0 +	0	+ (=	0	X ·	40 =	0	(6a)
Number of open flues	0 +	0	+ (=	0	x :	20 =	0	(6b)
Number of intermittent far	าร				3	X	10 =	30	(7a)
Number of passive vents					0	X	10 =	0	(7b)
Number of flueless gas fire	res				0	X 4	40 =	0	(7c)
							Air ch	anges per ho	ur
Infiltration due to chimney	/s, flues and fans =	(6a)+(6b)+(7a))+(7b)+(7c) =		30		÷ (5) =	0.11	(8)
If a pressurisation test has be	een carried out or is inte	ended, proceed t	to (17), other	vise continue	from (9) to (1				
Number of storeys in the	ne dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.				•	truction			0	(11)
if both types of wall are pr deducting areas of openin		rresponding to tl	he greater wa	ll area (after					
If suspended wooden f		ealed) or 0.1	(sealed),	else enter ()			0	(12)
If no draught lobby, ent	er 0.05, else enter	0					į	0	(13)
Percentage of windows	and doors draugh	t stripped					İ		, ,
Window infiltration								0	(14)
Williad William additi			0.25	- [0.2 x (14) ÷	100] =		İ	0	=
Infiltration rate				- [0.2 x (14) ÷ (10) + (11) +	_	(15) =			(14)
	q50, expressed in o	cubic metres	(8) +	(10) + (11) +	(12) + (13) +		area	0	(14)
Infiltration rate	•		(8) + per hour p	(10) + (11) + er square r	(12) + (13) +		area	0	(14) (15) (16)
Infiltration rate Air permeability value, If based on air permeability Air permeability value applies	ty value, then (18) = s if a pressurisation test	: [(17) ÷ 20]+(8),	(8) + per hour p otherwise (1	(10) + (11) + er square r 8) = (16)	(12) + (13) + metre of er	velope	area	0 0 5	(14) (15) (16) (17)
Infiltration rate Air permeability value, If based on air permeability Air permeability value applies Number of sides sheltere	ty value, then (18) = s if a pressurisation test	: [(17) ÷ 20]+(8),	(8) + per hour p otherwise (1 or a degree a	(10) + (11) + er square r 8) = (16) hir permeabilit	(12) + (13) + metre of er	velope	area	0 0 5 0.36	(14) (15) (16) (17) (18)
Infiltration rate Air permeability value, If based on air permeability Air permeability value applies Number of sides sheltere Shelter factor	ty value, then (18) = s if a pressurisation test d	: [(17) ÷ 20]+(8),	(8) + per hour p otherwise (1 or a degree a	(10) + (11) + er square r 8) = (16) hir permeabilit = 1 - [0.075 x	(12) + (13) + metre of er y is being use (19)] =	velope	area	0 0 5 0.36	(14) (15) (16) (17) (18) (19) (20)
Infiltration rate Air permeability value, If based on air permeability Air permeability value applies Number of sides sheltere Shelter factor Infiltration rate incorporation	ty value, then (18) = s if a pressurisation test d	: [(17) ÷ 20]+(8), has been done	(8) + per hour p otherwise (1 or a degree a	(10) + (11) + er square r 8) = (16) hir permeabilit	(12) + (13) + metre of er y is being use (19)] =	velope	area	0 0 5 0.36	(14) (15) (16) (17) (18)
Infiltration rate Air permeability value, If based on air permeability Air permeability value applies Number of sides sheltere Shelter factor Infiltration rate incorporation	ty value, then (18) = s if a pressurisation test d ing shelter factor or monthly wind spe	: [(17) ÷ 20]+(8), has been done	(8) + per hour p otherwise (1 or a degree a (20) (21)	(10) + (11) + er square r 8) = (16) air permeabilit = 1 - [0.075 x = (18) x (20) =	(12) + (13) + metre of er y is being use (19)] =	ed	; ; ;	0 0 5 0.36 2 0.85	(14) (15) (16) (17) (18) (19) (20)
Infiltration rate Air permeability value, If based on air permeability Air permeability value applies Number of sides sheltere Shelter factor Infiltration rate incorporation	ty value, then (18) = s if a pressurisation test d	: [(17) ÷ 20]+(8), has been done	(8) + per hour p otherwise (1 or a degree a (20) (21)	(10) + (11) + er square r 8) = (16) hir permeabilit = 1 - [0.075 x	(12) + (13) + metre of er y is being use (19)] =	velope	area	0 0 5 0.36 2 0.85	(14) (15) (16) (17) (18) (19) (20)

4.9

4.4

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

(22)m=

5.1

5

Wind Factor (22a)n	n = (22)m -	÷ 4										
(22a)m= 1.27 1.2	``	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
					<u>.</u>			<u>!</u>	<u> </u>			
Adjusted infiltration	`					`	`´	I	0.04	0.00		
0.39 0.3 Calculate effective		0.33 rate for t	0.33 he appli	0.29 cable ca	0.29 se	0.28	0.3	0.33	0.34	0.36		
If mechanical ver	_		по струпп								0	(23a)
If exhaust air heat pu	mp using Ap	pendix N, (2	23b) = (23a	ı) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If balanced with heat	recovery: eff	iciency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(23c)
a) If balanced me	chanical v	entilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (2	2b)m + (23b) × [1	1 – (23c)	÷ 100]	
(24a)m = 0 0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balanced me	echanical v	entilation	without	heat rec	covery (N	ЛV) (24b)m = (2	2b)m + (23b)			
(24b)m = 0 0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole house				•								
if (22b)m < 0		- `	ŕ	<u> </u>		ŕ	ŕ	· ` `		i -	l	
(24c)m= 0 0		0	0	0	0	0	0	0	0	0		(24c)
d) If natural venti if (22b)m = 1								0.51				
(24d)m = 0.57 0.5	<u>`</u>	0.56	0.55	0.54	0.54	0.5 1 [(2	0.55	0.55	0.56	0.56		(24d)
Effective air char	ļ	<u> </u>	<u> </u>		<u> </u>			1 0.00	0.00	0.00		,
(25)m= 0.57 0.5		0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(25)
			l		l	L	<u>. </u>	<u> </u>				
0 Heatleses as												
3. Heat losses and				Not Ar	·02	I I vali	110	A V I I		k value		A Y k
ELEMENT	l heat loss Gross rea (m²)	paramet Openin m	ıgs	Net Ar A ,r		U-valı W/m2		A X U (W/l	<)	k-value kJ/m²·ł		A X k kJ/K
ELEMENT	Gross	Openin	ıgs		n²				<) 			
ELEMENT (a	Gross	Openin	ıgs	A ,r	m² x	W/m2	2K =	(W/I	<) 			kJ/K
ELEMENT Ca Doors	Gross	Openin	ıgs	A ,r	m² x x1	W/m2	eK = 0.04] =	(W/l	<) 			kJ/K (26)
ELEMENT Ca Doors Windows Type 1	Gross	Openin	ıgs	A ,r	m² x x1. x1.	W/m2 1.4 /[1/(1.6)+	0.04] = 0.04] =	2.772 3.97	<) 			kJ/K (26) (27)
Doors Windows Type 1 Windows Type 2	Gross	Openin	ıgs	A ,r 1.98 2.64 1.44	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] =	2.772 3.97 2.17	<) 			kJ/K (26) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3	Gross	Openin	ıgs	A ,r 1.98 2.64 1.44 2.55	x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] =	2.772 3.97 2.17 3.83	<)			kJ/K (26) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4	Gross	Openin	ıgs	A ,r 1.98 2.64 1.44 2.55 2.34	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	2.772 3.97 2.17 3.83 3.52	<)			kJ/K (26) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5	Gross	Openin	ıgs	A ,r 1.98 2.64 1.44 2.55 2.34 0.81	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	2.772 3.97 2.17 3.83 3.52 1.22	<)			kJ/K (26) (27) (27) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6	Gross	Openin	ıgs	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49	m² x 1	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74				kJ/K (26) (27) (27) (27) (27) (27) (27) (27)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor	Gross rea (m²)	Openin n	gs 1 ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type1	Gross rea (m²)	Openin m	gs 1 ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type1 Walls Type2	60.8 29.23	13.0 1.98	gs 1 ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type1 Walls Type2 Walls Type3	60.8 29.23	13.0 1.98	gs 1 ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	EK	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15 0.34				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type1 Walls Type2 Walls Type3 Roof	60.8 29.23 20.68	13.0 1.98	gs 1 ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type 1 Walls Type 2 Walls Type 3 Roof Total area of elements	60.8 29.23 20.68	13.0 1.98	gs 1 ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83 20.68 132.0	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	EK	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15 0.34 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type1 Walls Type2 Walls Type3 Roof Total area of elements	60.8 29.23 20.68	13.0 1.98	gs 1 ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83 20.68 132.0 92.15	x1. x1. x1. x1. x1. x2. x2. x2. x3. x4. x4. x4. x4. x4. x4. x4. x4. x4. x4	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	EK	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15 0.34				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31) (32)
Doors Windows Type 1 Windows Type 2 Windows Type 3 Windows Type 4 Windows Type 5 Windows Type 6 Windows Type 7 Floor Walls Type 1 Walls Type 2 Walls Type 3 Roof Total area of elements	60.8 29.23 20.68	13.0 1.98	gs 1 ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83 20.68 132.0	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	EK	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15 0.34 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31)

* 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 Fabric heat loss, W/K = S (A x U) (26) (30) + (32) =(33)41.11 Heat capacity $Cm = S(A \times k)$ ((28) (30) + (32) + (32a) (32e) =(34)13532.85 Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium (35)250 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 19.81 (36)if details of thermal bridging are not known (36) = $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)60.92 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Jan Feb Mar Apr Mav Jun Jul Oct Nov Dec Aug Sen (38)53.11 52.84 52.57 51.34 50.03 50.03 49.83 50.44 51.57 52.06 (38)m=51.11 51.11 Heat transfer coefficient, W/K (39)m = (37) + (38)m 112.25 112.98 114.02 113.75 113.49 112.02 110 94 110.94 110 74 111.36 112.02 112.49 (39)m =(39)Average = $Sum(39)_{1}$ /12= 112.25 Heat loss parameter (HLP), W/m2K (40)m = (39)m ÷ (4)(40)m=1.16 1.16 1.15 1.14 1.13 1.13 1.13 1.13 1.14 1.14 1.15 (40)Average = $Sum(40)_{1/12}/12=$ 1.14 Number of days in month (Table 1a) Feb Mar May Aug Jan Jun .lul Sep Oct Nov Dec Apr 31 30 31 (41)(41)m=4. Water heating energy requirement: kWh/vear: Assumed occupancy, N 2.72 (42)if TFA > 13.9, N = 1 + 1.76 x [1 - $\exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 98.88 (43)Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Oct Jan Feb Mar Apr May Jun Jul Aug Sep Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) 108.77 104.81 100.86 96.9 92.95 88.99 88.99 92.95 96.9 100.86 104.81 108.77 (44)Total = $Sum(44)_{1}$ 12 = 1186.55 Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m=161.3 141.07 145.57 126.91 121.78 105.08 97.38 111.74 113.08 131.78 143.85 156.21 1555.75 (45)Total = $Sum(45)_{1}$ 12 = If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 21.16 (46)(46)m=24.19 21 84 19 04 18 27 15.76 14.61 16 76 16.96 19 77 21.58 23 43 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)n Temperature factor from Table 2b 0 (49)

Energy lost from b) If manufactur	•			or is not		(48) x (49)) =			0		(50)
Hot water storag			e 2 (kWh	n/litre/da	ıy)					0		(51)
If community heat Volume factor from	-	ion 4.3								0		(52)
Temperature fac		e 2b								0		(53)
Energy lost from	water storag	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (54) in (55)									0		(55)
Water storage lo	ss calculated	for each	month			((56)m = ((55) × (41)ı	m				
(56)m= 0	0 0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains d	edicated solar st	orage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0 0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit lo	ss (annual) fi	om Table	e 3							0		(58)
Primary circuit lo	ss calculated	for each	month (59)m = ((58) ÷ 36	65 × (41))m					
(modified by fa	ctor from Ta	ole H5 if t	here is s	olar wat	er heatir	ng and a	cylinde	thermo	stat)		l	
(59)m= 0	0 0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calcu	lated for eac	h month ((61)m = $($	60) ÷ 36	65 × (41))m						
(61)m= 50.96	16.03 50.96	47.79	47.36	43.89	45.35	47.36	47.79	50.96	49.32	50.96		(61)
Total heat requir	ed for water I	neating ca	alculated	for eacl	n month	(62)m =	: 0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 212.26	187.1 196.53	174.7	169.14	148.97	142.73	159.11	160.86	182.74	193.16	207.17		(62)
Solar DHW input cal	culated using Ap	pendix G o	Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contributi	ion to wate	er heating)	•	
(add additional li	nes if FGHR	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 water	er heater	_	_							_		
(64)m= 212.26	187.1 196.53	174.7	169.14	148.97	142.73	159.11	160.86	182.74	193.16	207.17		_
						Outp	out from wa	ater heater	r (annual) ₁	12	2134.46	(64)
Heat gains from	water heating	j, kWh/m	onth 0.25	5 ′ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	1	
(65)m= 66.37	58.41 61.14	54.15	52.33	45.91							. *	
include (57)m	n calculation	of (CE)m			43.71	49	49.54	56.56	60.16	64.68		(65)
5. Internal gain		01 (05)111	only if cy			<u> </u>			ļ	!		(65)
5	s (see Table	, ,				<u> </u>			ļ	!		(65)
Metab <u>olic gains</u>	•	5 and 5a				<u> </u>			ļ	!		(65)
	•	5 and 5a				<u> </u>			ļ	!		(65)
Metabolic gains Jan	Table 5), Wa	5 and 5a):	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h		(65)
Metabolic gains Jan	Table 5), Wa Feb Mar 36.17 136.17	5 and 5a htts Apr 136.17	May 136.17	Jun 136.17	Jul 136.17	Aug 136.17	or hot w	ater is fr	om com	munity h		
Metabolic gains Jan (66)m= 136.17 1 Lighting gains (c	Table 5), Wa Feb Mar 36.17 136.17	5 and 5a htts Apr 136.17	May 136.17	Jun 136.17	Jul 136.17	Aug 136.17	or hot w	ater is fr	om com	munity h		
Metabolic gains Jan (66)m= 136.17 1 Lighting gains (c	Table 5), War Feb Mar 36.17 136.17 alculated in A 17.74	5 and 5a tts Apr 136.17 ppendix 13.43	May 136.17 L, equati	Jun 136.17 on L9 on	Jul 136.17 r L9a), a	Aug 136.17 Iso see	Sep 136.17 Table 5	Oct 136.17	Nov 136.17	Dec 136.17		(66)
Metabolic gains Jan (66)m= 136.17 1 Lighting gains (c (67)m= 24.55 2 Appliances gains	Table 5), War Feb Mar 36.17 136.17 alculated in A 17.74	tts Apr 136.17 Appendix 13.43 n Append	May 136.17 L, equati	Jun 136.17 on L9 on	Jul 136.17 r L9a), a	Aug 136.17 Iso see	Sep 136.17 Table 5	Oct 136.17	Nov 136.17	Dec 136.17		(66)
Metabolic gains Jan (66)m= 136.17 1 Lighting gains (c (67)m= 24.55 2 Appliances gains	Table 5), Wa Feb Mar 36.17 136.17 alculated in A 17.74 c (calculated 256.2 249.57	5 and 5a tts Apr 136.17 ppendix 13.43 n Appendix 235.45	May 136.17 L, equati 10.04 dix L, equ 217.63	Jun 136.17 on L9 of 8.47 uation L 200.89	Jul 136.17 r L9a), a 9.16 13 or L1	Aug 136.17 Iso see 11.9 3a), also	Sep 136.17 Table 5 15.97 See Tal 193.7	Oct 136.17 20.28 ole 5 207.81	Nov 136.17 23.67	Dec 136.17		(66) (67)
Metabolic gains Jan (66)m= 136.17 1 Lighting gains (c (67)m= 24.55 3 Appliances gains (68)m= 253.57 3 Cooking gains (c	Table 5), Wa Feb Mar 36.17 136.17 alculated in A 17.74 c (calculated 256.2 249.57	5 and 5a tts Apr 136.17 ppendix 13.43 n Appendix 235.45	May 136.17 L, equati 10.04 dix L, equ 217.63	Jun 136.17 on L9 of 8.47 uation L 200.89	Jul 136.17 r L9a), a 9.16 13 or L1	Aug 136.17 Iso see 11.9 3a), also	Sep 136.17 Table 5 15.97 See Tal 193.7	Oct 136.17 20.28 ole 5 207.81	Nov 136.17 23.67	Dec 136.17		(66) (67)
Metabolic gains Jan (66)m= 136.17 1 Lighting gains (c (67)m= 24.55 3 Appliances gains (68)m= 253.57 3 Cooking gains (c	Table 5), Wa Feb Mar 36.17 136.17 alculated in A 17.74 (calculated 256.2 249.57 alculated in A 36.62 36.62 36.62	tts	May 136.17 L, equati 10.04 dix L, equ 217.63 L, equati	Jun 136.17 on L9 on 8.47 uation L 200.89	Jul 136.17 r L9a), a 9.16 13 or L1 189.7 or L15a)	Aug 136.17 Iso see 11.9 3a), also 187.07	Sep 136.17 Table 5 15.97 See Tale 193.7	Oct 136.17 20.28 ble 5 207.81	Nov 136.17 23.67	Dec 136.17 25.24 242.38		(66) (67) (68)
Metabolic gains Jan (66)m= 136.17 1 Lighting gains (c (67)m= 24.55 2 Appliances gains (68)m= 253.57 2 Cooking gains (c (69)m= 36.62 3	Table 5), Wa Feb Mar 36.17 136.17 alculated in A 17.74 (calculated 256.2 249.57 alculated in A 36.62 36.62 36.62	tts	May 136.17 L, equati 10.04 dix L, equ 217.63 L, equati	Jun 136.17 on L9 on 8.47 uation L 200.89	Jul 136.17 r L9a), a 9.16 13 or L1 189.7 or L15a)	Aug 136.17 Iso see 11.9 3a), also 187.07	Sep 136.17 Table 5 15.97 See Tale 193.7	Oct 136.17 20.28 ble 5 207.81	Nov 136.17 23.67	Dec 136.17 25.24 242.38		(66) (67) (68)
Metabolic gains Jan (66)m= 136.17 1 Lighting gains (c (67)m= 24.55 2 Appliances gains (68)m= 253.57 2 Cooking gains (c (69)m= 36.62 2 Pumps and fans	Table 5), War Feb Mar 36.17 136.17 alculated in A 17.74 (calculated 256.2 249.57 alculated in A 36.62 gains (Table 3 3	tts	May 136.17 L, equati 10.04 dix L, equ 217.63 L, equati 36.62	Jun 136.17 on L9 on 8.47 uation L 200.89 ion L15 36.62	Jul 136.17 r L9a), a 9.16 13 or L1 189.7 or L15a) 36.62	Aug 136.17 Iso see 11.9 3a), also 187.07), also se 36.62	Sep 136.17 Table 5 15.97 See Tal 193.7 ee Table 36.62	Oct 136.17 20.28 ole 5 207.81 5 36.62	Nov 136.17 23.67 225.63	Dec 136.17 25.24 242.38		(66) (67) (68) (69)
Metabolic gains Jan (66)m= 136.17 1 Lighting gains (c (67)m= 24.55 2 Appliances gains (68)m= 253.57 2 Cooking gains (c (69)m= 36.62 2 Pumps and fans (70)m= 3 Losses e.g. evap	Table 5), War Feb Mar 36.17 136.17 alculated in A 17.74 (calculated 256.2 249.57 alculated in A 36.62 gains (Table 3 3	tts	May 136.17 L, equati 10.04 dix L, equ 217.63 L, equati 36.62	Jun 136.17 on L9 on 8.47 uation L 200.89 ion L15 36.62	Jul 136.17 r L9a), a 9.16 13 or L1 189.7 or L15a) 36.62	Aug 136.17 Iso see 11.9 3a), also 187.07), also se 36.62	Sep 136.17 Table 5 15.97 See Tal 193.7 ee Table 36.62	Oct 136.17 20.28 ole 5 207.81 5 36.62	Nov 136.17 23.67 225.63	Dec 136.17 25.24 242.38		(66) (67) (68) (69)

Water heating	g gains (T	able 5)												
(72)m= 89.21	86.92	82.18	75.2	70.34	63	3.77 58.76	3	65.8	5 68.81	76.02	83.55	86.93		(72)
Total interna	l gains =			•		(66)m + (67	')m +	(68)	m + (69)m + (70)m +	(71)m + (72)	m	•	
(73)m= 434.18	431.78	416.33	390.93	364.86	33	9.98 324.46	6 3	331.6	345.33	370.96	399.71	421.4		(73)
6. Solar gain	ıs:						_							
Solar gains are	calculated i	using sola	flux from	Table 6a	and a	associated eq	uatio	ons to	convert to the	e applic	able orientati	on.		
Orientation:		actor	Area			Flux			_ g		FF		Gains	
	Table 6d		m²			Table 6a			Table 6b		Table 6c		(W)	
Southeast 0.9x	0.77	X	2.6	64	x	36.79		x	0.63	×	0.7	=	29.69	(77)
Southeast 0.9x	0.77	Х	1.4	14	x	36.79		x	0.63	X	0.7	=	16.19	(77)
Southeast 0.9x	0.77	X	2.6	64	X	62.67		X	0.63	X	0.7	=	50.57	(77)
Southeast 0.9x	0.77	X	1.4	14	X	62.67		X	0.63	X	0.7	=	27.58	(77)
Southeast 0.9x	0.77	X	2.6	64	X	85.75		X	0.63	×	0.7	=	69.19	(77)
Southeast 0.9x	0.77	X	1.4	14	x	85.75		x	0.63	x	0.7	=	37.74	(77)
Southeast 0.9x	0.77	X	2.6	64	x	106.25		x	0.63	X	0.7		85.73	(77)
Southeast 0.9x	0.77	X	1.4	14	x	106.25		x	0.63	X	0.7	=	46.76	(77)
Southeast 0.9x	0.77	X	2.6	64	x	119.01		x	0.63	x	0.7	=	96.02	(77)
Southeast 0.9x	0.77	X	1.4	14	x	119.01		x	0.63	x	0.7	=	52.37	(77)
Southeast 0.9x	0.77	X	2.6	64	x	118.15		x	0.63	x	0.7	=	95.33	(77)
Southeast 0.9x	0.77	X	1.4	14	x	118.15		x	0.63	x	0.7	=	52	(77)
Southeast 0.9x	0.77	X	2.6	64	x	113.91		x	0.63	x	0.7	=	91.9	(77)
Southeast 0.9x	0.77	X	1.4	14	x	113.91		x	0.63	x	0.7	-	50.13	(77)
Southeast 0.9x	0.77	Х	2.6	64	x	104.39		x	0.63	x	0.7	-	84.22	(77)
Southeast 0.9x	0.77	Х	1.4	14	x	104.39		x	0.63	x	0.7	=	45.94	(77)
Southeast 0.9x	0.77	X	2.6	64	x	92.85		x	0.63	x	0.7	-	74.91	(77)
Southeast 0.9x	0.77	X	1.4	14	x	92.85		x [0.63	x	0.7		40.86	(77)
Southeast 0.9x	0.77	X	2.6	64	x	69.27		x	0.63	x	0.7	=	55.89	(77)
Southeast 0.9x	0.77	X	1.4	14	x	69.27		x	0.63	x	0.7	=	30.48	(77)
Southeast 0.9x	0.77	X	2.6	64	x	44.07		x [0.63	x	0.7		35.56	(77)
Southeast 0.9x	0.77	X	1.4	14	x	44.07		x	0.63	X	0.7	=	19.39	(77)
Southeast 0.9x	0.77	X	2.6	64	x	31.49		x	0.63	x	0.7	=	25.4	(77)
Southeast 0.9x	0.77	X	1.4	14	x	31.49		x	0.63	x	0.7	=	13.86	(77)
Southwest _{0.9x}	0.77	X	2.4	19	x	36.79			0.63	x	0.7	=	28	(79)
Southwest _{0.9x}	0.77	X	2.4	19	x	62.67			0.63	x	0.7	=	47.69	(79)
Southwest _{0.9x}	0.77	х	2.4	19	x [85.75		Ī	0.63	X	0.7		65.26	(79)
Southwest _{0.9x}	0.77	X	2.4	19	x	106.25			0.63	x	0.7	-	80.85	(79)
Southwest _{0.9x}	0.77	X	2.4	19	x [119.01		Ī	0.63	X	0.7	=	90.56	(79)
Southwest _{0.9x}	0.77	X	2.4	19	x [118.15		Ī	0.63	X	0.7	=	89.91	(79)
Southwest _{0.9x}	0.77	X	2.4	19	x [113.91		Ī	0.63	X	0.7	=	86.68	(79)
Southwest _{0.9x}	0.77	x	2.4	19	x	104.39		Ī	0.63	x	0.7	=	79.44	(79)

Southwest _{0.9x}	0.77	1 ,	0.40	1	00.05	1	0.00	١ ,,	0.7	1 =	70.00	(79)
Southwest _{0.9x}	0.77] X]	2.49	X 1	92.85] 1	0.63	X	0.7]	70.66	=
Southwest _{0.9x}	0.77] X]	2.49	X 1	69.27] 1	0.63	X	0.7] = 1 _	52.71	(79)
Southwest _{0.9x}	0.77] X]	2.49] X]	44.07] 1	0.63	X	0.7] = 1 _	33.54	(79)
<u> </u>	0.77	J X	2.49	X	31.49] 1	0.63	X	0.7] = 1	23.96	(79)
Northwest 0.9x	0.77	X	2.55	X	11.28	X	0.63	X	0.7] = 1	8.79	(81)
Northwest 0.9x	0.77	」 X ¬	2.34	X	11.28	X	0.63	X	0.7] = 1	8.07	(81)
Northwest 0.9x	0.77	X	0.81	X	11.28	X 	0.63	X	0.7] = 1	2.79	(81)
Northwest 0.9x	0.77	X	0.74	X	11.28	X	0.63	X	0.7] = 1	2.55	(81)
Northwest _{0.9x}	0.77	X	2.55	X	22.97	X	0.63	X	0.7] =	17.9	(81)
Northwest 0.9x	0.77	X	2.34	X	22.97	X	0.63	X	0.7] =	16.42	(81)
Northwest 0.9x	0.77	X	0.81	X	22.97	X	0.63	X	0.7	=	5.69	(81)
Northwest 0.9x	0.77	X	0.74	X	22.97	X	0.63	X	0.7] =	5.19	(81)
Northwest _{0.9x}	0.77	X	2.55	X	41.38	X	0.63	X	0.7	=	32.25	(81)
Northwest _{0.9x}	0.77	X	2.34	X	41.38	X	0.63	X	0.7	=	29.59	(81)
Northwest _{0.9x}	0.77	X	0.81	X	41.38	X	0.63	X	0.7	=	10.24	(81)
Northwest _{0.9x}	0.77	X	0.74	X	41.38	X	0.63	X	0.7	=	9.36	(81)
Northwest _{0.9x}	0.77	X	2.55	X	67.96	X	0.63	X	0.7	=	52.96	(81)
Northwest _{0.9x}	0.77	X	2.34	X	67.96	X	0.63	X	0.7	=	48.6	(81)
Northwest 0.9x	0.77	X	0.81	X	67.96	X	0.63	X	0.7	=	16.82	(81)
Northwest 0.9x	0.77	X	0.74	X	67.96	X	0.63	X	0.7	=	15.37	(81)
Northwest 0.9x	0.77	X	2.55	X	91.35	X	0.63	X	0.7	=	71.19	(81)
Northwest 0.9x	0.77	X	2.34	X	91.35	x	0.63	x	0.7	=	65.32	(81)
Northwest 0.9x	0.77	X	0.81	X	91.35	x	0.63	x	0.7	=	22.61	(81)
Northwest 0.9x	0.77	X	0.74	X	91.35	X	0.63	x	0.7	=	20.66	(81)
Northwest 0.9x	0.77	X	2.55	X	97.38	X	0.63	x	0.7	=	75.89	(81)
Northwest 0.9x	0.77	X	2.34	X	97.38	X	0.63	x	0.7] =	69.64	(81)
Northwest 0.9x	0.77	X	0.81	X	97.38	x	0.63	x	0.7	=	24.11	(81)
Northwest _{0.9x}	0.77	X	0.74	X	97.38	X	0.63	x	0.7	=	22.02	(81)
Northwest _{0.9x}	0.77	X	2.55	x	91.1	x	0.63	x	0.7	=	71	(81)
Northwest 0.9x	0.77	X	2.34	x	91.1	x	0.63	x	0.7] =	65.15	(81)
Northwest _{0.9x}	0.77	X	0.81	x	91.1	X	0.63	X	0.7	=	22.55	(81)
Northwest _{0.9x}	0.77	x	0.74	x	91.1	x	0.63	x	0.7	=	20.6	(81)
Northwest 0.9x	0.77	X	2.55	x	72.63	x	0.63	x	0.7] =	56.6	(81)
Northwest _{0.9x}	0.77	X	2.34	x	72.63	x	0.63	x	0.7] <u>-</u>	51.94	(81)
Northwest _{0.9x}	0.77	X	0.81	x	72.63	x	0.63	X	0.7	j =	17.98	(81)
Northwest _{0.9x}	0.77	x	0.74	x	72.63	x	0.63	x	0.7	j =	16.42	(81)
Northwest _{0.9x}	0.77	X	2.55	x	50.42	x	0.63	x	0.7	j =	39.29	(81)
Northwest _{0.9x}	0.77	X	2.34	x	50.42	x	0.63	x	0.7	j =	36.06	(81)
Northwest _{0.9x}	0.77	×	0.81	×	50.42	×	0.63	x	0.7	j =	12.48	(81)
Northwest _{0.9x}	0.77	X	0.74	×	50.42	x	0.63	x	0.7	j =	11.4	(81)
Northwest _{0.9x}	0.77	x	2.55	×	28.07	x	0.63	x	0.7	i =	21.87	(81)
<u> </u>		_						ı		•		_

Northwe	est _{0.9x}	0.77	X	2.3	4	x	2	8.07	X	0.0	63	X	0.7		=	20.07	(81)
Northwe	est _{0.9x}	0.77	X	8.0	1	X	2	8.07	X	0.0	63	X	0.7		=	6.95	(81)
Northwe	est _{0.9x}	0.77	X	0.7	4	X	2	8.07	X	0.0	63	X	0.7		=	6.35	(81)
Northwe	est _{0.9x}	0.77	X	2.5	5	x		14.2	X	0.0	63	X	0.7		=	11.06	(81)
Northwe	est _{0.9x}	0.77	X	2.3	4	x		14.2	X	0.0	63	X	0.7		=	10.15	(81)
Northwe	est _{0.9x}	0.77	X	0.8	1	x		14.2	X	0.0	63	X	0.7		=	3.51	(81)
Northwe	est _{0.9x}	0.77	X	0.7	4	x		14.2	X	0.0	63	X	0.7		=	3.21	(81)
Northwe	est _{0.9x}	0.77	X	2.5	5	x		9.21	X	0.0	63	X	0.7		=	7.18	(81)
Northwe	est _{0.9x}	0.77	X	2.3	4	x	(9.21	X	0.0	63	X	0.7		=	6.59	(81)
Northwe	est 0.9x	0.77	X	8.0	1	X		9.21	X	0.0	63	X	0.7		=	2.28	(81)
Northwe	est _{0.9x}	0.77	X	0.7	4	X	(9.21	X	0.0	63	X	0.7		=	2.08	(81)
Solar g	ains in watt	s, cal	culated	for eacl	n month				(83)m	= Sum(74)m	(82)r	ı			•	
(83)m=			253.62	347.09	418.74		28.9	408.02	352	.54 28	35.67	194.	32 116.43	81.3	86		(83)
Ī	ains – inter			<u> </u>		·										Ī	
(84)m=	530.26 602	2.82	669.95	738.02	783.6	7	68.87	732.48	684	.21 6	31	565.	28 516.14	502.	76		(84)
7. Me	an internal t	empe	erature ((heating	seasor	1)											
Temp	erature duri	ng he	ating pe	eriods ir	the livi	ng	area 1	from Tab	ole 9,	Th1 (°	°C)					21	(85)
Utilisa	tion factor t	or gai	ns for li	ving are	ea, h1,m	า (s	ee Ta	ble 9a)						_		•	_
	Jan F	eb	Mar	Apr	May		Jun	Jul	Αι	ug :	Sep	O	t Nov	De	ес		
(86)m=	1	1	0.99	0.98	0.93		8.0	0.64	0.6	9 0).91	0.9) 1	1			(86)
Mean	internal ten	nperat	ture in I	iving are	ea T1 (f	ollo	w ste	ps 3 to 7	in T	able 9	c)						
(87)m=	19.69 19	.83	20.06	20.39	20.7	2	20.91	20.98	20.9	97 20	0.81	20.4	2 20	19.6	67		(87)
Temp	erature duri	ng he	ating pe	eriods ir	rest of	dw	elling	from Ta	ble 9), Th2	(°C)						
(88)m=			19.96	19.97	19.97	_	9.98	19.98	19.9		9.97	19.9	7 19.96	19.9	96		(88)
Utilisa	ition factor f	or gai	ins for r	est of d	vellina	h2	m (se	e Table	9a)	!			•	- !			
(89)m=		1	0.99	0.97	0.9	$\overline{}$	0.72	0.5	0.5	6 0	.85	0.9	3 1	1			(89)
Moon	internal ten	aporat	turo in t	ho root	of dwall	ina	T2 (f	ollow etc	no 2	to 7 in	Tobl	0.00	<u> </u>				
(90)m=	internal ten		18.75	19.23	19.65	Ť	9.91	19.97	19.9		9.81	19.2	7 18.66	18.1	7		(90)
(00)	10.2	<u></u>	10.70	10.20	10.00	<u> </u>	0.01	10.01	10				iving area ÷			0.33	(91)
										<u>.</u>			9	• •		0.00	
r	internal ten	- -	<u> </u>			$\overline{}$	-		r È			40.5	F 10.1	1400		l	(02)
(92)m=			19.18	19.61	20		20.24	20.3	20.		0.14	19.6		18.6	Ö		(92)
(93)m=	adjustment		19.18	19.61	20	_	20.24	20.3	4e, 20.	$\overline{}$	appro 0.14	19.6	1	18.6	6	1	(93)
	ace heating			19.01	20		.0.24	20.5	20.	.5 2	0.14	13.0	3 19.1	10.0	,0		(00)
	to the mea			neratur	e ohtair	hed	at eta	n 11 of	Tahl	e Oh s	o tha	t Tin	u=(76)m a	nd re-c	alc	rulate	
	ilisation fact					icu	at st	эр 11 OI	Tabi	C 0D, 3	o tria		1-(<i>10)</i> 111 a	110 10-0	Jaic	Julato	
	Jan F	eb	Mar	Apr	May		Jun	Jul	Aı	ug :	Sep	O	t Nov	De	ес		
Utilisa	tion factor t	or gai	ns, hm:	:						•						•	
(94)m=	1	1	0.99	0.97	0.9	(0.74	0.55	0.6	51 0	.86	0.9	3 1	1			(94)
Usefu	l gains, hm		N = (94)			_										•	
(95)m=			662.11	712.52	703.31	_	68.91	401.01	415	.31 54	3.41	551.	513.64	501.	83		(95)
r	ly average					т —			I							1	(00)
(96)m=	4.3 4	.9	6.5	8.9	11.7		14.6	16.6	16.	.4 1	4.1	10.	7.1	4.2			(96)

Lloat loss rate for magn in	stornal tomn	oroturo	lm \//.	-[/20\m :	v [(02)m	(06)m	1				
Heat loss rate for mean in (97)m= 1640.85 1589.27 143	9.44 1202.48		625.87	410.72	431.36	672.59	1013.95	1349.87	1634.22		(97)
Space heating requireme				<u> </u>		<u> </u>			1004.22		(51)
·	3.33 352.77	168.45	0	0	0	0	343.76	602.09	842.5		
	Į.				Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	4380	(98)
Space heating requireme	nt in kWh/m	²/year							ĺ	44.55	(99)
9a. Energy requirements –	· Individual h	eating s	ystems i	ncluding	micro-C	CHP)					
Space heating:		, .							ı		1
Fraction of space heat fro			mentary	-		(004)				0	(201)
Fraction of space heat fro	•	. ,			(202) = 1	, ,				1 	(202)
Fraction of total heating fi	•				(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of main space	• •									90.3	(206)
Efficiency of secondary/s	upplementa	y heating	g systen	າ, %						0	(208)
<u> </u>	1ar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ır
Space heating requireme	<u>`</u>	1									
	3.33 352.77	168.45	0	0	0	0	343.76	602.09	842.5		
$(211)m = \{[(98)m \times (204)]\}$	· · ·	 									(211)
916.09 736.29 640	390.67	186.55	0	0	0	0	380.68	666.76	933		.
					lota	ı (kvvn/yea	ar) =Sum(2	211) _{15,10. 12}	-	4850.5	(211)
Space heating fuel (secont = {[(98)m x (201)]} x 100 ÷	• /	/month									
	0 0	0	0	0	0	0	0	0	0		
					Tota	l (kWh/yea	ar) =Sum(2	215) _{15.10. 12}		0	(215)
Water heating									l]
Output from water heater (calculated a	bove)									
212.26 187.1 196	5.53 174.7	169.14	148.97	142.73	159.11	160.86	182.74	193.16	207.17		_
Efficiency of water heater										81	(216)
` '	.74 86.99	85.39	81	81	81	81	86.84	87.85	88.3		(217)
Fuel for water heating, kW $(219)m = (64)m \times 100 \div ($											
` '	3.98 200.83	198.09	183.91	176.2	196.43	198.6	210.43	219.88	234.62		
	I	1	ı		Tota	I = Sum(2	19a) ₁₁₂ =			2495.95	(219)
Annual totals							k'	Wh/year	•	kWh/year	_
Space heating fuel used, n	nain system	1								4850.5	
Water heating fuel used										2495.95]
Electricity for pumps, fans	and electric	keep-ho	t								_
central heating pump:									30		(230c)
Total electricity for the abo	ve, kWh/yea	ar			sum	of (230a)	(230g) =	,		30	(231)
Electricity for lighting									İ	433.62	(232)
12a. CO2 emissions – Inc	dividual hea	ting syste	ems inclu	uding mi	cro-CHF)					_

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	1047.71 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	539.13 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1586.83 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	15.57 (267)
Electricity for lighting	(232) x	0.519	225.05 (268)
Total CO2, kg/year	sum	of (265) (271) =	1827.45 (272)
Dwelling CO2 Emission Rate	(272	?) ÷ (4) =	18.59 (273)
El rating (section 14)			83 (274)

		User Details:				
Accessor	Obrita I I a alon all			OTDO	040000	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	Stroma Nur Software Ve			016363 n: 1.0.4.26	
Software Name.		operty Address: Flat 0		V CI SIO	11. 1.0.4.20	
Address :	Flat 03, 51 Calthorpe Street,	· · · · ·				
Overall dwelling dime		20112011, 110171				
		Area(m²)	Av. Height(m)	Volume(m³)	
Ground floor		56.13 (1a) x	3.33	(2a) =	186.91	(3a)
First floor		45.8 (1b) x	2.2	(2b) =	100.76	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1n) 101.93 (4)				_
Dwelling volume		(3a)+(3	3b)+(3c)+(3d)+(3e)+.	(3n) =	287.67	(5)
2. Ventilation rate:						
	main secondar heating heating	y other	total		m³ per hour	•
Number of chimneys	0 + 0	+ 0 =	0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent far	ns		3	x 10 =	30	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fire	res		0	x 40 =	0	(7c)
				Δir ch	anges per ho	ur
Infiltration due to chimne	/s, flues and fans = (6a)+(6b)+(7	a)+(7b)+(7c) =	30	÷ (5) =	0.1	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
•	een carried out or is intended, proceed			. (3) –	0.1	
Number of storeys in the	ne dwelling (ns)				0	(9)
Additional infiltration			[(9	9)-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber frame or	0.35 for masonry cons	truction		0	(11)
if both types of wall are pr deducting areas of openin	esent, use the value corresponding to	the greater wall area (after				
	loor, enter 0.2 (unsealed) or 0.	1 (sealed), else enter ()	[0	(12)
If no draught lobby, ent	,	, ,		Ì	0	(13)
Percentage of windows	and doors draught stripped			Ī	0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷	100] =	Ì	0	(15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	Ī	0	(16)
Air permeability value,	q50, expressed in cubic metre	s per hour per square i	metre of envelop	e area	5	(17)
	ity value, then (18) = [(17) ÷ 20]+(8		·		0.35	(18)
Air permeability value applies	s if a pressurisation test has been don	e or a degree air permeabilit	ty is being used	L		_
Number of sides sheltere	d				3	(19)
Shelter factor		$(20) = 1 - [0.075 \times$	(19)] =		0.78	(20)
Infiltration rate incorporati	ing shelter factor	(21) = (18) x (20) =	=		0.27	(21)
Infiltration rate modified for	or monthly wind speed					
Jan Feb	Mar Apr May Jun	Jul Aug Sep	Oct Nov	Dec		
Monthly average wind spe	eed from Table 7					

4.3

3.8

3.8

3.7

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 infilt	ration rat	e (allowi	ng for sl	nelter an	nd wind s	speed) =	(21a) x	(22a)m					
0.35	0.34	0.34	0.3	0.3	0.26	0.26	0.25	0.27	0.3	0.31	0.32		
Calculate effe		•	rate for t	he appli	icable ca	ise						0	(23a)
If exhaust air I			endix N, (2	.3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If balanced wi									, , ,			0	(23c)
a) If balanc	ed mech	anical ve	entilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2:	2b)m + (23b) × [1 – (23c)		(23)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If balanc	ed mech	anical ve	ntilation	without	heat red	covery (N	ИV) (24b	o)m = (22	2b)m + (23b)	•	•	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole I	house ex m < 0.5 >			•	•				.5 × (23k	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural	ventilation				•				0.51	•		•	
(24d)m = 0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(24d)
Effective ai	r change	rate - er	nter (24a	ı) or (24l	b) or (24	c) or (24	d) in bo	x (25)				ı	
(25)m= 0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(25)
2 Hoot lease	بطام متمالة												
3. Heat 10886	es and ne	eat loss p	paramet	er:									
ELEMENT	es and ne Gros area	SS	oaramet Openin m	ıgs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²·l		A X k kJ/K
	Gros	SS	Openin	ıgs		m²							
ELEMENT	Gros area	SS	Openin	ıgs	A ,r	m² x	W/m2	2K =	(W/				kJ/K
ELEMENT Doors	Gros area e 1	SS	Openin	ıgs	A ,r	m² x x1.	W/m2	2K = 0.04] =	(W/ 2.772				kJ/K (26)
ELEMENT Doors Windows Typ	Gros area e 1 e 2	SS	Openin	ıgs	A ,r	m² x x1.	W/m2 1.4 /[1/(1.6)+	2K = 0.04] = 0.04] =	2.772 3.97				kJ/K (26) (27)
ELEMENT Doors Windows Typ Windows Typ	Gros area e 1 e 2	SS	Openin	ıgs	A ,r 1.98 2.64 2.28	m² x x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0.04] =	2.772 3.97 3.43				kJ/K (26) (27) (27)
ELEMENT Doors Windows Typ Windows Typ Windows Typ	Gros area e 1 e 2	ss (m²)	Openin	gs 1 ²	A ,r 1.98 2.64 2.28 2.34	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+	eK = 0.04] = 0.04] = 0.04] =	2.772 3.97 3.43 3.52				kJ/K (26) (27) (27) (27)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor	Gros area e 1 e 2 e 3	ss (m²)	Openin n	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1	x1. x1. x1. x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0.04] = 0.04] = = = = =	(W// 2.772 3.97 3.43 3.52 7.092				kJ/K (26) (27) (27) (27) (28)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1	Gros area e 1 e 2 e 3	52 65	Openin	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98	x1. x1. x1. x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23	2K = 0.04]	(W// 2.772 3.97 3.43 3.52 7.092 13.34				kJ/K (26) (27) (27) (27) (28) (29)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2	Gros area e 1 e 2 e 3 70.5	52 55 55	12.5 1.98	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67	x1. x1. x1. x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12	2K = 0.04] = 0.04] = 0.04] = = = =	(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66				kJ/K (26) (27) (27) (27) (28) (29)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof	Gros area e 1 e 2 e 3 70.5	52 55 55	12.5 1.98	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55	x1. x1. x1. x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12	2K = 0.04] = 0.04] = 0.04] = = = =	(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66				kJ/K (26) (27) (27) (27) (28) (29) (30)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of	Gros area e 1 e 2 e 3 70.5	52 55 55	12.5 1.98	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.58	x1. x1. x1. x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = 0.04 = 0.04 = 0.04 = = = = =	(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05				kJ/K (26) (27) (27) (28) (29) (29) (30) (31)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall	Gros area e 1 e 2 e 3 70.5	52 55 55	12.5 1.98	gs 1 ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8	x1. x1. x1. x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = 0.04 = 0.04 = 0.04 = = = = =	(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05				kJ/K (26) (27) (27) (28) (29) (30) (31) (32)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor	Gros area e 1 e 2 e 3 70.5 20.5 elements	55 (m²) 55 55 5, m²	12.5 1.98 0	indow U-va	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8 51.98 43.87 alue calcul	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	EK = 0.04 = 0.04 = 0.04 = = = = =	(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	k)	kJ/m²·l		(26) (27) (27) (27) (28) (29) (29) (30) (31) (32) (32a)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling * for windows and	Gros area e 1 e 2 e 3 70.5 20.5 elements d roof wind eas on both	52 55 55 65 65 65 65 67 68 68 69 69 69 69 69 69 69 69 69 69 69 69 69	12.5 1.98 0	indow U-va	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8 51.98 43.87 alue calcul	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	EK = 0.04 = 0.04 = 0.04 = = = = =	(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	k)	kJ/m²·l		kJ/K (26) (27) (27) (28) (29) (30) (31) (32) (32a)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling * for windows and ** include the area	Gros area e 1 e 2 e 3 70.5 20.5 elements d roof wind eas on both	SS (m²) 55 55 5, m² ows, use e sides of in = S (A x	12.5 1.98 0	indow U-va	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8 51.98 43.87 alue calcul	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = 0.04 = 0.04 = 0.04 = = = = = =	(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	k)	kJ/m²·l	K	(26) (27) (27) (28) (29) (30) (31) (32) (32a) (32b)
ELEMENT Doors Windows Typ Windows Typ Windows Typ Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling * for windows and ** include the are Fabric heat lo	Gros area e 1 e 2 e 3 70.5 20.5 elements d roof wind eas on both eas, W/K c Cm = Si	ows, use esides of interest (A x k)	12.5 1.98 0 effective winternal wall	indow U-valls and par	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.58 183.8 51.98 5.32 43.87 alue calculatitions	x1. x1. x1. x1. x2. x2. x4. x4. x4. x4. x4. x4. x4. x4. x4. x4	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = 0.04 =	(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	K)	kJ/m²·l	13.2	(26) (27) (27) (28) (29) (30) (31) (32) (32a) (32b)

an be us	sed instea	iu oi a u c i	anou ouroc											_
Therma	l bridge	s : S (L	x Y) cal	culated (using Ap	pendix l	<						27.57	(36)
			are not kn	own (36) =	= 0.05 x (3	1)								_
	bric hea								(33) +	(36) =			75.35	(37)
entilati/ /	ion hea		alculated	l monthly	y I	i					25)m x (5)	ī	1	
L	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
38)m=	53.28	53.06	52.84	51.8	51.6	50.7	50.7	50.53	51.04	51.6	51.99	52.41		(38)
Heat tr <u>a</u>	ansfer c	oefficier	nt, W/K			_	_	_	(39)m	= (37) + (3	38)m	_	_	
39)m=	128.63	128.41	128.18	127.14	126.95	126.04	126.04	125.88	126.39	126.95	127.34	127.76		_
Heat los	ss parai	meter (H	HLP), W/	m²K						Average = = (39)m ÷	Sum(39) ₁ (4)	12 /12=	127.14	(39)
40)m=	1.26	1.26	1.26	1.25	1.25	1.24	1.24	1.23	1.24	1.25	1.25	1.25		
Number	r of day	s in mor	nth (Tabl	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.25	(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	gy requi	rement:								kWh/ye	ear:	
Assume	ed occu	pancy, I	N								2.	76		(42
if TFA if TFA Annual a	\ > 13.9 \ £ 13.9 average), N = 1), N = 1 e hot wa	+ 1.76 x ater usag	ge in litre	(-0.0003	ay Vd,av	erage =	(25 x N)	+ 36		9)	76]	•
if TFA if TFA Annual a Reduce th	A > 13.9 A £ 13.9 average the annua), N = 1), N = 1 e hot wa l average	+ 1.76 x ater usag	ge in litre		ay Vd,av	erage =	(25 x N)	+ 36		9)			•
if TFA if TFA Annual a Beduce th ot more a	A > 13.9 A £ 13.9 average the annua that 125 Jan	o, N = 1 o, N = 1 e hot wa l 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 lwelling is not and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36		9)			`
if TFA if TFA Annual a Reduce th not more a	A > 13.9 A £ 13.9 average the annua that 125 Jan	o, N = 1 o, N = 1 e hot wa l 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, I	ay Vd,av lwelling is not and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us	se target o	9) 99	.67		•
if TFA if TFA annual a deduce th ot more if	A > 13.9 A £ 13.9 average the annua that 125 Jan	o, N = 1 o, N = 1 e hot wa l 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 lwelling is not and co	erage = designed i ld) Jul	(25 x N) to achieve	+ 36 a water us	se target o	9) 99	.67		(43
if TFA if TFA Annual a Reduce th not more a Hot water 44)m=	A > 13.9 A £ 13.9 average the annual that 125 Jan rusage in	N = 1 N N = 1 e hot was l'average litres per p Feb d'itres per	+ 1.76 x 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 a vater use, I May Vd,m = fa	ay Vd,av lwelling is not and co Jun ctor from 1	erage = designed id) Jul Table 1c x 89.7	(25 x N) to achieve Aug (43) 93.69	+ 36 a water us Sep 97.68	Oct 101.66 Total = Sur	9) 99 Nov 105.65 m(44) _{1 12} =	Dec 109.64	1196.06	(43
if TFA if TFA Annual a Reduce th ot more a dot water 14)m=	A > 13.9 A £ 13.9 average the annual that 125 Jan rusage in	N = 1 N N = 1 e hot was l'average litres per p Feb d'itres per	+ 1.76 x 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 day vater use, I May Vd,m = fa 93.69	ay Vd,av lwelling is not and co Jun ctor from 1	erage = designed id) Jul Table 1c x 89.7	(25 x N) to achieve Aug (43) 93.69	+ 36 a water us Sep 97.68	Oct 101.66 Total = Sur	9) 99 Nov 105.65 m(44) _{1 12} =	Dec 109.64	1196.06	(43
if TFA if TFA Annual a Reduce the cot more a Hot water 44)m= Energy cot 45)m=	A > 13.9 A £ 13.9 average he annual that 125 Jan usage in 109.64 pontent of 162.59	Popular No. 10, N = 1	+ 1.76 x ater usag hot water person per Mar day for ea 101.66 used - calc 146.74	ge in litre usage by day (all w Apr ach month 97.68 culated me	es per da 5% if the a rater use, I May Vd,m = fa: 93.69 onthly = 4.	ay Vd,av lwelling is not and co Jun ctor from 7 89.7 190 x Vd,r	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 77m / 3600 112.64	+ 36 a water us Sep 97.68 0 kWh/more	Oct 101.66 Total = Sunth (see Tail 132.84	9) Nov 105.65 m(44) _{1 12} = ables 1b, 1	.67 Dec 109.64 c, 1d) 157.46	1196.06	(43
if TFA if TFA Annual a Reduce th not more a Hot water 44)m= Energy co 45)m= f instanta	A > 13.9 A £ 13.9 average he annua that 125 Jan 109.64 ontent of 162.59	P, N = 1 P, N = 1 Pe hot was laverage litres per per litres per per 105.65 Phot water 142.2	+ 1.76 x ater usag hot water person per Mar day for ea 101.66 used - calc 146.74	ge in litre usage by day (all w Apr ach month 97.68 culated me	es per da 5% if the a vater use, I May $Vd,m = fa$ 93.69 $ponthly = 4$	ay Vd,av Iwelling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 77m / 3600 112.64 boxes (46)	+ 36 a water us Sep 97.68 0 kWh/more	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth (see Tail 132.84)	9) 99 Nov 105.65 m(44) _{1 12} = ables 1b, 1 145	.67 Dec 109.64 157.46		(43
if TFA if TFA Annual a Reduce the continuous more a Hot water 44)m= Energy continuous more a 45)m= finstanta 46)m=	A > 13.9 A £ 13.9 average he annual that 125 Jan 109.64 109.64 162.59 aneous wa 24.39	Popular No. 10, N = 1	+ 1.76 x ater usag hot water person per Mar day for ea 101.66 used - calc 146.74	ge in litre usage by day (all w Apr ach month 97.68 culated me	es per da 5% if the a rater use, I May Vd,m = fa: 93.69 onthly = 4.	ay Vd,av lwelling is not and co Jun ctor from 7 89.7 190 x Vd,r	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 77m / 3600 112.64	+ 36 a water us Sep 97.68 0 kWh/more	Oct 101.66 Total = Sunth (see Tail 132.84	9) 99 Nov 105.65 m(44) _{1 12} = ables 1b, 1 145	.67 Dec 109.64 c, 1d) 157.46		(43
if TFA if TFA Annual a Reduce th not more a Hot water 44)m= Energy co 45)m= f instanta 46)m= Water S	A > 13.9 A £ 13.9 average the annual that 125 Jan 109.64 content of the annual that 125 annua	P, N = 1 P, N = 1 P, N = 1 Pe hot was I average litres per per per per per per per per per per	ter usage hot water person per Mar 101.66 used - calculated at point 22.01	ge in litre usage by day (all w Apr ach month 97.68 culated mo 127.93 of use (no	es per da 5% if the a rater use, I May Vd,m = far 93.69 onthly = 4. 122.75 o hot water 18.41	ay Vd,av. Iwelling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage), 15.89	erage = designed in did) Jul Table 1c x 89.7 m x nm x E 98.16 enter 0 in 14.72	(25 x N) to achieve Aug (43) 93.69 07m / 3600 112.64 boxes (46) 16.9	+ 36 a water us Sep 97.68 113.98 1 to (61) 17.1	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth 132.84	9) Nov 105.65 m(44) _{1 12} = ables 1b, 1 145 m(45) _{1 12} = 21.75	.67 Dec 109.64		(43
if TFA if TFA Annual a Reduce the continuous more a Hot water 44)m= Energy continuous more a 45)m= finstanta 46)m= Vater s Storage	A > 13.9 A £ 13.9 average he annual that 125 Jan rusage in 109.64 ontent of 162.59 aneous wa 24.39 ctorage e volume	Population (Property), N = 1 Population (Property), N = 1 Population (Property) Populati	ter usage hot water person per Mar day for each 101.66 used - calculated at point 22.01 including	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (no	es per da 5% if the orater use, I May Vd,m = fa: 93.69 onthly = 4. 122.75 o hot water 18.41 olar or W	ay Vd,av lwelling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage),	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 77m / 3600 112.64 boxes (46) 16.9 within sa	+ 36 a water us Sep 97.68 113.98 1 to (61) 17.1	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth 132.84	9) Nov 105.65 m(44) _{1 12} = ables 1b, 1 145 m(45) _{1 12} = 21.75	.67 Dec 109.64 157.46		(43
if TFA if TFA Annual a Reduce th not more a Hot water 44)m= Energy co 45)m= f instanta 46)m= Water s Storage f comm	A > 13.9 A £ 13.9 average the annual that 125 Jan 109.64 ontent of 162.59 aneous was 24.39 etorage volume nunity he	Popular No. 10, N = 1	ter usage hot water person per Mar 101.66 used - calculated at point 22.01 including and no talculated at the second seco	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (no	es per da 5% if the a rater use, I May Vd,m = far 93.69 onthly = 4. 122.75 o hot water 18.41	ay Vd,av welling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage), 15.89	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 7Tm / 3600 112.64 boxes (46) 16.9 within sa (47)	+ 36 a water us Sep 97.68 0 kWh/mor 113.98 0 to (61) 17.1 ame vess	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth 19.93 sel	9) Nov 105.65 m(44) _{1 12} = ables 1b, 1 145 m(45) _{1 12} = 21.75	.67 Dec 109.64		(43
if TFA if TFA Annual a Reduce th not more a Hot water 44)m= Energy co 45)m= f instanta 46)m= Water s Storage f comm Otherwis	A > 13.9 A £ 13.9 average the annual that 125 Jan 109.64 ontent of 162.59 aneous was 24.39 etorage volume nunity he	Population (Procedure) No. No. 1 No. 1 No. No. 1 No	ter usage hot water person per Mar 101.66 used - calculated at point 22.01 including and no talculated at the second seco	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (not) 19.19 ag any so	es per da 5% if the a rater use, I May Vd,m = fa 93.69 onthly = 4. 122.75 o hot water 18.41 olar or Water welling, e	ay Vd,av welling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage), 15.89	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 7Tm / 3600 112.64 boxes (46) 16.9 within sa (47)	+ 36 a water us Sep 97.68 0 kWh/mor 113.98 0 to (61) 17.1 ame vess	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth 19.93 sel	9) Nov 105.65 m(44) _{1 12} = ables 1b, 1 145 m(45) _{1 12} = 21.75	.67 Dec 109.64		(43
if TFA if TFA Annual a Reduce the cont more a Hot water 44)m= Energy co 45)m= f instanta 46)m= Vater s Storage f comm Otherwis	A > 13.9 A £ 13.9 average the annual that 125 Jan 109.64 ontent of 162.59 aneous was 24.39 storage e volume that ise if no of torage	Population N = 1 Popula	+ 1.76 x ater usage hot water person per Mar day for ear 101.66 used - calc 146.74 ang at point 22.01 including the including at hot water the including	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (no 19.19 ag any so nk in dw er (this in	es per da 5% if the a rater use, I May Vd,m = fa 93.69 onthly = 4. 122.75 o hot water 18.41 olar or Water welling, e	ay Vd,av lwelling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage), 15.89 /WHRS nter 110	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 7Tm / 3600 112.64 boxes (46) 16.9 within sa (47)	+ 36 a water us Sep 97.68 0 kWh/mor 113.98 0 to (61) 17.1 ame vess	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth 19.93 sel	9) Nov 105.65 m(44) _{1 12} = ables 1b, 1 145 m(45) _{1 12} = 21.75	.67 Dec 109.64		(43 (44 (45 (46 (47
if TFA if TFA Annual a Reduce the left more to that water 44)m= Energy cc 45)m= finstanta 46)m= Vater s Storage f comm Otherwi: Vater s a) If ma	average he annual that 125 Jan 109.64 109.64 162.59	Population (Processing Action of the Control of the	+ 1.76 x ater usage hot water person per Mar day for ear 101.66 used - calc 146.74 ang at point 22.01 including the including at hot water the including	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (no 19.19 ag any so ank in dw er (this in	es per da 5% if the of water use, I May Vd,m = fact 93.69 onthly = 4. 122.75 o hot water 18.41 olar or W velling, e	ay Vd,av lwelling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage), 15.89 /WHRS nter 110	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 7Tm / 3600 112.64 boxes (46) 16.9 within sa (47)	+ 36 a water us Sep 97.68 0 kWh/mor 113.98 0 to (61) 17.1 ame vess	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth 19.93 sel	9) Nov 105.65 m(44) _{1 12} = ables 1b, 1 145 m(45) _{1 12} = 21.75	.67 Dec 109.64 c, 1d) 157.46 23.62		(43 (44 (45 (46 (47
if TFA if TFA Annual a Reduce the not more is Hot water 44)m= Energy co 45)m= Vater s Storage f comm Otherwis Nater s a) If ma Tempera	average he annual that 125 Jan 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.65	Pe hot water litres per per litres per per litres per per litres p	ter usage hot water person per day for ear 101.66 used - calculation and no talculation a	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (no 19.19 ag any so ank in dw er (this in oss facto 2b , kWh/ye	es per da 5% if the a rater use, I May Vd,m = fa 93.69 onthly = 4. 122.75 o hot water 18.41 colar or W relling, e acludes i	ay Vd,av Iwelling is not and co Jun 89.7 190 x Vd,r 105.93 storage), 15.89 IWHRS nter 110 nstantar	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 7Tm / 3600 112.64 boxes (46) 16.9 within sa (47)	+ 36 a water us Sep 97.68 113.98 1 to (61) 17.1 ame vess ers) ente	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth 19.93 sel	9) Nov 105.65 m(44) _{1 12} = ables 1b, 1 145 m(45) _{1 12} = 21.75	.67 Dec 109.64 c, 1d) 157.46 23.62		(43 (44 (45 (46 (47 (48 (49
if TFA if TFA if TFA Annual a Reduce the continuous of the common of the	average in 109.64 Jan 109.64	Pe hot water respectively and respectively personal respective respectively. The respective respectively personal respective respectively personal respective respectively. The respective respective respective respective respective respective respective respectively. The respective resp	ter usage hot water person per Mar day for ear 101.66 used - calculated and person per 101.66 used - calculated and person per 101.66 used - calculated and person per 101.66 used - calculated and person person per 101.66 used - calculated and person person person per 101.66 used and person perso	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (not 19.19 ag any so nk in dw er (this in oss facto 2b , kWh/ye cylinder l om Tabl	es per da 5% if the a vater use, I May Vd,m = fa 93.69 onthly = 4. 122.75 o hot water 18.41 olar or W velling, e acludes i or is knowear	ay Vd,av lwelling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage), 15.89 /WHRS nter 110 nstantar wn (kWh	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 27m / 3600 112.64 boxes (46) 16.9 within sa (47) ombi boil	+ 36 a water us Sep 97.68 113.98 1 to (61) 17.1 ame vess ers) ente	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth 19.93 sel	9) 99 Nov 105.65 m(44) _{1 12} = ables 1b, 1 145 m(45) _{1 12} = 21.75	.67 Dec 109.64		(42) (43) (44) (45) (46) (47) (48) (49) (50) (51)
if TFA if TFA Annual a Reduce the lot more is allow water 44)m= Finergy co 45)m= Vater s Storage f comm Otherwis Nater s a) If ma Fempera Energy is b) If ma Hot water f comm	average he annual that 125 Jan 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.64 109.65	Pe hot water respectively and respectively personal respective respectively. The respective respectively personal respective respectively personal respective respectively. The respective respective respective respective respective respective respective respectively. The respective resp	ater usage hot water person per day for ear 101.66 used - calculus at point 22.01 including at point at hot water eclared less storage eclared of factor free sections.	ge in litre usage by day (all w Apr ach month 97.68 127.93 of use (not 19.19 ag any so nk in dw er (this in oss facto 2b , kWh/ye cylinder l om Tabl	es per da 5% if the o rater use, I May Vd,m = fa 93.69 onthly = 4. 122.75 o hot water 18.41 olar or W relling, e ncludes i or is known ear oss factor	ay Vd,av lwelling is not and co Jun ctor from 7 89.7 190 x Vd,r 105.93 storage), 15.89 /WHRS nter 110 nstantar wn (kWh	erage = designed in designed i	(25 x N) to achieve Aug (43) 93.69 27m / 3600 112.64 boxes (46) 16.9 within sa (47) ombi boil	+ 36 a water us Sep 97.68 113.98 1 to (61) 17.1 ame vess ers) ente	Oct 101.66 Total = Sunth (see Tail 132.84) Total = Sunth 19.93 sel	9) 99 Nov 105.65 m(44) _{1 12} = ables 1b, 1 145 m(45) _{1 12} = 21.75	.67 Dec 109.64 c, 1d) 157.46 23.62 0		(43) (44) (45) (46) (47) (48) (49) (50)

Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or Water storage	. , .	•	or each	month			((56)m = ((55) × (41)r	m		0		(55)
						1	., /					1	(EG)
(56)m= 0 If cylinder contain	0 s dedicated	0 d solar stor	0 rage (57)	0 m = (56)m	0 x [(50) – (0 H11)] ÷ (5)	0 0) else (5	7)m = (56)	0 m where (0 H11) is fro	m Append	ix H	(56)
	0		0		0	0	1			•	1		(57)
(57)m= 0	<u> </u>	0	-	0	0	U	0	0	0	0	0		` '
Primary circuit	`	,			50)	(50) - 00	NE (44)				0		(58)
Primary circuit (modified by				•	•		` '		r thermo	etat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss ca	loulated:	for each	month ((61)m = 1	(60) ÷ 3(L	l	<u> </u>					
(61)m= 50.96	46.03	50.96	48.17	47.74	44.24	45.71	47.74	48.17	50.96	49.32	50.96		(61)
` '	<u> </u>						<u> </u>					(59)m + (61)m	(0.)
(62)m= 213.55	188.23	197.7	176.1	170.5	150.16	143.87	160.38	162.15	183.79	194.31	208.42	(59)111 + (61)111	(62)
Solar DHW input	<u> </u>												(02)
(add additiona									CONTINUE	on to wate	i nealing)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from w	ater heat	ter .	-						-				
(64)m= 213.55	188.23	197.7	176.1	170.5	150.16	143.87	160.38	162.15	183.79	194.31	208.42		
								out from wa			l	2149.17	(64)
Heat gains fro	m water	heating	k\/\/h/m/	onth 0 24	5 ′ [0 85	x (45)m], ,
	ı water	ncating,	1	511111 0.20	, [0.00	(+0)!!!	. (0 . /	11 . 0.0 /			. (00/11)		
8.00 I = III(CO)	l 58.79 l	61.53	54.58	52.75	46.28	44.07	49.39	49.94	56.91	60.54	65.1	1	(65)
(65)m= 66.8	58.79 m in calc	61.53	54.58 of (65)m	52.75	46.28	<u> </u>	49.39	49.94	56.91	60.54	65.1		(65)
include (57)	m in calc	culation o	of (65)m	only if c		<u> </u>	49.39	49.94	56.91	60.54	65.1		(65)
include (57) 5. Internal ga	m in calc ains (see	culation of Table 5	of (65)m and 5a	only if c		<u> </u>	49.39	49.94	56.91	60.54	65.1		(65)
include (57) 5. Internal game	m in calc ains (see as (Table	culation of Table 5	of (65)m and 5a	only if c	ylinder i	s in the o	49.39 dwelling	49.94 or hot w	56.91 ater is fr	60.54 om com	65.1 munity h		(65)
include (57) 5. Internal ga Metabolic gair Jan	m in calc ains (see as (Table Feb	culation of Table 5 5), Watt	of (65)m and 5a ts Apr	only if c	ylinder is Jun	s in the o	49.39 dwelling	49.94 or hot w	56.91 ater is fr	60.54 om com	65.1 munity h		
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83	m in calc ains (see as (Table Feb	tulation control Table 5 5), Watt Mar 137.83	of (65)m and 5a ts Apr 137.83	only if c): May 137.83	ylinder is Jun 137.83	Jul 137.83	49.39 dwelling Aug 137.83	49.94 or hot w Sep 137.83	56.91 ater is fr	60.54 om com	65.1 munity h		(65)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains	m in calc ains (see as (Table Feb 137.83	Table 5 5), Watt Mar 137.83	and 5a ts Apr 137.83	only if c : May 137.83 L, equati	Jun 137.83 on L9 o	Jul 137.83 r L9a), a	49.39 dwelling Aug 137.83 lso see	49.94 or hot w Sep 137.83 Table 5	56.91 ater is fr Oct 137.83	60.54 om com Nov 137.83	65.1 munity h		(66)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53	m in calculation in c	Table 5 5), Watt Mar 137.83 ted in Ap	of (65)m and 5a ts Apr 137.83 opendix 13.96	only if c May 137.83 L, equati 10.44	Jun 137.83 on L9 o	Jul 137.83 r L9a), a	Aug 137.83 Iso see	49.94 or hot w Sep 137.83 Table 5	56.91 ater is fr Oct 137.83	60.54 om com	65.1 munity h		
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games	m in calc	5), Watt Mar 137.83 ted in Ap	and 5a and 5a ts Apr 137.83 opendix 13.96 Append	only if c): May 137.83 L, equati 10.44 dix L, equ	Jun 137.83 on L9 o 8.81 uation L	Jul 137.83 r L9a), a 9.52	49.39 dwelling Aug 137.83 lso see 12.37 3a), also	49.94 or hot w Sep 137.83 Table 5 16.61 o see Tal	56.91 ater is fr Oct 137.83 21.09 ble 5	60.54 om com Nov 137.83	65.1 munity h		(66) (67)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41	m in calconains (see Feb 137.83 (calcular 22.67 ins (calcular 262.1	Table 5 5), Watt Mar 137.83 ted in Ap 18.44 ulated in	and 5a and 5a ts Apr 137.83 opendix 13.96 Appendix 240.88	only if c): May 137.83 L, equati 10.44 dix L, eq 222.65	Jun 137.83 on L9 o 8.81 uation L 205.52	Jul 137.83 r L9a), a 9.52 13 or L1 194.07	49.39 dwelling Aug 137.83 lso see 12.37 3a), also 191.38	49.94 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16	56.91 ater is fr Oct 137.83 21.09 ble 5 212.6	60.54 om com Nov 137.83	65.1 munity h		(66)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains	m in calconians (see Feb 137.83 (calculate 22.67 ins (calculate 262.1 (calculate 262.1)	Table 5 5), Watt Mar 137.83 ted in Ap 18.44 ulated in 255.32 ted in Ap	and 5a and 5a ts Apr 137.83 ependix 13.96 Appendix 240.88	only if c May 137.83 L, equati 10.44 dix L, equ 222.65 L, equat	Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a	49.39 dwelling Aug 137.83 lso see 12.37 3a), also 191.38), also se	49.94 or hot w Sep 137.83 Table 5 16.61 o see Table 198.16 ee Table	56.91 ater is fr Oct 137.83 21.09 ole 5 212.6 5	60.54 om com Nov 137.83 24.61	Dec 137.83		(66) (67) (68)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78	m in calculations (see Feb 137.83) (calculations (calculat	Table 5 5), Watt Mar 137.83 ted in Ap 18.44 ulated in 255.32 ted in Ap	and 5a ts Apr 137.83 opendix 13.96 Appendix 240.88 opendix 36.78	only if c): May 137.83 L, equati 10.44 dix L, eq 222.65	Jun 137.83 on L9 o 8.81 uation L 205.52	Jul 137.83 r L9a), a 9.52 13 or L1 194.07	49.39 dwelling Aug 137.83 lso see 12.37 3a), also 191.38	49.94 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16	56.91 ater is fr Oct 137.83 21.09 ble 5 212.6	60.54 om com Nov 137.83	65.1 munity h		(66) (67)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fain	m in calconains (see Feb 137.83 (calcular 22.67 ins (calcular 262.1 (calcular 36.78 ns gains	Table 5 5), Watt Mar 137.83 ted in Ap 18.44 ulated in 255.32 ted in Ap 36.78 (Table 5	and 5a and 5a ds Apr 137.83 opendix 13.96 Appendix 240.88 opendix 36.78	only if c): May 137.83 L, equati 10.44 dix L, equati 222.65 L, equati 36.78	Jun 137.83 on L9 o 8.81 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a; 36.78	Aug 137.83 Iso see 12.37 3a), also 191.38), also se 36.78	49.94 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78	56.91 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78	00.54 om com Nov 137.83 24.61 230.83	Dec 137.83 26.24 247.96 36.78		(66) (67) (68) (69)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fames (70)m= 3	m in calculations (see Feb 137.83) (calculations (calculations (calculations (calculations)) (calculations (calculations)) (calculations)	Table 5 5), Watt Mar 137.83 ted in Ap 18.44 ulated in 255.32 ted in Ap 36.78 (Table 5	and 5a ts Apr 137.83 ependix 13.96 Append 240.88 ependix 36.78 ia)	only if construction only if c	Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a	49.39 dwelling Aug 137.83 lso see 12.37 3a), also 191.38), also se	49.94 or hot w Sep 137.83 Table 5 16.61 o see Table 198.16 ee Table	56.91 ater is fr Oct 137.83 21.09 ole 5 212.6 5	60.54 om com Nov 137.83 24.61	Dec 137.83		(66) (67) (68)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fames Pumps and fames (70)m= 3 Losses e.g. even	m in calconains (see Feb 137.83) (calculate 22.67) ins (calculate 262.1) (calculate 36.78) ns gains 3	ted in Apulated in	and 5a an	only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equati 36.78 3 es) (Tab	Jun 137.83 fon L9 of 8.81 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78	49.39 dwelling Aug 137.83 lso see 12.37 3a), also 191.38), also se 36.78	49.94 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78	56.91 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78	60.54 om com Nov 137.83 24.61 230.83	65.1 munity h Dec 137.83 26.24 247.96 36.78		(66) (67) (68) (69) (70)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fame (70)m= 3 Losses e.g. even (71)m= -110.27	m in calconsins (see Feb 137.83) (calculate 22.67) ins (calculate 262.1) (calculate 36.78) ns gains 3 raporatio -110.27	ted in Apulated in	and 5a ts Apr 137.83 ependix 13.96 Append 240.88 ependix 36.78 ia)	only if construction only if c	Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a; 36.78	Aug 137.83 Iso see 12.37 3a), also 191.38), also se 36.78	49.94 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78	56.91 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78	00.54 om com Nov 137.83 24.61 230.83	Dec 137.83 26.24 247.96 36.78		(66) (67) (68) (69)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fames (70)m= 3 Losses e.g. even (71)m= -110.27 Water heating	m in calculations (see Es (Table Feb 137.83) (calculations (calculations (calculations (calculations gains 3) raporatio -110.27 gains (T	ted in Ap 36.78 (Table 5 3 n (negat	and 5a ts Apr 137.83 pendix 13.96 Append 240.88 opendix 36.78 sa) 3 ive valu	only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equati 36.78 3 es) (Tab	Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15 36.78 3 le 5) -110.27	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78	49.39 dwelling Aug 137.83 lso see 12.37 3a), also 191.38), also se 36.78	49.94 or hot w Sep 137.83 Table 5 16.61 o see Table 198.16 ee Table 36.78	56.91 ater is fr Oct 137.83 21.09 ole 5 212.6 5 36.78	60.54 om com Nov 137.83 24.61 230.83 36.78	65.1 munity h Dec 137.83 26.24 247.96 36.78 3		(66) (67) (68) (69) (70) (71)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fames (70)m= 3 Losses e.g. even (71)m= -110.27 Water heating (72)m= 89.79	m in calconins (see Feb 137.83) (calculate 22.67) ins (calculate 36.78) ns gains 3 vaporatio -110.27 gains (T	ted in Ap 18.44 ulated in 255.32 ted in Ap 36.78 (Table 5 3 n (negat -110.27 able 5) 82.7	and 5a an	only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equati 36.78 3 es) (Tab	Jun 137.83 fon L9 of 8.81 uation L 205.52 ion L15 36.78 3 le 5) -110.27	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78	49.39 dwelling Aug 137.83 lso see 12.37 3a), also 191.38 3, also se 36.78 3 -110.27	49.94 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78 3 -110.27	56.91 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78 3 -110.27	60.54 om com Nov 137.83 24.61 230.83 36.78 3 -110.27	65.1 munity h Dec 137.83 26.24 247.96 36.78 3 -110.27		(66) (67) (68) (69) (70)
include (57) 5. Internal games Metabolic gair Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fames (70)m= 3 Losses e.g. even (71)m= -110.27 Water heating (72)m= 89.79 Total internal	m in calculations (see 137.83) (calculations (calculations (calculations)) (calculations) (calcu	ted in Ap 18.44 ulated in 255.32 ted in Ap 36.78 (Table 5 3 n (negat -110.27)	and 5a ts Apr 137.83 pendix 13.96 Append 240.88 pendix 36.78 sa) 3 ive valu -110.27	only if c May 137.83 L, equati 10.44 dix L, equ 222.65 L, equat 36.78 3 es) (Tab -110.27	Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15 36.78 3 le 5) -110.27	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a; 36.78 3	49.39 dwelling Aug 137.83 lso see 12.37 3a), also 191.38), also se 36.78 3 -110.27	49.94 or hot w Sep 137.83 Table 5 16.61 o see Tall 198.16 ee Table 36.78 3 -110.27 69.36 + (69)m + (56.91 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78 3 -110.27 76.49 70)m + (7	60.54 om com Nov 137.83 24.61 230.83 36.78 3 -110.27 84.09 1)m + (72)	65.1 munity h Dec 137.83 26.24 247.96 36.78 3 -110.27		(66) (67) (68) (69) (70) (71) (72)
include (57) 5. Internal games Metabolic gain Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances games (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fames (70)m= 3 Losses e.g. even (71)m= -110.27 Water heating (72)m= 89.79	m in calconsins (see see (Table Feb 137.83) (calculat 22.67) ins (calculat 36.78) ns gains 3 raporatio -110.27 gains (T 87.48) gains = 439.61	ted in Ap 18.44 ulated in 255.32 ted in Ap 36.78 (Table 5 3 n (negat -110.27 able 5) 82.7	and 5a ts Apr 137.83 pendix 13.96 Append 240.88 opendix 36.78 sa) 3 ive valu	only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equati 36.78 3 es) (Tab	Jun 137.83 fon L9 of 8.81 uation L 205.52 ion L15 36.78 3 le 5) -110.27	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78	49.39 dwelling Aug 137.83 lso see 12.37 3a), also 191.38 3, also se 36.78 3 -110.27	49.94 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78 3 -110.27	56.91 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78 3 -110.27	60.54 om com Nov 137.83 24.61 230.83 36.78 3 -110.27	65.1 munity h Dec 137.83 26.24 247.96 36.78 3 -110.27		(66) (67) (68) (69) (70) (71)

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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	2.34	x	11.28	x	0.63	x	0.7	=	8.07	(75)
Northeast _{0.9x} 0.77	X	2.34	x	22.97	x	0.63	x	0.7	=	16.42	(75)
Northeast 0.9x 0.77	x	2.34	x	41.38	x	0.63	_ x	0.7	=	29.59	(75)
Northeast 0.9x 0.77	x	2.34	x	67.96	x	0.63	x	0.7		48.6	(75)
Northeast _{0.9x} 0.77	x	2.34	x	91.35	x	0.63	×	0.7	=	65.32	(75)
Northeast 0.9x 0.77	X	2.34	x	97.38	x	0.63	x [0.7	=	69.64	(75)
Northeast _{0.9x} 0.77	x	2.34	x	91.1	x	0.63	x [0.7	=	65.15	(75)
Northeast _{0.9x} 0.77	X	2.34	x	72.63	X	0.63	x [0.7	=	51.94	(75)
Northeast _{0.9x} 0.77	X	2.34	x	50.42	x	0.63	x [0.7	=	36.06	(75)
Northeast _{0.9x} 0.77	X	2.34	x	28.07	X	0.63	x [0.7	=	20.07	(75)
Northeast _{0.9x} 0.77	X	2.34	X	14.2	X	0.63	x	0.7	_	10.15	(75)
Northeast _{0.9x} 0.77	X	2.34	x	9.21	x	0.63	x [0.7	=	6.59	(75)
Southeast 0.9x 0.77	X	2.64	x	36.79	x	0.63	x [0.7	=	89.06	(77)
Southeast 0.9x 0.77	X	2.64	x	62.67	x	0.63	x [0.7	=	151.7	(77)
Southeast 0.9x 0.77	x	2.64	x	85.75	x	0.63	x	0.7	=	207.56	(77)
Southeast 0.9x 0.77	x	2.64	x	106.25	x	0.63	×	0.7	=	257.18	(77)
Southeast 0.9x 0.77	x	2.64	x	119.01	x	0.63	x	0.7	=	288.06	(77)
Southeast 0.9x 0.77	X	2.64	x	118.15	x	0.63	×	0.7	=	285.98	(77)
Southeast 0.9x 0.77	X	2.64	x	113.91	x	0.63	x	0.7	=	275.71	(77)
Southeast 0.9x 0.77	x	2.64	x	104.39	x	0.63	x	0.7	=	252.67	(77)
Southeast 0.9x 0.77	x	2.64	x	92.85	x	0.63	×	0.7	=	224.74	(77)
Southeast 0.9x 0.77	x	2.64	x	69.27	x	0.63	x [0.7	=	167.66	(77)
Southeast 0.9x 0.77	x	2.64	x	44.07	x	0.63	x	0.7	=	106.67	(77)
Southeast 0.9x 0.77	X	2.64	x	31.49	x	0.63	x [0.7	=	76.21	(77)
Southwest _{0.9x} 0.77	x	2.28	x	36.79		0.63	x	0.7	=	25.64	(79)
Southwest _{0.9x} 0.77	X	2.28	X	62.67		0.63	x	0.7	=	43.67	(79)
Southwest _{0.9x} 0.77	X	2.28	X	85.75]	0.63	x [0.7		59.75	(79)
Southwest _{0.9x} 0.77	x	2.28	X	106.25		0.63	x [0.7	=	74.04	(79)
Southwest _{0.9x} 0.77	X	2.28	x	119.01]	0.63	x [0.7	=	82.93	(79)
Southwest _{0.9x} 0.77	x	2.28	x	118.15]	0.63	x [0.7	=	82.33	(79)
Southwest _{0.9x} 0.77	X	2.28	x	113.91]	0.63	x [0.7	=	79.37	(79)
Southwest _{0.9x} 0.77	x	2.28	x	104.39]	0.63	x [0.7	=	72.74	(79)
Southwest _{0.9x} 0.77	x	2.28	x	92.85		0.63	x [0.7	=	64.7	(79)
Southwest _{0.9x} 0.77	X	2.28	x	69.27]	0.63	x [0.7	=	48.27	(79)
Southwest _{0.9x} 0.77	x	2.28	x	44.07		0.63	x [0.7	=	30.71	(79)
Southwest _{0.9x} 0.77	X	2.28	X	31.49]	0.63	x [0.7		21.94	(79)
Solar gains in watts, calcula	$\overline{}$		$\overline{}$			n = Sum(74)m	(82)m	_			
(83)m= 122.76 211.79 296.		379.81 436.3		37.95 420.23	377	.35 325.5	236	147.53	104.74		(83)
Total gains – internal and so		` 	<u> </u>		I _ ·	00 []					(0.4)
(84)m= 564.84 651.4 720.7	72	777.8 807.69	5 7	783.9 750.4	714	.83 676.98	613.53	554.41	533.79		(84)

Temperature during heating periods in the living area from Table 9, Th1 (°C) Utilisation factor for gains for living area, h1,m (see Table 9a) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (86)m= 1 1 0.99 0.98 0.94 0.84 0.68 0.73 0.91 0.99 1 1 (86) Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m= 19.57 19.72 19.97 20.3 20.62 20.86 20.96 20.95 20.77 20.35 19.9 19.54 Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m= 19.87 19.87 19.87 19.88 19.88 19.89 19.89 19.89 19.89 19.89 19.88 19.88 19.88 19.88 (88) Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)	7. Me	an inter	nal tem	perature	(heating	season)								
Utilisation factor for gains for living area, h1,m see Table 9a) 3an Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Responsible Nov Dec Responsible Nov Nov Responsible Nov Nov Responsible Nov Nov Responsible Nov Nov Responsible Nov Nov Responsible Nov Nov Nov Responsible Nov			·					from Tal	ole 9, Th	1 (°C)				21	(85)
Begins	•		•	٠.			•								`
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)ms 19:57 19:72 19:97 20:3 20:62 20:86 20:96 20:95 20:77 20:35 19:9 19:54 (87) Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)ms 19:87 19:87 19:87 19:87 19:88 19:88 19:88 19:89 19:89 19:88 19:8		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(87)	(86)m=	1	1	0.99	0.98	0.94	0.84	0.68	0.73	0.91	0.99	1	1		(86)
Temperature during heating periods in rest of dwelling from Table 9, Th2 ("C") (88)m= 19.87	Mean	interna	temper	ature in		ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(88)	(87)m=	19.57	19.72	19.97	20.3	20.62	20.86	20.96	20.95	20.77	20.35	19.9	19.54		(87)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)me	Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)	(88)m=	19.87	19.87	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.88	19.88		(88)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 17.97 18.19 18.55 19.03 19.48 19.79 19.88 19.87 19.69 19.12 18.46 17.93 (90) (RA = Living area + (4) = 0.27 (91) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 − fLA) × T2 (92)m= 18.4 18.6 18.93 19.38 19.79 20.08 20.17 20.16 19.98 19.45 18.85 18.37 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 18.4 18.6 18.93 19.38 19.79 20.08 20.17 20.16 19.98 19.45 18.85 18.37 (93) S. 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-calculate the utilisation factor for gains using Table 9a Utilisation factor for gains using Table 9a Useful gains, hmGm. W = (94)m x (84)m (96)m= 563.16 647.45 711 750.89 733.29 035.7 433.18 448.5 583.39 596.96 551.13 532.57 (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 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) (98)m= 930.59 747.29 656.82 418.29 218.54 0 0 0 0 3 91.85 680.2 950.37 Total per year (kWhyear) = Sum(98)s. x = 4993.95 (98) Space heating requirements – Individual heating systems including micro-CHP)	Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(90) (90) (90) (17.97 18.19 18.55 19.03 19.48 19.79 19.88 19.87 19.69 19.12 18.46 17.93 (90) (18.4 = Living area + (4) =	(89)m=	1	1	0.99	0.97	0.91	0.75	0.54	0.59	0.86	0.98	1	1		(89)
Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2 (92)m=	Mean	interna	l temper	ature in	the rest	of dwelli	ing T2 (f	ollow ste	ps 3 to	7 in Tabl	le 9c)				
Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2 (92)me	(90)m=	17.97	18.19	18.55	19.03	19.48	19.79	19.88	19.87				L		(90)
(92) me										f	fLA = Livin	g area ÷ (4	4) =	0.27	(91)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 18.4 18.6 18.93 19.38 19.79 20.08 20.17 20.16 19.98 19.45 18.85 18.37 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-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	A) × T2					
93)me	(92)m=	18.4	18.6	18.93	19.38	19.79	20.08	20.17	20.16	19.98	19.45	18.85	18.37		(92)
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-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: (94)m= 1 0.99 0.99 0.97 0.91 0.77 0.58 0.63 0.86 0.97 0.99 1 Useful gains, hmGm, W = (94)m x (84)m (95)m= 563.16 647.45 711 750.89 733.29 603.57 433.18 448.5 583.39 596.96 551.13 532.57 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 Heat loss rate for mean internal temperature, Lm, W = (39)m x ((93)m - (96)m) (97)m= 1813.95 1759.49 1593.82 1331.85 1027.03 690.81 450 473.43 743.17 1123.64 1495.85 1809.95 Space heating requirement for each month, kWh/month = 0.024 x ((97)m - (95)m) x ((41)m) (98)m= 930.59 747.29 656.82 418.29 218.54 0 0 0 0 0 391.85 680.2 950.37 Total per year (kWh/year) = Sum(98), 38.1 2 493.95 (98) Space heating requirement in kWh/m²/year 48.99 (99) 9a. Energy requirements — Individual heating systems including micro-CHP) Space heating: Fraction of space heat from main system(s) (202) = 1 - (201) =						 		I		· · ·	r i	1			(00)
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						19.79	20.08	20.17	20.16	19.98	19.45	18.85	18.37		(93)
the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec						na abtain		on 11 of	Table O	h oo tho	4 T:/	7C) ma am	d == ==l=	lata	
Utilisation factor for gains, hm: (94)m= 1							ieu at st	ер п ог	rable 9	o, so ma	ıt 11,111 – (rojili ali	u re-caic	uiate	
94 m=		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains, hmGm , W = (94)m x (84)m (95)m=	Utilisa	ation fac	tor for g	ains, hm	:										
95 m 563.16							0.77	0.58	0.63	0.86	0.97	0.99	1		(94)
Monthly average external temperature from Table 8 (96)m= 4.3				<u> </u>	<u> </u>			100.40	140.5	500.00			-		(05)
(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= 1813.95 1759.49 1593.82 1331.85 1027.03 690.81 450 473.43 743.17 1123.64 1495.85 1809.95 (97) Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 930.59 747.29 656.82 418.29 218.54 0 0 0 0 0 391.85 680.2 950.37 Total per year (kWh/year) = Sum(98)								433.18	448.5	583.39	596.96	551.13	532.57		(95)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m – (96)m] (97)m=							i	16.6	16.4	14 1	10.6	7 1	4.2		(96)
(97)m=						<u> </u>		l	<u> </u>			,			()
(98)m= 930.59 747.29 656.82 418.29 218.54 0 0 0 0 391.85 680.2 950.37 Total per year (kWh/year) = Sum(98) ₁₅₉₁₂ = 4993.95 (98) Space heating requirement in kWh/m²/year 48.99 (99) 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) Efficiency of main space heating system 1 90.3 (206)						ı		<u> </u>			ī —	1495.85	1809.95		(97)
Total per year (kWh/year) = Sum(98) ₁₅₉₁₂ = 4993.95 (98) Space heating requirement in kWh/m²/year 48.99 (99) 9a. Energy requirements – Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system 0 (201) Fraction of space heat from main system(s) (202) = $1 - (201) = 1 - (202)$ Fraction of total heating from main system 1 (204) = $(202) \times [1 - (203)] = 1 - (204)$ Efficiency of main space heating system 1 90.3 (206)	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			
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 (204) = (202) × [1 – (203)] = 1 (204) 90.3 (206)	(98)m=	930.59	747.29	656.82	418.29	218.54	0	0	0	0	391.85	680.2	950.37		
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 Space heating including micro-CHP) 0 (201) 1 (202) 1 (202) 1 (204) 204) 206)									Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	4993.95	(98)
Space heating:Fraction of space heat from secondary/supplementary system0(201)Fraction of space heat from main system(s) $(202) = 1 - (201) =$ 1(202)Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$ 1(204)Efficiency of main space heating system 190.3(206)	Space	e heatin	g require	ement in	kWh/m²	²/year								48.99	(99)
Fraction of space heat from secondary/supplementary system 0 (201) Fraction of space heat from main system(s) $(202) = 1 - (201) =$ 1 (202) Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$ 1 (204) Efficiency of main space heating system 1 90.3 (206)	9a. En	ergy rec	quiremer	nts – Indi	vidual h	eating s	ystems i	ncluding	micro-C	CHP)					
Fraction of space heat from main system(s) $ (202) = 1 - (201) = $ $ (202) = 1 - (201) = $ $ (204) = (202) \times [1 - (203)] = $ $ (204) = (202) \times [1 - (203)] = $ $ (204) = (202) \times [1 - (203)] = $ $ (204) = (202) \times [1 - (203)] = $ $ (204) = (202) \times [1 - (203)] = $ $ (204) = (202) \times [1 - (203)] = $ $ (206) = (202) $	-		_	at from s	econdar	v/sunnle	mentary	, evetem						0	(201)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$ 1 (204) Efficiency of main space heating system 1 90.3 (206)							incinal y	-		- (201) =					= '
Efficiency of main space heating system 1					-	, ,					(203)] =				= ' '
				•	-				(204) - (2	02) ^ [1 =	(200)] =				= ' '
Cinciency of Secondary/supplementary heating system, %		-	•				a ovete-	o 0/							= '
	⊏IIICI€	ency of s	seconda	ı y/suppi	emeniar	y neaun	y systen	1, 70						0	(208)

		T	1				_	_	_		<u> </u>	1	
Jan Space bootin	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heatin	747.29	656.82	418.29	218.54	0	0	0	0	391.85	680.2	950.37		
(211)m = {[(98	<u> </u>												(211)
1030.55	í `	727.38	463.23	242.02	0	0	0	0	433.94	753.26	1052.46		(=11)
							Tota	l (kWh/yea	ar) =Sum(2	211),15,10. 12	=	5530.39	(211)
Space heatin	g fuel (s	econdar	y), kWh/	month									_
= {[(98)m x (20												l	
(215)m= 0	0	0	0	0	0	0	0 Tota	0 L (k\\/b/vo:	0 ar) =Sum(2	0	0		7(045)
Water beating	_						TOLA	i (KVVII/yea	ar) =3um(2	13)15,10. 12		0	(215)
Water heating Output from wa		ter (calc	ulated a	bove)									
213.55	188.23	197.7	176.1	170.5	150.16	143.87	160.38	162.15	183.79	194.31	208.42		
Efficiency of w	ater hea	iter										81	(216)
(217)m= 88.41	88.26	87.96	87.33	85.97	81	81	81	81	87.11	88.05	88.47		(217)
Fuel for water (219)m = (64)													
(219)m = 241.56	213.27	224.75	201.65	198.31	185.39	177.62	198	200.19	211	220.68	235.57		
		•	•	•			Tota	I = Sum(2	19a) ₁₁₂ =		•	2507.98	(219)
Annual totals									k\	Wh/yeaı	•	kWh/year	_
Space heating	fuel use	ed, main	svstem	1								5530.39	
		ŕ	-,									0000.00	Ⅎ
Water heating	fuel use		.,									2507.98	
Water heating Electricity for p		ed	•		t								j
-	oumps, f	ed ans and	•		t						30		(230c)
Electricity for p	oumps, fa	ed ans and :	electric	keep-ho	t		sum	of (230a)	(230g) =		30		(230c) (231)
Electricity for p	oumps, failing pumps	ed ans and :	electric	keep-ho	t		sum	of (230a)	(230g) =		30	2507.98	_
Electricity for posterior central heating Total electricity	oumps, fang pump of graphy for the dighting	ed ans and : above, l	electric kWh/yea	keep-ho r		uding mi			(230g) =		30	2507.98	(231)
Electricity for positive central heating Total electricity Electricity for li	oumps, fang pump of graphy for the dighting	ed ans and : above, l	electric kWh/yea	keep-ho r	ems inclu					ion foo		2507.98 30 450.84	(231)
Electricity for positive central heating Total electricity Electricity for li	oumps, fang pump of graphy for the dighting	ed ans and : above, l	electric kWh/yea	keep-ho r	ems inclu En	uding mi ergy /h/year				ion fac 2/kWh		2507.98	(231)
Electricity for positive central heating Total electricity Electricity for li	oumps, fang pump y for the ighting issions -	ed ans and : above, l	electric kWh/yea ual heat	keep-ho r	ems inclu En kW	ergy			Emiss kg CO	2/kWh		30 450.84 Emissions kg CO2/yea	(231) (232)
Electricity for procentral heating Total electricity Electricity for li 12a. CO2 em	oumps, fang pump y for the ighting issions -	ans and : above, I - Individ	electric kWh/yea ual heat	keep-ho r	ems inclu En kW (211	ergy /h/year			Emiss kg CO2	2/kWh	tor	30 450.84 Emissions kg CO2/yea	(231) (232) (232) (261)
Electricity for positive central heating Total electricity Electricity for li 12a. CO2 em Space heating Space heating	oumps, fang pump y for the ighting issions -	ans and : above, I - Individ	electric kWh/yea ual heat	keep-ho r	ems inclu En kW (211	ergy /h/year			Emiss kg CO2	2/kWh	tor =	30 450.84 Emissions kg CO2/yea 1194.57	(231) (232) (232) (261) (263)
Electricity for procentral heating Total electricity Electricity for li 12a. CO2 em Space heating Space heating Water heating	oumps, fang pump y for the ighting issions -	ans and : above, I Individ	electric kWh/yea ual heat	keep-ho r	ems inclu En kW (211 (215	ergy /h/year i) x 5) x			Emiss kg CO2	2/kWh	tor = =	30 450.84 Emissions kg CO2/yea 1194.57 0	(231) (232) (232) (261) (263) (264)
Electricity for procentral heating Total electricity Electricity for li 12a. CO2 em Space heating Space heating Water heating Space and was	oumps, fang pumps y for the ighting issions (main s (second	ans and ans and above, l above, l ustem 1 dary)	electric kWh/yea ual heat	keep-ho	ems inclu En kW (211 (215 (219)	ergy /h/year i) x 5) x	cro-CHF		Emiss kg CO2 0.2 0.5 0.2	2/kWh	tor = =	30 450.84 Emissions kg CO2/yea 1194.57 0 541.72 1736.29	(231) (232) (232) (261) (263) (264) (265)
Electricity for procentral heating Total electricity Electricity for li 12a. CO2 em Space heating Space heating Water heating	oumps, fang pumps,	ans and ans and above, l above, l ustem 1 dary)	electric kWh/yea ual heat	keep-ho	ems inclu En kW (211 (215 (219 (261	ergy /h/year 1) × 5) × 9) ×	cro-CHF		Emiss kg CO2 0.2 0.5 0.5	2/kWh 16 19 16	tor = = =	30 450.84 Emissions kg CO2/yes 1194.57 0 541.72 1736.29 15.57	(231) (232) (232) (261) (263) (264) (265) (267)
Electricity for procentral heating Total electricity Electricity for li 12a. CO2 em Space heating Water heating Space and was Electricity for procentral process.	oumps, faring pumps, faring pumps, faring lissions -	ans and ans and above, l above, l ustem 1 dary)	electric kWh/yea ual heat	keep-ho	ems inclu En kW (211 (215 (219 (261	ergy /h/year 1) x 5) x 9) x 1) + (262)	cro-CHF	264) =	Emiss kg CO2 0.2 0.5 0.2	2/kWh 16 19 16	tor = = =	30 450.84 Emissions kg CO2/yes 1194.57 0 541.72 1736.29 15.57 233.99	(231) (232) (232) (261) (263) (264) (265) (267) (268)
Electricity for procentral heating. Total electricity for life the second secon	oumps, farge pumps	ans and ans and above, I above 1 alory) ang ans and	electric kWh/yea ual heat	keep-ho	ems inclu En kW (211 (215 (219 (261	ergy /h/year 1) x 5) x 9) x 1) + (262)	cro-CHF	264) = sum o	Emiss kg CO2 0.5 0.5 0.5 0.5	2/kWh 16 19 16	tor = = =	30 450.84 Emissions kg CO2/yes 1194.57 0 541.72 1736.29 15.57	(231) (232) (232) (261) (263) (264) (265) (267)
Electricity for procentral heating. Total electricity for life the second secon	oumps, farge pumps, farge pumps, farget from the fighting dissions - ter heating pumps, farget from the fighting displayer at the emission of the farget from	ans and ans and above, I above 1 alory) ang ans and	electric kWh/yea ual heat	keep-ho	ems inclu En kW (211 (215 (219 (261	ergy /h/year 1) x 5) x 9) x 1) + (262)	cro-CHF	264) = sum o	Emiss kg CO2 0.2 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	2/kWh 16 19 16	tor = = =	30 450.84 Emissions kg CO2/yea 1194.57 0 541.72 1736.29 15.57 233.99 1985.85	(231) (232) (232) (261) (263) (264) (265) (267) (268) (272)

		User Details:				
Assessor Name:	Chris Hocknell	Stroma Nu	mber:	STRO	016363	
Software Name:	Stroma FSAP 2012	Software V	ersion:	Versio	n: 1.0.4.26	
		Property Address: Flat (
Address :	Flat 04, 51 Calthorpe Street	t, LONDON, WC1X 0H	1			
1. Overall dwelling dime	ensions:					
Ground floor		Area(m²) 83.77 (1a) x	Av. Height(m	1) (2a) = [Volume(m³)	(3a)
First floor				-		_
	-) . (4 -) . (4 -) . (4 -) . (4	20.32 (1b) x	2.2	(2b) =	44.7	(3b)
·	a)+(1b)+(1c)+(1d)+(1e)+(1i	,		_		_
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+	(3n) =	301.04	(5)
2. Ventilation rate:	main	m, othor	total		m³ nor hour	•
	main seconda heating heating	ry other	total	_	m³ per hou	_
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	ns		4	x 10 =	40	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fi	res		0	x 40 =	0	(7c)
				A ! !.		_
				-	anges per ho	_
•	ys, flues and fans = (6a)+(6b)+(7 een carried out or is intended, procee		40 from (9) to (16)	÷ (5) =	0.13	(8)
Number of storeys in the		ed to (17), otherwise continue	110111 (9) 10 (10)	Г	0	(9)
Additional infiltration			[0	(9)-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame or	r 0.35 for masonry cons	struction		0	(11)
if both types of wall are pa deducting areas of openia	resent, use the value corresponding to	o the greater wall area (after		_		_
	iloor, enter 0.2 (unsealed) or 0	.1 (sealed), else enter	0	Г	0	(12)
If no draught lobby, en	ter 0.05, else enter 0	,			0	(13)
Percentage of windows	s and doors draught stripped			Ī	0	(14)
Window infiltration		0.25 - [0.2 x (14)	÷ 100] =	Ī	0	(15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =		0	(16)
Air permeability value,	q50, expressed in cubic metre	es per hour per square	metre of envelor	oe area	5	(17)
If based on air permeabil	ity value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		Ī	0.38	(18)
Air permeability value applie	s if a pressurisation test has been do	ne or a degree air permeabili	ty is being used	-		
Number of sides sheltere	ed				1	(19)
Shelter factor		$(20) = 1 - [0.075 \times$	(19)] =		0.92	(20)
Infiltration rate incorporat	ing shelter factor	$(21) = (18) \times (20)$	=		0.35	(21)
Infiltration rate modified f		, , , , , , , , , , , , , , , , , , , 				
Jan Feb	Mar Apr May Jun	Jul Aug Ser	Oct No	v Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

Wind F	actor (2	2a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjuste	ed infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
	0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42]	
		<i>tive air</i> al ventila	•	rate for t	he appli	cable ca	se	•	•	•	•	•	,	(220)
				endix N. (2	(23a) = (23a	a) × Fmv (e	eguation (N5)) , othe	rwise (23b) = (23a)			0	(23a) (23b)
			•	· ·	, ,		. ,	n Table 4h	•	, (,			0	(23c)
a) If	balance	d mecha	anical ve	entilation	with he	at recove	ery (MV	HR) (24a	a)m = (2:	2b)m + (23b) × [1 – (23c)		(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat red	covery (I	MV) (24b	o)m = (2:	2b)m + (2	23b)	•	•	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
,					•	•		on from o						
Ī			<u> </u>	<u> </u>	ŕ	ŕ	· `		i 	.5 × (23b	ŕ	Ι.	1	(0.1.)
(24c)m=	0	0	0		0	0	0	0	0	0	0	0]	(24c)
,					•	•		on from 0.5 + [(2		0.51				
(24d)m=		0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	1	(24d)
Effec	ctive air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	ld) in bo	x (25)	<u> </u>	<u> </u>	<u>!</u>	J	
(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(25)
3. Hea	at losse:	s and he	eat loss r	paramet	er:								_	
ELEN	IENT	Gros area	_	Openin m	gs	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	IENT		_	Openin	gs		m²				K)			
Doors	IENT ws Type	area	_	Openin	gs	A ,r	m² x	W/m2	2K =	(W/I	K)			kJ/K
Doors Window		area	_	Openin	gs	A ,r	m² x x1	W/m2	2K = = 0.04] =	(W/I 2.772	K)			kJ/K (26)
Doors Window Window	ws Type	area	_	Openin	gs	A ,r	m² x x1 x1	W/m2 1.4 /[1/(1.6)+	2K = 0.04] =	2.772 2.17	K)			kJ/K (26) (27)
Doors Window Window Window	ws Type ws Type	area	_	Openin	gs	A ,r 1.98 1.44 2.64	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0.04] = 0.04] =	2.772 2.17 3.97	K)			kJ/K (26) (27) (27)
Doors Window Window Window	ws Type ws Type ws Type	area 1 2 2 3 4	_	Openin	gs	A ,r 1.98 1.44 2.64 0.69	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] =	2.772 2.17 3.97 1.04	K)			kJ/K (26) (27) (27) (27)
Doors Window Window Window Window Window	ws Type ws Type ws Type ws Type	area	_	Openin	gs	A ,r 1.98 1.44 2.64 0.69 1.8	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+	2K = 0.04] =	2.772 2.17 3.97 1.04 2.06	K)			kJ/K (26) (27) (27) (27) (27)
Doors Window Window Window Window Window Window	ws Type ws Type ws Type ws Type ws Type	area 1 2 3 4 4 5 5 6 6	_	Openin	gs	A ,r 1.98 1.44 2.64 0.69 1.8	m ²	W/m ² 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+	EK = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65	K)			kJ/K (26) (27) (27) (27) (27) (27)
Doors Window Window Window Window Window Window	ws Type ws Type ws Type ws Type ws Type	area 1 2 3 4 4 5 5 6 6	_	Openin	gs	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	EK = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65 9.92				kJ/K (26) (27) (27) (27) (27) (27) (27)
Doors Window Window Window Window Window Window Window	ws Type ws Type ws Type ws Type ws Type ws Type	area 1 2 3 4 4 5 5 6 6	(m²)	Openin	gs ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+	2K = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38				kJ/K (26) (27) (27) (27) (27) (27) (27) (27)
Doors Window Window Window Window Window Window Window Floor	ws Type ws Type ws Type ws Type ws Type ws Type ws Type	area 1 2 3 4 4 5 5 6 6 7	(m²)	Openin n	gs ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+	2K = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Window Window Window Window Window Window Window Window Window Window Window Window Window Window Window Window Window Window	ws Type ws Type ws Type ws Type ws Type ws Type fype1 Type2	area 1 2 3 4 5 6 7	(m²)	Openin m	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66	m²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.6)+ 0.12	2K = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28)
Doors Window Win	ws Type ws Type ws Type ws Type ws Type ws Type fype1 Type2	area 1 2 3 4 5 6 7 55.6	(m²)	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92	m²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ 0.12 0.23 0.12	2K = 0.04] = 0	(W/I 2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524 10.73 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29)
Doors Window Window Window Window Window Window Window Window Window Window Window Window Window Rloor Walls 1 Walls 1 Roof	ws Type ws Type ws Type ws Type ws Type fype1 Type2 Type3	area 1 2 3 4 4 5 5 6 6 7 55.6 19.9 36.4	(m²)	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92 24.52	m²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	EK =	(W/I 2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524 10.73 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (29) (29)
Doors Window Window Window Window Window Window Window Window Window Window Window Window Window Rloor Walls 1 Walls 1 Roof	ws Type ws Type ws Type ws Type ws Type fype1 Type2 Type3 rea of e	area 1 2 3 4 4 5 6 6 7 55.6 19.9 36.4 13.0	(m²)	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92 24.52	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	EK =	(W/I 2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524 10.73 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (29) (29) (29)
Doors Window Window Window Window Window Window Window Window Window Window Window Window Window Window Tloor Walls 1 Walls 1 Roof Total a	ws Type ws Type ws Type ws Type ws Type fype1 fype2 fype3 rea of e vall	area 1 2 3 4 4 5 6 6 7 55.6 19.9 36.4 13.0	(m²)	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92 24.52 13.01	m²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ 0.12 0.12 0.12	2K = 0.04] = 0	(W/I 2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524 10.73 2.07 2.94				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31)

(26) (30) + (32) =

Fabric heat loss, W/K = S (A x U)

57.05

(33)

	$S(A \times k)$						((28)	(30) + (32	2) + (32a)	(32e) =	18376.29	(34)
Thermal mass paran	` ,	⊃ = Cm +	÷ TFA) ir	ı kJ/m²K				tive Value:		` '	250	(35)
For design assessments v	,		,			ecisely the				able 1f	230	
can be used instead of a					,	,						
Thermal bridges : S	L x Y) cal	culated	using Ap	pendix l	K						31.32	(36)
if details of thermal bridging	_	own (36) :	= 0.05 x (3	1)								_
Total fabric heat loss							, ,	(36) =			88.36	(37)
Ventilation heat loss	calculated	monthly	У				(38)m	= 0.33 × (25)m x (5)		1	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 59.8 59.41	59.02	57.21	56.87	55.29	55.29	55	55.9	56.87	57.56	58.27		(38)
Heat transfer coeffici	ent, W/K						(39)m	= (37) + (3	38)m		_	
(39)m= 148.16 147.7	147.38	145.57	145.23	143.66	143.66	143.37	144.27	145.23	145.92	146.64		_
Heat loss parameter	(HLP), W	/m²K						Average = = (39)m ÷	` '	12 /12=	145.57	(39)
(40)m= 1.42 1.42	1.42	1.4	1.4	1.38	1.38	1.38	1.39	1.4	1.4	1.41		
Number of days in m	onth (Tab	le 1a)			•		,	Average =	Sum(40) ₁	12 /12=	1.4	(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>											J	
4. Water heating en	ergy requ	irement:								kWh/y	ear:	
Assumed occupancy	. N										1	
if TFA > 13.9, N = if TFA £ 13.9, N =	1 + 1.76 x 1			·		, , -		ΓFA -13.		77]	(42)
	1 + 1.76 x 1 vater usaç ge hot water	ge in litre	es per da 5% if the a	ay Vd,av	erage =	(25 x N)	+ 36		9)).09]	(42)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres pe	1 + 1.76 x 1 vater usaç ge hot water rr person per	ge in litre usage by r day (all w	es per da 5% if the d vater use, I	y Vd,av welling is not and co	erage = designed t ld)	(25 x N) to achieve	+ 36 a water us	se target o	9)	0.09]	` ,
if TFA £ 13.9, N = Annual average hot v Reduce the annual average	1 + 1.76 x 1 vater usag ge hot water or person per	ge in litre usage by r day (all w	es per da 5% if the d vater use, f	ny Vd,av lwelling is not and co Jun	erage = designed t ld) Jul	(25 x N) to achieve	+ 36		9)]	` ,
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per	1 + 1.76 x 1 vater usage hot water or person per Mar er day for ea	ge in litre usage by r day (all w Apr ach month	es per da 5% if the a vater use, I May Vd,m = fa	y Vd,av welling is not and co Jun ctor from	erage = designed to lid) Jul Table 1c x	(25 x N) to achieve Aug (43)	+ 36 a water us Sep	Ge target of	9)	0.09 Dec]	` ,
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per	1 + 1.76 x 1 vater usage hot water or person per Mar er day for ea	ge in litre usage by r day (all w	es per da 5% if the d vater use, f	ny Vd,av lwelling is not and co Jun	erage = designed t ld) Jul	(25 x N) to achieve	+ 36 a water us Sep 98.09	se target o	Nov	Dec 110.1	1201.08	` ,
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per	1 + 1.76 x 1 vater usage hot water or person per Marer day for each of the control of the cont	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the day vater use, I May Vd,m = fac 94.08	ay Vd,av welling is not and co Jun ctor from 1	erage = designed to ld) Jul Table 1c x 90.08	(25 x N) o achieve Aug (43) 94.08	+ 36 a water us Sep 98.09	Oct 102.09 Total = Sui	Nov 106.09 m(44) _{1 12} =	Dec 110.1	1201.08	(43)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09	1 + 1.76 x 1 vater usage hot water or person per Mar er day for each 102.09 er used - cal	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the day vater use, I May Vd,m = fac 94.08	ay Vd,av welling is not and co Jun ctor from 1	erage = designed to ld) Jul Table 1c x 90.08	(25 x N) o achieve Aug (43) 94.08	+ 36 a water us Sep 98.09	Oct 102.09 Total = Sui	Nov 106.09 m(44) _{1 12} =	Dec 110.1	1201.08	(43)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09 Energy content of hot wat (45)m= 163.27 142.8	1 + 1.76 x 1 vater usage hot water or person per Mar er day for each 102.09 er used - cal	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the a vater use, l May Vd,m = fa 94.08 onthly = 4.	y Vd,av lwelling is not and co Jun ctor from 7 90.08	erage = designed to designed t	(25 x N) o achieve Aug (43) 94.08	+ 36 a water us Sep 98.09 0 kWh/mor 114.46	Oct 102.09 Total = Suith (see Tai	Nov 106.09 m(44) _{1 12} = 1bles 1b, 1 145.61	Dec 110.1 c, 1d) 158.12	1201.08	(43)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09 Energy content of hot wate (45)m= 163.27 142.8	1 + 1.76 x 1 vater usage hot water or person per Mar er day for each 102.09 er used - cal 147.36	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the a vater use, l May Vd,m = fa: 94.08 onthly = 4.	y Vd,av lwelling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in	(25 x N) o achieve Aug (43) 94.08 97m / 3600 113.11 boxes (46)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 1 to (61)	Oct 102.09 Total = Sun 133.39 Total = Sun	Nov 106.09 m(44) _{1 12} = shles 1b, 1 145.61 m(45) _{1 12} =	Dec 110.1 : c, 1d) 158.12		(43) (44) (45)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09 Energy content of hot wate (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42	1 + 1.76 x 1 vater usage hot water or person per Mar er day for each 102.09 er used - cal 147.36	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the a vater use, l May Vd,m = fa 94.08 onthly = 4.	y Vd,av lwelling is not and co Jun ctor from 7 90.08	erage = designed to designed t	(25 x N) o achieve Aug (43) 94.08	+ 36 a water us Sep 98.09 0 kWh/mor 114.46	Oct 102.09 Total = Sunth (see Tail 133.39	Nov 106.09 m(44) _{1 12} = 1bles 1b, 1 145.61	Dec 110.1 c, 1d) 158.12		(43)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09 Energy content of hot wate (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss:	1 + 1.76 x 1 vater usage hot water person per many for each of the second person per used - cal second per use	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 f of use (no	es per da 5% if the a vater use, I May Vd,m = fa 94.08	y Vd,av welling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37 x storage),	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79	(25 x N) o achieve Aug (43) 94.08 77m / 3600 113.11 boxes (46) 16.97	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 1 to (61) 17.17	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) _{1 12} = sibles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09 Energy content of hot wate (45)m= 163.27 142.8 If instantaneous water her (46)m= 24.49 21.42 Water storage loss: Storage volume (litres)	1 + 1.76 x 1 vater usage hot water or person per ler day for each of the left	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 f of use (no	es per da 5% if the orater use, I May Vd,m = far 94.08	y Vd,av lwelling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37 x storage), 15.96	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11 boxes (46) 16.97 within sa	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 1 to (61) 17.17	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) _{1 12} = sibles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 : c, 1d) 158.12		(43) (44) (45)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09 Energy content of hot wate (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss: Storage volume (litred of the storage storage) Otherwise if no store	1 + 1.76 x 1 vater usage hot water or person per mer day for each of the second of the	ge in litre usage by r day (all w Apr ach month 98.09 culated mo 128.47 t of use (no 19.27 and any so ank in dw	es per da 5% if the of vater use, I May Vd,m = fa 94.08 onthly = 4. 123.27 o hot water 18.49 olar or W velling, e	y Vd,av welling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37 storage), 15.96	erage = designed to designed t	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 17.17 ame ves	Oct 102.09 Total = Sun 133.39 Total = Sun 20.01	Nov 106.09 m(44) _{1 12} = sbles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46)
if TFA £ 13.9, N = Annual average hot of Reduce the annual average not more that 125 litres per lit	1 + 1.76 x 1 vater usage hot water or person per ler day for each of the left	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 f of use (no 19.27 and any se ank in dw er (this in	es per da 5% if the a vater use, I May Va,m = fa 94.08 onthly = 4. 123.27 o hot water 18.49 olar or W velling, e acludes i	y Vd,av welling is not and co Jun 200.08 190 x Vd,r 106.37 15.96 WHRS nter 110 nstantar	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 17.17 ame ves	Oct 102.09 Total = Sun 133.39 Total = Sun 20.01	Nov 106.09 m(44) _{1 12} = sbles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09 Energy content of hot wate (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss: Storage volume (litre If community heating Otherwise if no store Water storage loss:	1 + 1.76 x 1 vater usage hot water or person per er day for each of the second of the	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 for use (no 19.27 and any se ank in dw er (this in	es per da 5% if the a vater use, I May Va,m = fa 94.08 onthly = 4. 123.27 o hot water 18.49 olar or W velling, e acludes i	y Vd,av welling is not and co Jun 200.08 190 x Vd,r 106.37 15.96 WHRS nter 110 nstantar	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 17.17 ame ves	Oct 102.09 Total = Sun 133.39 Total = Sun 20.01	Nov 106.09 m(44) _{1 12} = 12bles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 23.72		(43) (44) (45) (46) (47)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09 Energy content of hot wate (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss: Storage volume (litred of the storage storage) Otherwise if no stored water storage loss: a) If manufacturer's	1 + 1.76 x 1 vater usage hot water or person per er day for each of the second of the	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 t of use (not 19.27 ank in dw er (this ir oss factor 2b	es per da 5% if the of water use, I May Vd,m = fact 94.08 123.27 hot water 18.49 color or W welling, e ncludes i	y Vd,av welling is not and co Jun 200.08 190 x Vd,r 106.37 15.96 WHRS nter 110 nstantar	erage = designed to designed t	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 17.17 ame vess ers) ente	Oct 102.09 Total = Sun 133.39 Total = Sun 20.01	Nov 106.09 m(44) _{1 12} = sbles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46) (47)

Hot water storage			e 2 (kW	h/litre/da	ay)					0		(51)
If community hea	•	ion 4.3									•	
Volume factor fro		. 2h								0		(52)
Temperature fact										0		(53)
Energy lost from	=	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (54	` '									0		(55)
Water storage los	s calculated	for each	month			((56)m = (55) × (41)ı	m 				
(56)m= 0	0 0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains de	dicated solar sto	orage, (57)	m = (56)m	x [(50) – ([H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0 0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit los	s (annual) fr	om Table	3							0		(58)
Primary circuit los	s calculated	for each	month (59)m = ((58) ÷ 36	65 × (41)	m					
(modified by fa	tor from Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0 0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calcu	ated for each	n month ((61)m =	(60) ÷ 36	65 × (41)m						
(61)m= 50.96 4	50.96	48.37	47.94	44.42	45.9	47.94	48.37	50.96	49.32	50.96		(61)
Total heat require	d for water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 × (′45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
	8.83 198.32	176.84	171.21	150.8	144.47	161.05	162.83	184.35	194.92	209.08		(62)
Solar DHW input calc	I ulated using Apr	l pendix G or	Appendix	H (negati	ve quantity	L	L ' if no sola	L r contribut	Iion to wate	r heating)		
(add additional lir										,g/		
(63)m= 0	0 0	0	0	0	0	0	0	0	0	0		(63)
Output from wate	heater				ļ				<u> </u>		l	
· —	8.83 198.32	176.84	171.21	150.8	144.47	161.05	162.83	184.35	194.92	209.08		
(*)		1			<u> </u>	l	l		<u>l</u> r (annual)₁	l	2156.94	(64)
Heat gains from v	zter heating	k\\/h/m/	onth () 2	5 ′ [0 85	x (45)m							1
	3.99 61.74	54.81	52.97	46.47	44.25	49.59	1] . 0.0 /	- ` 	- ` 	1 (55)111	,1	
` ′	7.00 01.74						50.15	1 5/09	I 60 /4	65.32		(65)
include (57)m i	, coloulation	<u> </u>	<u> </u>				50.15	57.09	60.74	65.32	o o tina	(65)
	n calculation	of (65)m	only if c						<u> </u>		eating	(65)
5. Internal gains		of (65)m	only if c						<u> </u>		eating	(65)
Metabolic gains ((see Table s	of (65)m 5 and 5a tts	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	rom com	munity h	eating	(65)
Metabolic gains (rable 5), Wa eb Mar	of (65)m 5 and 5a tts Apr	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
Metabolic gains ((see Table s	of (65)m 5 and 5a tts	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	rom com	munity h	eating	(65)
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca	Fable 5), Wares 138.71 138.71 138.71	of (65)m 5 and 5a tts Apr 138.71	only if constant only i	ylinder i Jun 138.71	Jul 138.71	Aug 138.71	Sep 138.71	ater is fr	Nov	Dec	eating	(66)
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca	G (see Table 5), Wa Feb Mar 18.71 138.71	of (65)m 5 and 5a tts Apr 138.71	only if c): May 138.71	ylinder i Jun 138.71	Jul 138.71	Aug 138.71	or hot w Sep 138.71	ater is fr	om com	munity h	eating	
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca	Fable 5 (see Table 5) Wa Feb Mar 8.71 138.71 Iculated in A 0.94 17.03	of (65)m 5 and 5a tts Apr 138.71 ppendix 12.9	only if constraints only if constraints only if constraints on the constraint on the constraints on the constraint on the constraints on the constraint on the constraints on the constraint on the constraints on the constraint on the c	Jun 138.71 ion L9 o	Jul 138.71 r L9a), a	Aug 138.71 Iso see	Sep 138.71 Table 5	Oct 138.71	Nov	Dec	eating	(66)
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca (67)m= 23.58 2 Appliances gains	Fable 5 (see Table 5) Wa Feb Mar 8.71 138.71 Iculated in A 0.94 17.03	of (65)m 5 and 5a tts Apr 138.71 ppendix 12.9	only if constraints only if constraints only if constraints on the constraint on the constraints on the constraint on the constraints of the constraints on the constraints on the constraint on the constraints on the constraint on the constraints on the constraint on the constraints on the constraint on	Jun 138.71 ion L9 o	Jul 138.71 r L9a), a	Aug 138.71 Iso see	Sep 138.71 Table 5	Oct 138.71	Nov	Dec	eating	(66)
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca (67)m= 23.58 2 Appliances gains	Fable 5), Wa Feb Mar 18.71 138.71 Iculated in A 0.94 17.03 (calculated in 65.5 258.63	of (65)m 5 and 5a tts Apr 138.71 ppendix 12.9 n Append 244	only if construction only if c	Jun 138.71 ion L9 o 8.14 uation L 208.18	Jul 138.71 r L9a), a 8.79 13 or L1 196.59	Aug 138.71 Iso see 11.43 3a), also	Sep 138.71 Table 5 15.34 see Ta 200.73	Oct 138.71 19.48 ble 5 215.36	Nov 138.71 22.73	Dec 138.71	eating	(66) (67)
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca (67)m= 23.58 2 Appliances gains (68)m= 262.78 2 Cooking gains (ca	Fable 5), Wa Feb Mar 18.71 138.71 Iculated in A 0.94 17.03 (calculated in 65.5 258.63	of (65)m 5 and 5a tts Apr 138.71 ppendix 12.9 n Append 244	only if construction only if c	Jun 138.71 ion L9 o 8.14 uation L 208.18	Jul 138.71 r L9a), a 8.79 13 or L1 196.59	Aug 138.71 Iso see 11.43 3a), also	Sep 138.71 Table 5 15.34 see Ta 200.73	Oct 138.71 19.48 ble 5 215.36	Nov 138.71 22.73	Dec 138.71	eating	(66) (67)
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca (67)m= 23.58 2 Appliances gains (68)m= 262.78 2 Cooking gains (ca	Fable 5), Wareb Mar 138.71 138.71 138.71 17.03 (calculated in A 2.94 17.03 (calculated in A 2.94 17.03 1.55.5 258.63 alculated in A 3.87 36.87	of (65)m 5 and 5a tts Apr 138.71 ppendix 12.9 Append 244 Appendix 36.87	only if construction is the construction of th	Jun 138.71 ion L9 o 8.14 uation L 208.18	Jul 138.71 r L9a), a 8.79 13 or L1 196.59 or L15a	Aug 138.71 Iso see 11.43 3a), also 193.86	Sep 138.71 Table 5 15.34 See Ta 200.73	Oct 138.71 19.48 ble 5 215.36 5	Nov 138.71 22.73	Dec 138.71 24.24 251.18	eating	(66) (67) (68)
Metabolic gains (Jan	Fable 5), Wareb Mar 138.71 138.71 138.71 17.03 (calculated in A 2.94 17.03 (calculated in A 2.94 17.03 1.55.5 258.63 alculated in A 3.87 36.87	of (65)m 5 and 5a tts Apr 138.71 ppendix 12.9 Append 244 Appendix 36.87	only if construction is the construction of th	Jun 138.71 ion L9 o 8.14 uation L 208.18	Jul 138.71 r L9a), a 8.79 13 or L1 196.59 or L15a	Aug 138.71 Iso see 11.43 3a), also 193.86	Sep 138.71 Table 5 15.34 See Ta 200.73	Oct 138.71 19.48 ble 5 215.36 5	Nov 138.71 22.73	Dec 138.71 24.24 251.18	eating	(66) (67) (68)
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca (67)m= 23.58 2 Appliances gains (68)m= 262.78 2 Cooking gains (ca (69)m= 36.87 3 Pumps and fans (70)m= 3	Table 5 Wa Feb	of (65)m 5 and 5a tts Apr 138.71 ppendix 12.9 Appendix 244 Appendix 36.87 5a) 3	only if construction only if c	Jun 138.71 ion L9 o 8.14 uation L 208.18 iion L15 36.87	Jul 138.71 r L9a), a 8.79 13 or L1 196.59 or L15a;	Aug 138.71 Iso see 11.43 3a), also 193.86), also se 36.87	Sep 138.71 Table 5 15.34 see Ta 200.73 ee Table 36.87	Oct 138.71 19.48 ble 5 215.36 5 36.87	Nov 138.71 22.73 233.83	Dec 138.71 24.24 251.18 36.87	eating	(66) (67) (68) (69)
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca (67)m= 23.58 2 Appliances gains (68)m= 262.78 2 Cooking gains (ca (69)m= 36.87 3 Pumps and fans	Table Sample Sa	of (65)m 5 and 5a tts Apr 138.71 ppendix 12.9 n Append 244 ppendix 36.87 5a) 3	only if construction only if c	Jun 138.71 ion L9 o 8.14 uation L 208.18 iion L15 36.87	Jul 138.71 r L9a), a 8.79 13 or L1 196.59 or L15a;	Aug 138.71 Iso see 11.43 3a), also 193.86), also se 36.87	Sep 138.71 Table 5 15.34 see Ta 200.73 ee Table 36.87	Oct 138.71 19.48 ble 5 215.36 5 36.87	Nov 138.71 22.73 233.83	Dec 138.71 24.24 251.18 36.87	eating	(66) (67) (68) (69)
Metabolic gains (Jan	Table Table Fabl	of (65)m 5 and 5a tts	only if construction only if c	Jun 138.71 ion L9 o 8.14 uation L 208.18 ion L15 36.87	Jul 138.71 r L9a), a 8.79 13 or L1 196.59 or L15a) 36.87	Aug 138.71 Iso see 11.43 3a), also 193.86), also se 36.87	Sep 138.71 Table 5 15.34 see Ta 200.73 ee Table 36.87	Oct 138.71 19.48 ble 5 215.36 5 36.87	Nov 138.71 22.73 233.83 36.87	Dec 138.71 24.24 251.18 36.87	eating	(66) (67) (68) (69) (70)
Metabolic gains (Jan (66)m= 138.71 13 Lighting gains (ca (67)m= 23.58 2 Appliances gains (68)m= 262.78 2 Cooking gains (ca (69)m= 36.87 3 Pumps and fans (70)m= 3 Losses e.g. evap (71)m= -110.97 -1 Water heating gains	Table Table Fabl	of (65)m 5 and 5a tts	only if construction only if c	Jun 138.71 ion L9 o 8.14 uation L 208.18 ion L15 36.87	Jul 138.71 r L9a), a 8.79 13 or L1 196.59 or L15a) 36.87	Aug 138.71 Iso see 11.43 3a), also 193.86), also se 36.87	Sep 138.71 Table 5 15.34 see Ta 200.73 ee Table 36.87	Oct 138.71 19.48 ble 5 215.36 5 36.87	Nov 138.71 22.73 233.83 36.87	Dec 138.71 24.24 251.18 36.87	eating	(66) (67) (68) (69) (70)

Total internal	Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$													
(73)m= 444.06	441.84	426.26	400.64	373.99	348.4	8 332.47	339	9.56	353.34	379.19	9 408.54	430.82		(73)
6. Solar gain	S:				'									
Solar gains are	calculated	using sola	flux from	Table 6a	and ass	ociated equ	ations	to co	nvert to the	e applic	able orientat	ion.		
Orientation: /	Access F Fable 6d		Area m²			lux able 6a		T	g_ able 6b		FF Table 6c		Gains (W)	
Northeast _{0.9x}	0.77	х	4.2	24	x	11.28	x		0.63	х	0.7	-	14.62	(75)
Northeast 0.9x	0.77	X	4.2	24	x	22.97	x		0.63	×	0.7	=	29.76	(75)
Northeast _{0.9x}	0.77	х	4.2	24	x	41.38	x		0.63	x	0.7	=	53.62	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	67.96	x		0.63	x	0.7	=	88.06	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	91.35	x		0.63	X	0.7	=	118.37	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	97.38	X		0.63	X	0.7	=	126.19	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	91.1	X		0.63	X	0.7	=	118.05	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	72.63	X		0.63	X	0.7	=	94.11	(75)
Northeast _{0.9x}	0.77	X	4.2	24	X	50.42	X		0.63	X	0.7	=	65.34	(75)
Northeast _{0.9x}	0.77	X	4.2	24	X	28.07	X		0.63	X	0.7	=	36.37	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	14.2	X		0.63	X	0.7	=	18.4	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	9.21	X		0.63	X	0.7	=	11.94	(75)
East 0.9x	0.77	X	0.6	69	x	19.64	X		0.63	X	0.7	=	4.14	(76)
East 0.9x	0.77	X	1.	8	x	19.64	X		0.5	X	0.7	=	8.57	(76)
East 0.9x	0.77	X	1.4	14	x	19.64	X		0.5	X	0.7	=	6.86	(76)
East 0.9x	0.77	X	0.6	69	x	38.42	X		0.63	X	0.7	=	8.1	(76)
East 0.9x	0.77	X	1.	8	x	38.42	X		0.5	X	0.7		16.77	(76)
East 0.9x	0.77	X	1.4	14	x	38.42	X		0.5	×	0.7	=	13.42	(76)
East 0.9x	0.77	X	0.6	69	x	63.27	X		0.63	X	0.7	=	13.34	(76)
East 0.9x	0.77	X	1.	8	x	63.27	X		0.5	X	0.7	=	27.62	(76)
East 0.9x	0.77	X	1.4	14	X	63.27	X		0.5	X	0.7	=	22.1	(76)
East 0.9x	0.77	X	0.6	9	X	92.28	X		0.63	X	0.7	=	19.46	(76)
East 0.9x	0.77	X	1.	8	X	92.28	X		0.5	X	0.7	=	40.29	(76)
East 0.9x	0.77	X	1.4	14	x	92.28	X		0.5	×	0.7	=	32.23	(76)
East 0.9x	0.77	X	0.6	9	X	113.09	X		0.63	X	0.7	=	23.85	(76)
East 0.9x	0.77	X	1.	8	X	113.09	X		0.5	X	0.7	=	49.38	(76)
East 0.9x	0.77	X	1.4	14	X	113.09	X		0.5	X	0.7	=	39.5	(76)
East 0.9x	0.77	X	0.6	9	X	115.77	X		0.63	X	0.7	=	24.41	(76)
East 0.9x	0.77	X	1.	8	X	115.77	X		0.5	X	0.7	=	50.54	(76)
East 0.9x	0.77	X	1.4	14	x	115.77	X		0.5	X	0.7	=	40.44	(76)
East 0.9x	0.77	X	0.6	69	x	110.22	x		0.63	X	0.7	=	23.24	(76)
East 0.9x	0.77	X	1.	8	x	110.22	x		0.5	X	0.7	=	48.12	(76)
East 0.9x	0.77	X	1.4	14	x	110.22	X		0.5	X	0.7	=	38.5	(76)
East 0.9x	0.77	X	0.6	69	x	94.68	x		0.63	X	0.7	=	19.96	(76)

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East 0.9x	0.77	X	1.8	X	94.68	X	0.5	X	0.7	=	41.33	(76)
East 0.9x	0.77	X	1.44	x	94.68	X	0.5	X	0.7	=	33.07	(76)
East 0.9x	0.77	X	0.69	X	73.59	X	0.63	X	0.7	=	15.52	(76)
East 0.9x	0.77	X	1.8	X	73.59	X	0.5	x	0.7	=	32.13	(76)
East 0.9x	0.77	X	1.44	X	73.59	X	0.5	X	0.7	=	25.7	(76)
East 0.9x	0.77	X	0.69	x	45.59	X	0.63	X	0.7	=	9.61	(76)
East 0.9x	0.77	X	1.8	x	45.59	X	0.5	x	0.7	=	19.9	(76)
East 0.9x	0.77	x	1.44	x	45.59	x	0.5	x	0.7	=	15.92	(76)
East 0.9x	0.77	x	0.69	x	24.49	X	0.63	X	0.7	=	5.16	(76)
East 0.9x	0.77	x	1.8	x	24.49	X	0.5	x	0.7] =	10.69	(76)
East 0.9x	0.77	x	1.44	x	24.49	x	0.5	x	0.7	=	8.55	(76)
East 0.9x	0.77	x	0.69	x	16.15	x	0.63	x	0.7	=	3.41	(76)
East 0.9x	0.77	x	1.8	x	16.15	x	0.5	x	0.7	=	7.05	(76)
East 0.9x	0.77	x	1.44	x	16.15	x	0.5	x	0.7	=	5.64	(76)
Southeast _{0.9x}	0.77	X	1.44	x	36.79	X	0.63	X	0.7	=	16.19	(77)
Southeast _{0.9x}	0.77	x	2.64	x	36.79	x	0.63	x	0.7	=	29.69	(77)
Southeast _{0.9x}	0.77	x	1.44	x	62.67	x	0.63	x	0.7	=	27.58	(77)
Southeast _{0.9x}	0.77	x	2.64	x	62.67	x	0.63	x	0.7] =	50.57	(77)
Southeast _{0.9x}	0.77	x	1.44	x	85.75	x	0.63	x	0.7	=	37.74	(77)
Southeast _{0.9x}	0.77	x	2.64	x	85.75	x	0.63	x	0.7] =	69.19	(77)
Southeast _{0.9x}	0.77	x	1.44	x	106.25	x	0.63	x	0.7	=	46.76	(77)
Southeast _{0.9x}	0.77	x	2.64	x	106.25	x	0.63	x	0.7	j =	85.73	(77)
Southeast _{0.9x}	0.77	x	1.44	x	119.01	x	0.63	x	0.7	j =	52.37	(77)
Southeast _{0.9x}	0.77	x	2.64	×	119.01	x	0.63	x	0.7	j =	96.02	(77)
Southeast _{0.9x}	0.77	x	1.44	x	118.15	x	0.63	x	0.7	j =	52	(77)
Southeast _{0.9x}	0.77	x	2.64	x	118.15	x	0.63	x	0.7] =	95.33	(77)
Southeast _{0.9x}	0.77	x	1.44	x	113.91	x	0.63	x	0.7	=	50.13	(77)
Southeast 0.9x	0.77	x	2.64	x	113.91	x	0.63	x	0.7] =	91.9	(77)
Southeast _{0.9x}	0.77	x	1.44	×	104.39	x	0.63	x	0.7] =	45.94	(77)
Southeast 0.9x	0.77	x	2.64	x	104.39	x	0.63	x	0.7	j =	84.22	(77)
Southeast _{0.9x}	0.77	х	1.44	x	92.85	x	0.63	x	0.7] =	40.86	(77)
Southeast _{0.9x}	0.77	х	2.64	x	92.85	x	0.63	x	0.7	=	74.91	(77)
Southeast 0.9x	0.77	x	1.44	x	69.27	x	0.63	x	0.7	j =	30.48	(77)
Southeast _{0.9x}	0.77	х	2.64	x	69.27	x	0.63	x	0.7] =	55.89	(77)
Southeast _{0.9x}	0.77	х	1.44	x	44.07	x	0.63	x	0.7	=	19.39	(77)
Southeast 0.9x	0.77	x	2.64	x	44.07	x	0.63	x	0.7	j =	35.56	(77)
Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.63	x	0.7] =	13.86	(77)
Southeast 0.9x	0.77	x	2.64	x	31.49	x	0.63	x	0.7	j =	25.4	(77)
Northwest 0.9x	0.77	x	8.66	x	11.28	x	0.5	x	0.7	j =	23.7	(81)
Northwest 0.9x	0.77	x	8.66	x	22.97	x	0.5	x	0.7] =	48.24	(81)
Northwest _{0.9x}	0.77	X	8.66	x	41.38	X	0.5	x	0.7	=	86.92	(81)

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Northwest _{0.9x}	0.77	X	8.6	66	X	67.96	X	0.5	x	0.7	=	142.74	(81)
Northwest _{0.9x}	0.77	X	8.6	66	X	91.35	X	0.5	x	0.7	=	191.87	(81)
Northwest _{0.9x}	0.77	X	8.6	66	X	97.38	x _	0.5	x	0.7	=	204.55	(81)
Northwest _{0.9x}	0.77	X	8.6	66	x	91.1	x	0.5	×	0.7	=	191.36	(81)
Northwest _{0.9x}	0.77	X	8.6	66	x	72.63	x _	0.5	x	0.7	=	152.55	(81)
Northwest _{0.9x}	0.77	X	8.6	66	x	50.42	x _	0.5	x	0.7	=	105.91	(81)
Northwest 0.9x	0.77	X	8.6	66	x	28.07	x [0.5	x	0.7	=	58.95	(81)
Northwest 0.9x	0.77	X	8.6	66	x	14.2	x	0.5	x	0.7	=	29.82	(81)
Northwest _{0.9x}	0.77	X	8.6	66	x	9.21	x	0.5	x	0.7	=	19.35	(81)
_													
Solar gains in v	watts, ca	lculated	for eacl	h month			(83)m =	Sum(74)m	(82)m				
(83)m= 103.77	194.44	310.53	455.26	571.35	593.46	561.3	471.19	360.37	227.13	127.58	86.65		(83)
Total gains – ir	nternal a	nd solar	(84)m =	(73)m ·	+ (83)m	, watts	•	•	•	•		·	
(84)m= 547.84	636.28	736.78	855.9	945.35	941.94	893.77	810.76	713.71	606.33	536.12	517.48		(84)
7. Mean interr	nal temp	erature	(heating	season)								
Temperature			`		<i>'</i>	from Tal	ole 9. T	h1 (°C)				21	(85)
Utilisation fact	_	•			•		,	(- /					`
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.98	0.92	0.8	0.65	0.72	0.92	0.99	1	1		(86)
` '		I			<u> </u>		<u> </u>		1 0.00	<u> </u>			(3-3)
Mean internal	· ·	ī		<u> </u>		-i	i e		00.04	10.74	10.00	1	(07)
(87)m= 19.34	19.5	19.79	20.2	20.59	20.86	20.96	20.94	20.71	20.21	19.71	19.32		(87)
Temperature	during h	eating p	eriods ir	rest of	dwellin	g from Ta	ble 9,	Th2 (°C)					
(88)m= 19.75	19.75	19.75	19.76	19.77	19.78	19.78	19.78	19.77	19.77	19.76	19.76		(88)
Utilisation fact	tor for ga	ains for r	est of d	welling,	h2,m (s	ee Table	9a)						
(89)m= 1	1	0.99	0.97	0.89	0.71	0.5	0.57	0.86	0.98	1	1		(89)
Mean internal	tempers	ature in t	the rest	of dwelli	na T2 /	follow ste	ne 3 to	7 in Tahl	le 0c)			l	
(90)m= 17.55	17.78	18.21	18.81	19.35	19.68	19.76	19.75	19.52	18.84	18.1	17.53		(90)
(00)		10.21	10.01	10.00	10.00	1 10.10	10.70			g area ÷ (0.33	(91)
										· • • • • • • • • • • • • • • • • • • •	-,	0.55	(01)
Mean internal						1	+ (1 –	fLA) × T2	1	1		I	
(92)m= 18.15	18.36	18.74	19.27	19.76	20.07	20.16	20.15	19.91	19.3	18.64	18.13		(92)
Apply adjustm		T					1			1		ı	
(93)m= 18.15	18.36	18.74	19.27	19.76	20.07	20.16	20.15	19.91	19.3	18.64	18.13		(93)
8. Space heat													
Set Ti to the n the utilisation					ed at s	tep 11 of	Table	9b, so tha	ıt Ti,m=(76)m an	d re-calc	culate	
	Feb	Mar			مييا	Jul		Con	Oct	Nov	Dec		
Jan Utilisation fact	!	!	Apr	May	Jun	Jui	Aug	Sep	Oct	Nov	Dec		
(94)m= 1	0.99	0.99	0.96	0.89	0.73	0.55	0.62	0.87	0.98	1	1		(94)
Useful gains,					0.70	0.00	0.02	0.07	0.00		<u> </u>		()
(95)m= 546.37	632.91	727.16	822.17	838.93	690.82	491.39	503.42	622.36	592.79	533.46	516.4		(95)
Monthly avera					<u> </u>	1		1	<u> </u>	<u> </u>			
(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							ļ		ļ	<u> </u>	<u> </u>	l	
(97)m= 2052.19	r	1803.55		1170.73	786.29		537.27		1262.88	1683.87	2042.42		(97)
						1			I	I	I	I	

98)m= 1120.33 910.9	800.83	495.43	246.86	0	0	0	0	498.55	828.29	1135.36		
						Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	6036.55	(98)
Space heating require	ement in	kWh/m²	/year								57.99	(99)
a. Energy requiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	HP)					
Space heating:	ot from o	oondor	u/auppla	montory	ovotom					Г	0	(201
Fraction of space hear Fraction of space hear				пепату	•	(202) = 1 -	- (201) =			Ļ	1	(202
Fraction of total heati		-	• ,			(204) = (20	` ,	(203)] =		L	1	(204
Efficiency of main spa	_	-				(-) (, .			L	90.3	(206
Efficiency of seconda				a svstem	າ. %						0	(208
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	
Space heating require	l	•			oui	Aug	ОСР	Oct	1407	Dec	KVVIII y	Jai
1120.33 910.9	800.83	495.43	246.86	0	0	0	0	498.55	828.29	1135.36		
211)m = {[(98)m x (20	4)] } x 1	00 ÷ (20	06)									(21
1240.67 1008.75	886.86	548.65	273.38	0	0	0	0	552.1	917.27	1257.32		
						Tota	l (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	F	6685	(21
Space heating fuel (s			month									
: {[(98)m x (201)] } x 1	· ·				I .	I . I	_	_				
215)m= 0 0	0	0	0	0	0	0 Tota	0 I (kWh/yea	0 vr) =Sum(3	0	0		7(24)
Vater heating						Tota	i (KVVIII yee	ii) =3uiii(2	10) _{15,10. 12}	L	0	(215
output from water hea	ter (calc	ulated al	bove)									
214.23 188.83	198.32	176.84	171.21	150.8	144.47	161.05	162.83	184.35	194.92	209.08		
fficiency of water hea	ter										81	(216
217)m= 88.67 88.55	88.29	87.65	86.24	81	81	81	81	87.59	88.37	88.72		(21
fuel for water heating,												
$219)m = (64)m \times 100$ $219)m = 241.62 213.23$	224.62	201.75	198.52	186.17	178.36	198.83	201.03	210.48	220.58	235.67		
					<u> </u>	Tota	I = Sum(2	19a) ₁₁₂ =			2510.87	(219
Annual totals								k۱	Wh/year	· _	kWh/yea	<u></u>
pace heating fuel use	ed, main	system	1								6685	
Vater heating fuel use	d										2510.87	
lectricity for pumps, fa	ans and	electric	keep-ho	t						_		•
central heating pump	• •									30		(23
otal electricity for the	above, k	(Wh/yea	r			sum	of (230a)	(230g) =			30	(23
otal olootholty for the										1		
Electricity for lighting										Ī	416.45	(23

Energy

kWh/year

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Emissions

kg CO2/year

Emission factor

kg CO2/kWh

Space heating (main system 1)	(211) x	0.216	=	1443.96	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	542.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1986.31	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	216.14	(268)
Total CO2, kg/year	sum	of (265) (271) =		2218.01	(272)
Dwelling CO2 Emission Rate	(272)) ÷ (4) =		21.31	(273)
El rating (section 14)				80	(274)

			User E	Details:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 20)12		Strom Softwa					0016363 on: 1.0.4.26	
				Address		-Lean				
Address:	Flat 05, 51 Calthor	rpe Street	, LOND	ON, WC	1X 0HH					
Overall dwelling dime	ensions:		۸ro	a(m²)		۸۰, Ua	ight(m)		Volume(m ³	1
Ground floor					(1a) x		2.4	(2a) =	180.22	(3a)
Total floor area TFA = (1	1a)+(1b)+(1c)+(1d)+(1	1e)+(1r	1) T	75.09	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	180.22	(5)
2. Ventilation rate:										
Number of chimneys	heating	secondar heating	'y □ + □	other	7 = 6	total	x,	40 =	m³ per hou	r
ř			」	0]			20 =		╡` `
Number of open flues		0	J T L	0	J Ū	0			0	(6b)
Number of intermittent fa	ans				L	3	X 1	10 =	30	(7a)
Number of passive vents	S					0	X	10 =	0	(7b)
Number of flueless gas f	fires					0	X ·	40 =	0	(7c)
								Δir cl	hanges per ho	our
Infiltration due to chimne	eve flues and fans =	(6a)+(6b)+(7	'a)+(7b)+	(7c) =	Г	20	_	÷ (5) =		(8)
If a pressurisation test has					continue fr	30 om (9) to		+ (5) =	0.17	(0)
Number of storeys in t		· •	, ,,			,	,		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: (•	ruction			0	(11)
if both types of wall are p deducting areas of open	oresent, use the value corre	esponding to	the grea	ter wall are	a (after					
If suspended wooden	· · · · · ·	aled) 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	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)
Air permeability value	•		•		•	etre of e	envelope	area	5	(17)
If based on air permeab	=								0.42	(18)
Air permeability value appli Number of sides shelter	·	as been dor	ne or a de	gree air pe	rmeability	is being u	sed			(19)
Shelter factor	eu			(20) = 1 -	[0.075 x (1	19)] =			0.92	(20)
Infiltration rate incorpora	iting shelter factor			(21) = (18) x (20) =				0.39	(21)
Infiltration rate modified	for monthly wind spee	ed								
Jan Feb	Mar Apr May	/ Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s	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]	
NA/:			-	•	•	•	-	•	_	
Wind Factor (22a)m = $(2^{2})^{2}$		1 005	0.05	1 000		1 400	1 4 40	1 4 40	٦	
(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	

24c)m= 0 d) If natura	th heat recovered mechan of the dispersion of th	tion: sing Appervery: effice unical very unical very oract very (23b), t	endix N, (2 entilation 0 entilation 0 entilation chilation (240	3b) = (23a allowing f with head of without 0 or positive control of the control o	a) × Fmv (effor in-use for in-use	equation (Nactor (from Pry (MVI) 0 covery (Nactor 0 ventilation)	n Table 4h HR) (24a 0 MV) (24b) = a)m = (22 0 b)m = (22	2b)m + (2	0	0.45 1 - (23c)	0 0 0 ÷ 100]	(23a (23d (23d (24a
If mechanic If exhaust air If balanced wi a) If balance 24a)m= 0 b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	th heat reconsed mechanical wentilate the mechanical me	tion: sing Appervery: effice unical very unical very oract very (23b), t	endix N, (2 entilation 0 entilation 0 entilation chilation (240	3b) = (23a allowing f with head of without 0 or positive) = (23b)	a) × Fmv (effor in-use for in-use	equation (Nactor (from Pry (MVI) 0 covery (Nactor 0 ventilation)	n Table 4h HR) (24a 0 MV) (24b) = a)m = (22 0 b)m = (22	2b)m + (2	0	<u> </u>	0	(23)
If balanced wi a) If balance 24a)m= 0 b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	th heat recorded mechan of the desired mechan of the desired mechan of the desired mechan of the desired mechan of the desired mechan of the desired mechan of the desired mechanism of the desired	very: effice anical very of the control of the cont	entilation o entilation o entilation o entilation o then (240)	allowing f with her 0 without 0 or positive) = (23b	or in-use for at recover the street of the s	actor (from ery (MVI 0 covery (N 0	n Table 4h HR) (24a 0 MV) (24b) = a)m = (22 0 b)m = (22	2b)m + (2	0	<u> </u>	0	(23)
a) If balance 24a)m= 0 b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	ed mecha ed mecha house ext m < 0.5 × 0 I ventilatio m = 1, the	nnical ve 0 nnical ve 0 ract ver (23b), t	entilation o entilation o ntilation o then (240	with head of without of positive of the control of	at recover the street of the s	ery (MVI 0 covery (N 0	HR) (24a 0 MV) (24b 0	a)m = (22) a)m = (22) a)m = (22)	0	0	<u> </u>		
24a)m= 0 b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	o ded mechalo o	o inical ve 0 ract ver (23b), t 0	0 entilation 0 ntilation c then (240	without o or positive c) = (23b)	neat rec	ocovery (No	0 ИV) (24b	0 p)m = (22	0	0	<u> </u>	÷ 100]	(24
b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	eed mecha o house ext m < 0.5 × o ventilatio m = 1, the	nnical ver 0 ract ver (23b), t 0 n or wh	entilation o ntilation o then (24o	without or positive) = (23b	heat rec	covery (N o ventilation	иV) (24b)m = (22			0		(24
24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	house ext m < 0.5 × 0 I ventilatio m = 1, the	oract ven (23b), t o	ontilation of then (24o	0 or positiv c) = (23b	0 ve input v	0 ventilatio	0	``	2b)m + (2	23b)			
c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	house ext m < 0.5 × 0 I ventilatio m = 1, the	ract ven (23b), t 0 n or wh	ntilation of then (24o	or positiv	e input	ventilatio		_					
if (22b) 24c)m= 0 d) If natura if (22b)	m < 0.5 × 0 I ventilatio m = 1, the	(23b), t 0 n or wh	then (240	c) = (23b	•			0	0	0	0		(24
d) If natura if (22b)	I ventilatio m = 1, the	n or wh		Λ	,,	vise (24			5 × (23b)			
if (22b)	m = 1, the		ole hous	l	0	0	0	0	0	0	0		(24
24d)m= 0.62	0.62	··· (= ·u)							0.5]			•	
		0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6		(24
Effective ai	r change ı	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)					
25)m= 0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6		(25
3. Heat loss	es and he	at loss r	paramete	er:									
ELEMENT	Gros area (s	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/h	()	k-value kJ/m²·ł		A X k kJ/K
Doors					1.98	х	1.4	= [2.772				(26
Windows Typ	e 1				4.24	x1.	/[1/(1.6)+	0.04] =	6.38	=			(27
Vindows Typ	e 2				2.03	x1.	/[1/(1.6)+	0.04] =	3.05	=			(27
Floor					75.09) x	0.12		9.010799	<u>=</u>			(28
Walls Type1	52.54	4	8.3		44.24	x	0.23	<u> </u>	10.18				(29
Walls Type2	8.28		1.98		6.3	x	0.12	<u> </u>	0.73	T i		ī	(29
Roof	9.64		0		9.64	x	0.12	<u> </u>	1.16	T i		ī	(30
Total area of	elements,	m²			145.5	5							(31
Party wall					40.53	3 x	0	=	0				(32
Party ceiling					65.45	5						7 F	(32
for windows an						ated using	ı formula 1	/[(1/U-valu	ie)+0.04] a	s given in	paragraph	3.2	
abric heat lo	ss, W/K =	S (A x	U)				(26) (30)) + (32) =				36.32	(33
Heat capacity	/ Cm = S(/	Axk)						((28)	(30) + (32) + (32a)	(32e) =	16157.1	12 (34
Thermal mas	s paramet	er (TMF	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35
For design asses an be used inst				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridg	ges : S (L :	x Y) cal	culated ı	using Ap	pendix l	<						21.83	(36
f details of thern		are not kn	own (36) =	= 0.05 x (3	1)			(00) ÷	(26) -		ĺ		
Fotal fabric h		- عداريما	l manth					` '	(36) =)E\m +: /E\		58.16	(37
/entilation he	eat loss ca	Iculated Mar	Apr	y May	Jun	Jul	Aug	(38)m Sep	= 0.33 × (2	25)m x (5) Nov	Dec	1	

						l	l						(00)
(38)m= 36.91	36.63	36.36	35.08	34.84	33.72	33.72	33.51	34.15	34.84	35.32	35.83		(38)
Heat transfer c								· · · ·	= (37) + (3	·			
(39)m= 95.07	94.79	94.52	93.23	92.99	91.88	91.88	91.67	92.31	92.99	93.48 Sum(30)	93.99	93.23	(39)
Heat loss para	meter (ł	HLP), W	/m²K						= (39)m ÷	Sum(39) ₁ (4)	12 / 12-	93.23	(33)
(40)m= 1.27	1.26	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.24	1.25		_
Number of day	s in mo	nth (Tab	le 1a)					,	Average =	Sum(40) ₁	12 /12=	1.24	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing ene	rgy requi	irement:								kWh/yea	ar:	
Assumed occu	nancy	NI											(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		36		(42)
Annual average	•	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		90	.32		(43)
Reduce the annua	_				_	_	to achieve	a water us	se target o	f			. ,
not more that 125		1			ı		Ι,						
Jan Hot water usage ir	Feb	Mar day for ea	Apr	May Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m= 99.36	95.74	92.13	88.52	84.9	81.29	81.29	84.9	88.52	92.13	95.74	99.36		
(44)111- 99.30	95.74	92.13	00.32	04.9	01.29	01.29	04.9	l		m(44) _{1 12} =		1083.89	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			` '		1000.00	(```
(45)m= 147.34	128.87	132.98	115.93	111.24	95.99	88.95	102.07	103.29	120.38	131.4	142.69		
If instantaneous w	ator booti	na at naint	of was (no	, hat water	· otorogo)	antar O in	haves (46		Γotal = Su	m(45) _{1 12} =	=	1421.15	(45)
If instantaneous w			,	1	· · ·	ı		` , ,					(40)
(46)m= 22.1 Water storage	19.33 loss:	19.95	17.39	16.69	14.4	13.34	15.31	15.49	18.06	19.71	21.4		(46)
Storage volume) 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	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufacti		oclared I	occ fact	or ic kno	wp /k\\/k	a/dayı):							(40)
Temperature fa				JI IS KIIO	wii (Kvvi	i/uay).					0		(48) (49)
Energy lost from				-ar			(48) x (49)) =			0		(50)
b) If manufacti		-	-		or is not		(10) X (10)	,			0		(30)
Hot water stora	_			le 2 (kW	h/litre/da	ay)					0		(51)
If community h	•		on 4.3								_		(50)
Temperature fa			2h							-	0		(52) (53)
Energy lost from				aar			(47) x (51)) v (52) v (53) =				(54)
Enter (50) or (-	, KVVII/ yt	cai			(41) X (31)) X (32) X (55) –		0		(55)
Water storage		•	for each	month			((56)m = (55) × (41)ı	m				` '
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	dedicate	-										:H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
I		•		•		•	•			•			

Primary circuit loss (annual) from Table 3	0 (58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water	heating and a cylinder thermostat)
(59)m= 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
	1.43 43.27 43.65 46.95 47.22 50.63 (61)
Total heat required for water heating calculated for each m	nonth (62)m = $0.85 \times (45)$ m + (46) m + (57) m + (59) m + (61) m
	30.38 145.34 146.94 167.33 178.62 193.32 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative of	
(add additional lines if FGHRS and/or WWHRS applies, se	
(63)m= 0 0 0 0 0 0	0 0 0 0 0 0 (63)
Output from water heater	
·	30.38 145.34 146.94 167.33 178.62 193.32
(6.7)	Output from water heater (annual) _{1 12} 1962.94 (64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (, , ,
	9.93 44.76 45.26 51.76 55.49 60.1 (65)
` '	
include (57)m in calculation of (65)m only if cylinder is in	the dwelling or not water is from community heating
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
	Jul Aug Sep Oct Nov Dec
(66)m= 118.16 118.16 118.16 118.16 118.16 1	18.16 118.16 118.16 118.16 118.16 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9	9a), also see Table 5
(67)m= 21.05 18.69 15.2 11.51 8.6 7.26 7	7.85 10.2 13.69 17.38 20.29 21.63 (67)
Appliances gains (calculated in Appendix L, equation L13	or L13a), also see Table 5
(68)m= 208.87 211.04 205.58 193.95 179.27 165.48 1	56.26 154.1 159.56 171.18 185.86 199.66 (68)
Cooking gains (calculated in Appendix L, equation L15 or	L15a), also see Table 5
(69)m= 34.82 34.82 34.82 34.82 34.82 34.82 3	4.82 34.82 34.82 34.82 34.82 (69)
Pumps and fans gains (Table 5a)	
(70)m= 3 3 3 3 3 3 3	3 3 3 3 (70)
Losses e.g. evaporation (negative values) (Table 5)	
	94.52 -94.52 -94.52 -94.52 -94.52 (71)
Water heating gains (Table 5)	
	3.67 60.16 62.86 69.57 77.08 80.78 (72)
	(67)m + (68)m + (69)m + (70)m + (71)m + (72)m
Total Informati game =	79.23 285.9 297.55 319.59 344.68 363.52 (73)
6. Solar gains:	9.25 205.9 297.55 319.59 344.00 305.52
Solar gains are calculated using solar flux from Table 6a and associate	d equations to convert to the applicable orientation.
Orientation: Access Factor Area Flux	g_ FF Gains
Table 6d m ² Table	5 _
Northeast 0.9x 0.77 x 4.24 x 11.2	8 × 0.63 × 0.7 = 14.62 (75)
Notice of East State of State	
Nortneast 0.9x 0.77 x 4.24 x 22.9	7 X 0.63 X 0.7 = 29.76 (75)

Northogat a a T		_					1		_		_		
Northeast _{0.9x}	0.77	X	4.2	24	* <u> </u>	41.38	X	0.63	X	0.7	=	53.62	(75)
Northeast 0.9x	0.77	X	4.2	24	x	67.96	X	0.63	X	0.7	=	88.06	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	91.35	X	0.63	X	0.7	=	118.37	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	97.38	X	0.63	X	0.7	=	126.19	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	91.1	X	0.63	X	0.7	=	118.05	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	72.63	X	0.63	X	0.7	=	94.11	(75)
Northeast 0.9x	0.77	X	4.2	24	x	50.42	X	0.63	X	0.7	=	65.34	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	28.07	X	0.63	X	0.7	=	36.37	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	14.2	X	0.63	X	0.7	=	18.4	(75)
Northeast 0.9x	0.77	X	4.2	24	x	9.21	X	0.63	X	0.7	=	11.94	(75)
Southwest _{0.9x}	0.77	X	2.0)3	x	36.79]	0.63	X	0.7	=	45.65	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x	62.67		0.63	X	0.7	=	77.76	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x	85.75]	0.63	X	0.7	=	106.4	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x	106.25	Ī	0.63	x	0.7	=	131.84	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x =	119.01	ĺ	0.63	x	0.7	<u> </u>	147.67	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x =	118.15	Ī	0.63	x	0.7	=	146.6	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x =	113.91	j	0.63	x	0.7	=	141.34	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x 🗀	104.39	ĺ	0.63	x	0.7	=	129.53	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x =	92.85	ĺ	0.63	×	0.7		115.21	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x	69.27	ĺ	0.63	×	0.7		85.95	(79)
Southwest _{0.9x}	0.77	X	2.0)3	x 🗀	44.07	i	0.63	×	0.7	= =	54.68	(79)
Southwest _{0.9x}	0.77	X	2.0		x	31.49	i	0.63	×	0.7		39.07	(79)
L					_		J						
Solar gains in	watts, ca	lculated	for eacl	h month			(83)m	n = Sum(74)m	(82)m				
(83)m= 60.27	107.52	160.02	219.89	266.03	272.7	79 259.39	223	.64 180.54	122.3	73.08	51.01		(83)
Total gains – i	nternal ar	nd solar	(84)m =	(73)m ·	+ (83)	m , watts						_	
(84)m= 434.5	478.86	517.45	555.5	579.61	565.2	23 538.62	509	.54 478.1	441.9	1 417.76	414.53		(84)
7. Mean inter	nal tempe	erature	(heating	season)								
Temperature			`		,	a from Ta	ble 9	, Th1 (°C)				21	(85)
Utilisation fac	ctor for ga	ins for I	iving are	ea, h1,m	(see	Table 9a)							
Jan	Feb	Mar	Apr	May	Ju		A	ug Sep	Oct	Nov	Dec]	
(86)m= 1	1	0.99	0.98	0.94	0.84	0.69	0.7	74 0.92	0.99	1	1	1	(86)
Mean interna	l temnera	ature in l	living ar	-a T1 (fd	llow s	stens 3 to	7 in T	ahle 9c)		!		4	
(87)m= 19.59	19.71	19.95	20.28	20.61	20.8	_i	20.		20.35	19.91	19.57]	(87)
					-l 113		- - - (<u> </u>	<u> </u>		<u> </u>	J	
Temperature (88)m= 19.87	19.87	19.87	19.89	19.89	19.9	<u> </u>	19	<u> </u>	19.89	19.88	19.88	1	(88)
		!					<u> </u>	.5 18.8	19.09	19.00	19.00	J	(00)
Utilisation fac	T 1					`	-		1.			1	(00)
(89)m= 1	1	0.99	0.97	0.92	0.76	0.55	0.	6 0.87	0.98	1	1]	(89)
Mean interna	l tempera	ature in t	the rest	of dwelli	ng T2	(follow ste	eps 3	to 7 in Tab	le 9c)	_		1	
(90)m= 17.99	18.18	18.52	19.02	19.47	19.8	19.89	19.		19.11		17.97		(90)
									fLA = Liv	ring area ÷ (4) =	0.36	(91)

Mean internal	i tomoore	atura (fa	r tha wh	مام طبيرما	lina) – fl	I A U T1	. /1 fl	۸ \ ی T ع					
	18.73	19.04	19.47	19.88	20.18	20.27	+ (1 – 1L 20.26	20.07	19.56	19	18.55		(92)
Apply adjustn	LI							l	l	10	10.00		(/
(93)m= 18.56	18.73	19.04	19.47	19.88	20.18	20.27	20.26	20.07	19.56	19	18.55		(93)
8. Space hea	ting requ	irement											
Set Ti to the r			•		ed at ste	ep 11 of	Table 9l	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		
Utilisation fac	tor for ga	ins, hm	:	-				-					
(94)m= 1	0.99	0.99	0.97	0.92	0.78	0.6	0.65	0.88	0.98	0.99	1		(94)
Useful gains,	hmGm ,	W = (94	I)m x (84	4)m		1							
(95)m= 433.03	476.09	511.35	538.76	531.49	443.39	322.94	332.53	420.51	431.33	415.18	413.4		(95)
Monthly avera													(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)
Heat loss rate						-``	- ,	·		4440.00	4040.00		(07)
(97)m= 1356.02		1184.86		760.92	512.69	337.35	354	550.89	832.8		1348.36		(97)
Space heating (98)m= 686.71	561.06	501.09	321.71	170.7	0	$\ln = 0.02$	4 X [(97])m – (95 0	298.69	501.73	695.61		
(90)111= 000.71	301.00	301.09	321.71	170.7	0				(kWh/year			3737.3	(98)
							TUld	i per year	(KVVII/yeai) – Sum(9	O)15,912 -	3/3/.3	╡``
Space heating	g require	ment in	kWh/m²	/year								49.77	(99)
9a. Energy req	uiremen	ts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
Space heating	•			,							Г		٦
Fraction of sp			-		mentary	•					ļ	0	(201)
Fraction of sp	ace heat	t from m	ain syst	em(s)			(202) = 1 -	- (201) =			ļ	1	(202)
Fraction of tot	tal heatin	ig from r	main sys	stem 1			(204) = (2	02) × [1 –	(203)] =			1	(204)
Efficiency of r	nain spa	ce heati	ng syste	em 1							L		(204)
Efficiency of s			• •								ĺ	90.3	(206)
Emolority of c	secondar	y/supple	ementary		g system	າ, %					[[90.3	╡ `
Jan	secondar Feb	y/supple Mar	ementary Apr		g system Jun	n, % Jul	Aug	Sep	Oct	Nov	Dec		(206)
	Feb	Mar	Apr	y heating May	Jun		Aug	Sep	Oct	Nov	Dec	0	(206)
Jan	Feb	Mar	Apr	y heating May	Jun		Aug 0	Sep 0	Oct 298.69	Nov 501.73	Dec 695.61	0	(206)
Jan Space heating	Feb g require 561.06	Mar ement (c	Apr alculated 321.71	y heating May d above)	Jun	Jul						0	(206)
Jan Space heating	Feb g require 561.06	Mar ement (c	Apr alculated 321.71	y heating May d above)	Jun	Jul						0	(206) (208) ar
Jan Space heating 686.71 (211)m = {[(98	Feb g require 561.06)m x (204	Mar ement (c. 501.09 4)] } x 1	Apr alculated 321.71 00 ÷ (20	May dabove)	Jun 0	Jul 0	0	0	298.69	501.73	695.61 770.33	0	(206) (208) ar
Jan Space heating 686.71 (211)m = {[(98	Feb g require 561.06)m x (204 621.33	Mar ement (c 501.09 4)] } x 1 554.91	Apr alculated 321.71 00 ÷ (20 356.27	May d above) 170.7 16)	Jun 0	Jul 0	0	0	298.69	501.73	695.61 770.33	0 kWh/ye	(206) (208) ar (211)
Jan Space heating 686.71 (211)m = {[(98) 760.47	Feb g require 561.06)m x (204 621.33 g fuel (se	Mar ement (ca 501.09 4)] } x 1 554.91 econdary	Apr alculated 321.71 00 ÷ (20 356.27	May d above) 170.7 16)	Jun 0	Jul 0	0	0	298.69	501.73	695.61 770.33	0 kWh/ye	(206) (208) ar (211)
Jan Space heating 686.71 (211)m = {[(98) 760.47} Space heating	Feb g require 561.06)m x (204 621.33 g fuel (se	Mar ement (ca 501.09 4)] } x 1 554.91 econdary	Apr alculated 321.71 00 ÷ (20 356.27	May d above) 170.7 16)	Jun 0	Jul 0	0 Tota	0 0 I (kWh/yea	298.69 330.78 ar) =Sum(2	501.73 555.63 211) _{15,10. 12}	770.33	0 kWh/ye	(206) (208) ar (211)
Jan Space heating 686.71 (211)m = {[(98) 760.47 Space heating = {[(98)m x (20)	Feb g require 561.06)m x (204 621.33 g fuel (se 01)] } x 10	Mar ement (c 501.09 4)] } x 1 554.91 econdary 00 ÷ (20	Apr alculated 321.71 00 ÷ (20 356.27 y), kWh// 8)	May dabove) 170.7 16) 189.04	Jun 0 0	Jul 0	0 Tota	0 0 I (kWh/yea	298.69 330.78 ar) =Sum(2	501.73 555.63 211) _{15,10. 12}	770.33	0 kWh/ye	(206) (208) ar (211)
Jan Space heating 686.71 (211)m = {[(98) 760.47] Space heating = {[(98)m x (20) (215)m= 0] Water heating	Feb g require 561.06)m x (204 621.33 g fuel (se 01)] } x 10	Mar ement (co 501.09 4)] } x 1 554.91 econdary 00 ÷ (200.00 0)	Apr alculated 321.71 00 ÷ (20 356.27 y), kWh/9	May dabove) 170.7 16) 189.04 month	Jun 0 0	Jul 0	0 Tota	0 0 I (kWh/yea	298.69 330.78 ar) =Sum(2	501.73 555.63 211) _{15,10. 12}	770.33	0 kWh/ye 4138.76	(206) (208) ar (211)
Jan Space heating [686.71] (211)m = {[(98) 760.47] Space heating = {[(98)m x (20) (215)m= 0 Water heating Output from wa	Feb g require 561.06)m x (204 621.33 g fuel (se 01)] } x 10 0	Mar 100	Apr alculated 321.71 00 ÷ (20 356.27 y), kWh/i 8) 0	May dabove) 170.7 16) 189.04 month 0	Jun 0 0	0 0 0	0 Tota	0 I (kWh/yea	298.69 330.78 ar) =Sum(2 0 ar) =Sum(2	501.73 555.63 211) _{15,10. 12}	770.33 = 0	0 kWh/ye 4138.76	(206) (208) ar (211)
Jan Space heating 686.71 (211)m = {[(98) 760.47 Space heating = {[(98)m x (20) (215)m= 0 Water heating Output from wa 197.97	Feb g require 561.06)m x (204 621.33] g fuel (se 01)] } x 10 0	Mar ement (ca 501.09 4)] } x 1 554.91 econdary 00 ÷ (200 0 er (calculation) 179.93 er (calculation) 179.93 er (calculation) er (calculation	Apr alculated 321.71 00 ÷ (20 356.27 y), kWh/9	May dabove) 170.7 16) 189.04 month	Jun 0 0	Jul 0	0 Tota	0 0 I (kWh/yea	298.69 330.78 ar) =Sum(2	501.73 555.63 211) _{15,10. 12}	770.33	0 kWh/ye 4138.76	(206) (208) ar (211) (211)
Jan Space heating 686.71 (211)m = {[(98) 760.47 Space heating = {[(98)m x (20) (215)m= 0 Water heating Output from water heating 197.97 Efficiency of water heating	Feb g require 561.06)m x (204 621.33] g fuel (second)] } x 10 0] ater heat 172.93 ater heat	Mar 100	Apr alculated 321.71 00 ÷ (20 356.27 y), kWh/(8) 0 ulated at 159.59	May dabove) 170.7 16) 189.04 month 0 154.51	Jun 0 0 0 136.08	0 0 0 130.38	0 Tota 0 Tota	0 I (kWh/yea 0 I (kWh/yea 146.94	298.69 330.78 330.78 0 0 167.33	501.73 555.63 211) _{15,10. 12} 0 215) _{15,10. 12}	695.61 770.33 0 193.32	0 kWh/ye 4138.76	(206) (208) ar (211) (211) (215)
Jan Space heating 686.71 (211)m = {[(98) 760.47 Space heating = {[(98)m x (20) (215)m= 0 Water heating Output from water heating Output from water heating Space heating Output from water heating Output from water heating 0 water heating Output from water heating 0 water heating Output from water heating 0 wat	Feb g require 561.06)m x (204 621.33 g fuel (se 01)] } x 10	Mar 100	Apr alculated 321.71 00 ÷ (20 356.27 y), kWh/(8) 0 ulated at 159.59	May dabove) 170.7 16) 189.04 month 0	Jun 0 0	0 0 0	0 Tota	0 I (kWh/yea	298.69 330.78 ar) =Sum(2 0 ar) =Sum(2	501.73 555.63 211) _{15,10. 12}	770.33 = 0	0 kWh/ye 4138.76	(206) (208) ar (211) (211)
Jan Space heating 686.71 (211)m = {[(98) 760.47 Space heating = {[(98)m x (20) (215)m= 0 Water heating Output from water 197.97 Efficiency of water (217)m= 88.04 Fuel for water	Feb g require 561.06)m x (204 621.33] g fuel (second) } x 10 0] gater heat 172.93 ater heat 87.92 heating,	Mar 100	Apr alculated 321.71 00 ÷ (20 356.27 y), kWh/6 8) 0 ulated at 159.59 86.99 onth	May dabove) 170.7 16) 189.04 month 0 154.51	Jun 0 0 0 136.08	0 0 0 130.38	0 Tota 0 Tota	0 I (kWh/yea 0 I (kWh/yea 146.94	298.69 330.78 330.78 0 0 167.33	501.73 555.63 211) _{15,10. 12} 0 215) _{15,10. 12}	695.61 770.33 0 193.32	0 kWh/ye 4138.76	(206) (208) ar (211) (211) (215)
Jan Space heating 686.71 (211)m = {[(98) 760.47 Space heating = {[(98)m x (20) (215)m= 0 Water heating Output from water fro	Feb g require 561.06)m x (204 621.33] g fuel (second) } x 10 0] gater heat 172.93 ater heat 87.92 heating,	Mar 100	Apr alculated 321.71 00 ÷ (20 356.27 y), kWh/6 8) 0 ulated at 159.59 86.99 onth	May dabove) 170.7 16) 189.04 month 0 154.51	Jun 0 0 0 136.08	0 0 0 130.38	0 Tota 0 Tota	0 I (kWh/yea 0 I (kWh/yea 146.94	298.69 330.78 330.78 0 0 167.33	501.73 555.63 211) _{15,10. 12} 0 215) _{15,10. 12}	695.61 770.33 0 193.32	0 kWh/ye 4138.76	(206) (208) ar (211) (211) (215)
Jan Space heating [686.71] (211)m = {[(98) 760.47] Space heating = {[(98)m x (20) (215)m= 0 Water heating Output from wa 197.97 Efficiency of water (217)m= 88.04 Fuel for water (219)m = (64)	Feb g require 561.06)m x (204 621.33]g fuel (se 01)] } x 10]g turn full fill for the second for the second full full full full full full full ful	Mar 100	Apr alculated 321.71 00 ÷ (20 356.27 y), kWh/8 0 ulated at 159.59 86.99 onth m	May dabove) 170.7 16) 189.04 month 0 000ve) 154.51	Jun 0 0 0 136.08	0 0 0 130.38 81	0 Tota 0 Tota 145.34 81	0 0 I (kWh/yea 146.94	298.69 330.78 ar) =Sum(2 0 167.33 86.72	501.73 555.63 211) _{15,10. 12} 0 215) _{15,10. 12}	0 = 193.32 88.1	0 kWh/ye 4138.76	(206) (208) ar (211) (211) (215)

Annual totals		kWh/ye	ar	kWh/yea	<u>r_</u>
Space heating fuel used, main system 1				4138.76	
Water heating fuel used				2296.71	
Electricity for pumps, fans and electric keep-hot					
central heating pump:			30]	(230c)
Total electricity for the above, kWh/year	sum of	f (230a) (230g) =		30	(231)
Electricity for lighting				371.68	(232)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	Energy	Emission fa	actor	Emissions	:
	kWh/year	kg CO2/kWh	า	kg CO2/ye	
Space heating (main system 1)	kWh/year (211) x	kg CO2/kWh	n] =	kg CO2/ye	
Space heating (main system 1) Space heating (secondary)	•		•		ar
, , ,	(211) x	0.216	=	893.97	ar (261)
Space heating (secondary)	(211) x (215) x	0.216 0.519 0.216] =] =	893.97	(261) (263)
Space heating (secondary) Water heating	(211) x (215) x (219) x	0.216 0.519 0.216] =] =	893.97 0 496.09	(261) (263) (264)
Space heating (secondary) Water heating Space and water heating	(211) x (215) x (219) x (261) + (262) + (263) + (263)	0.216 0.519 0.216] =] =] =	893.97 0 496.09 1390.06	(261) (263) (264) (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	(211) x (215) x (219) x (261) + (262) + (263) + (263) (261) x	0.216 0.519 0.216 34) =] =] =] =	893.97 0 496.09 1390.06	(261) (263) (264) (265) (267)

El rating (section 14)

			Hoor) otoilo:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 20		User D	Strom Softwa	are Ve	rsion:			0016363 on: 1.0.4.26	
A ddwggg	Flat 06, 51 Caltho			Address		-Lean				
Address: 1. Overall dwelling din		rpe Sireei	, LOND	JIN, VVC						
1. Overall awelling all	1011310113.		Δrea	a(m²)		Δv He	eight(m)		Volume(m ³	3)
Ground floor					(1a) x		2.2	(2a) =	117.06	(3a)
Total floor area TFA = ((1a)+(1b)+(1c)+(1d)+(1e)+(1r	1) 5	53.21	(4)			_		
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	117.06	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hou	ır
Number of chimneys	0 +	0	7 + [0] = [0	X e	40 =	0	(6a)
Number of open flues	0 +	0	Ī + Ē	0	Ī - [0	x	20 =	0	(6b)
Number of intermittent	fans					0	x	10 =	0	(7a)
Number of passive ven	ts					0	x	10 =	0	(7b)
Number of flueless gas						0	x	40 =	0	(7c)
rtamber et maelees gae										
								Air ch	nanges per ho	our
Infiltration due to chimn	eys, flues and fans =	(6a)+(6b)+(7	a)+(7b)+(7c) =		0		÷ (5) =	0	(8)
If a pressurisation test has	s been carried out or is inter	ded, procee	d to (17), d	otherwise o	continue fr	om (9) to	(16)			_
Number of storeys in	the dwelling (ns)								0	(9)
Additional infiltration	0.05 for the all on the h		0.05.6-				[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timbe present, use the value corn				•	uction			0	(11)
	nings); if equal user 0.35	coponaing to	the great	or wan are	a (anoi					
If suspended wooder	n floor, enter 0.2 (unse	aled) or 0	.1 (seale	ed), else	enter 0				0	(12)
•	enter 0.05, else enter 0								0	(13)
-	ws and doors draught	stripped				•			0	(14)
Window infiltration				0.25 - [0.2	` /	•	. (45) -		0	(15)
Infiltration rate	a EO avaragad in a	ıbia matra	o por bo	(8) + (10)				araa	0	(16)
If based on air permeal	e, q50, expressed in co		•		•	elle oi e	rivelope	alea	3	(17)
	lies if a pressurisation test h					is being u	sed		0.15	(10)
Number of sides shelte	red			,	·				2	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorpor	ating shelter factor			(21) = (18	s) x (20) =				0.13	(21)
Infiltration rate modified	I for monthly wind spe	ed		,	,				•	
Jan Feb	Mar Apr May	y 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]	
			Щ				<u> </u>		ı	

(24c)m= 0 d) If natura	rective air ical ventila i heat pump vith heat reco ced mecha 0.28 ced mecha 0 house ex 0)m < 0.5 > 0 al ventilatio 0)m = 1, th 0 air change 0.28	ation: using Apper overy: efficient anical ver anical ver anical ver c (23b), t 0 on or when (24d)	endix N, (2 entilation 0.26 entilation 0 ntilation (246 0 encle hous m = (221 0	allowing f with hea 0.25 without 0 or positive c) = (23b	a) × Fmv (effor in-use for in-use	equation (National Property (MVNational Property (M	n Table 4h HR) (24a 0.24 MV) (24b 0 on from c c) = (22b 0) = a)m = (22 0.24))m = (22 0)m = (22 0)utside b) m + 0. 0	2b)m + (2 0.25 2b)m + (2 0	0.26 23b)	0.15 1 - (23c) 0.27	0.5 0.5 76.5 ÷ 100]	(23a) (23a) (23a) (24a) (24a)
If mechanic lf exhaust air lf balanced wa) If balanced wa) If balanced wa) If balanced wa) If balanced wa) If balanced wa) If balanced was bounded if (24b)m= 0 c) If whole if (22b) was considered was a consider	ical ventilation heat pump with heat recorded mechanisms of the control of the co	ation: using Apper overy: effice anical vectorical vect	endix N, (2 entilation 0.26 entilation 0 ntilation (246 0 encle hous m = (221 0	allowing f with hea 0.25 without 0 or positive c) = (23b 0 se positive c)m other	a) × Fmv (effor in-use for in-use	equation (National Property (MVNational Property (M	n Table 4h HR) (24a 0.24 MV) (24b 0 on from c c) = (22b 0) = a)m = (22 0.24))m = (22 0)m = (22 0)utside b) m + 0. 0	2b)m + (2 0.25 2b)m + (2 0 5 × (23b	0.26 23b) 0	0.27	0.5 76.5	(23) (23) (24) (24)
a) If balanced w a) If balanced w a) If balanced w 244a)m= 0.28 b) If balanced w 244b)m= 0 c) If whole if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a (25)m= 0.28	ced mechanic of the control of the c	overy: efficient anical version of tract version of when (24d) or rate - er	entilation 0.26 entilation 0 then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of the of	allowing f with hea 0.25 without 0 or positiv c) = (23t 0 se positiv c)m other	for in-use for in-use for at recover the control of	ery (MVI) 0.24 covery (N 0 ventilation ventilation ventilation ventilation ventilation	n Table 4h HR) (24a 0.24 MV) (24b 0 on from c c) = (22b 0) = a)m = (22 0.24))m = (22 0)m = (22 0)utside b) m + 0. 0	2b)m + (2 0.25 2b)m + (2 0 5 × (23b	0.26 23b) 0	0.27	0.5 76.5	(23) (23) (24) (24)
a) If balance (24a)m= 0.28 b) If balance (24b)m= 0 c) If whole if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a	ced mechanics of the control of the	anical version of tract version of the contract versio	entilation 0.26 entilation ontilation of then (24c) ontile house om = (22c) o	with head 0.25 without 0 or positive 0 c) = (23t) se positive 0)m other	at recover 10.24 heat recover 10	covery (MVI) 0.24 covery (N) ventilation wise (24) ventilation ventilation	HR) (24a 0.24 MV) (24b 0 on from 0 c) = (22b 0	a)m = (22 0.24 b)m = (22 0 outside b) m + 0.	0.25 2b)m + (2 0	0.26 23b) 0	0.27	76.5	(24)
(24a)m= 0.28 b) If baland (24b)m= 0 c) If whole if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a	0.28 ced mechange house except of the second of the seco	0.27 anical veres (23b), to 0 on or when (24d) rate - er	0.26 entilation 0 ntilation (24c) 0 nole house m = (22l) 0	0.25 without 0 or positive c) = (23b 0 se positive c)m other	0.24 heat recovering only only otherwise input version of the covering of the	0.24 covery (N 0 ventilation wise (24) 0 ventilation	0.24 MV) (24th 0 on from (c) = (22th 0	0.24 0)m = (22 0 0 0 0 0 0 m + 0.	0.25 2b)m + (2 0	0.26 23b) 0	0.27	÷ 100]	(24)
b) If baland (24b)m= 0 c) If whole if (22b) (24c)m= 0 d) If natural if (22b) (24d)m= 0 Effective at (25)m= 0.28	house ex)m < 0.5 > 0 al ventilation)m = 1, th 0 air change	anical ver tract ver (23b), t 0 on or wh en (24d) rate - er	entilation ontilation of then (24o) oliole house om = (22o)	without 0 or positiv c) = (23t 0 se positiv c)m other	heat red ove input vo); other ove input	covery (N 0 ventilatio wise (24 0 ventilatio	MV) (24b 0 on from (c) = (22b	b)m = (22 0 cutside b) m + 0.	2b)m + (2 0 5 × (23b	23b) 0	0		(24)
c) If whole if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a	0 house ex)m < 0.5 > 0 al ventilation)m = 1, th 0 air change 0.28	tract ver (23b), t 0 on or wh en (24d) 0	0 ntilation of then (24) 0 nole house om = (22) 0	or positive) = (23b) 0 se positive) m other	ove input o); other	ventilation vise (24 0 ventilation	0 on from (c) = (22t	0 outside o) m + 0.	0 5 × (23b	0			
c) If whole if (22b (24c)m= 0 d) If natura if (22b (24d)m= 0 Effective a (25)m= 0.28	house ex)m < 0.5 > 0 al ventilation)m = 1, th 0 air change	tract ver (23b), t 0 on or wh en (24d) 0	other (24) older house one (22)	or positive c) = (23b) 0 se positive c)m other	ve input vo); otherwood	ventilation vise (24) 0 ventilation	on from (c) = (22b	outside b) m + 0.	5 × (23b)			
if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a (25)m= 0.28	0)m < 0.5 > 0 al ventilatio)m = 1, th 0 air change 0.28	(23b), t 0 on or wh en (24d) 0 rate - er	0 ole house m = (221	c) = (23b 0 se positivo)m othe	o); other 0 ve input	wise (24 0 ventilation	c) = (22h	o) m + 0.	<u> </u>		0		(24
d) If natura if (22b) (24d)m= 0 Effective a (25)m= 0.28	al ventilation) m = 1, th 0 air change 0.28	on or wh en (24d) 0 rate - er	ole hous m = (221	se positive)m othe	ve input	ventilatio			0	0	0		(24)
if (22b) (24d)m= 0 Effective a (25)m= 0.28)m = 1, th 0 hir change 0.28	en (24d) 0 rate - er	m = (22l	o)m othe			on from I	- £1		U			
Effective a (25)m= 0.28	uir change 0.28	rate - er		0		:4a)m =			0.5]				
(25)m= 0.28	0.28		nter (24a	<u> </u>	0	0	0	0	0	0	0		(24
`		0.27	1101 (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)	-		-		
3. Heat loss	ses and be	1	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27		(25
· · · · · · · · · · · · · · · · · · ·		eat loss i	paramet	er:									
ELEMENT		SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/ł	()	k-value kJ/m²·ł		A X k kJ/K
Doors					1.98	х	1.4	= [2.772				(26
Windows Ty	pe 1				4.95	x1.	/[1/(1.2)+	0.04] =	5.67	=			(27
Windows Ty	pe 2				1.67	x1.	/[1/(1.2)+	0.04] =	1.91	\exists			(27
Nalls Type1	29.7	77	8.29)	21.48	3 x	0.12		2.58	$\overline{\neg}$ [(29
Walls Type2	11.9	99	1.98	3	10.01	1 x	0.12	_ = [1.16	$\overline{}$ $\overline{}$		$\neg $	(29
Roof	38.7	74	0		38.74	1 x	0.12	_ = [4.65	$\overline{}$ $\overline{}$		$\neg $	(30
Total area of	elements	s, m²			80.5							_	(31
Party wall					39.44	1 x	0	= [0	\neg			(32
Party floor					53.21	1							(32
Party ceiling					14.48	3				Ī			(32
* for windows a ** include the a						lated using	formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragraph	3.2	
abric heat I	oss, W/K	= S (A x	U)				(26) (30)) + (32) =				20.65	(33
Heat capacit	y Cm = S	(Axk)						((28)	(30) + (32	!) + (32a)	(32e) =	7125.67	7 (34
hermal mas	ss parame	eter (TMF	⊃ = Cm ÷	+ TFA) ir	n kJ/m²K			Indica	tive Value:	Low		100	(35
For design asse an be used ins				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal brid	ges : S (L	x Y) cal	culated (using Ap	pendix I	K						12.08	(36
f details of then		are not kn	nown (36) =	= 0.05 x (3	11)			(20) ÷	(26) -		ĺ		
Fotal fabric h		oloulete -	1 manthi					, ,	(36) =	0E\m v (F\		32.72	(37
entilation h/ Jan	T	Mar	Apr	y May	Jun	Jul	Aug	(38)m Sep	= 0.33 × (2	25)m x (5) Nov	Dec		

(38)m= 10.82	10.7	10.57	9.96	9.83	9.22	9.22	9.1	9.46	9.83	10.08	10.33		(38)
(**)	-		9.90	9.03	9.22	9.22	9.1				10.33		(30)
Heat transfer of 43.54	43.42	43.3	42.68	42.56	41.94	41.94	41.82	42.19	42.56	42.8	43.05		
10.01	10.12	10.0	12.00	12.00	11.01	11.01	11.02			Sum(39) ₁	<u> </u>	42.65	(39)
Heat loss para	meter (F	ILP), W/	m²K						= (39)m ÷				
(40)m= 0.82	0.82	0.81	0.8	8.0	0.79	0.79	0.79	0.79	0.8	0.8	0.81		_
Number of day	rs in mor	nth (Tahl	le 1a)					,	Average =	Sum(40) ₁	12 /12=	0.8	(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			l			
4. Water heat	ina ener	av reaui	rement:								kWh/ye	ear:	
Assumed occur if TFA > 13.9			[1 - exp	(-0 0003	349 x (TF	FA -13 9)2)] + 0 (0013 x (ΓFA -13		78		(42)
if TFA £ 13.9		· 1.70 X	i ovb	(0.0000	710 X (11	71 10.0	<i>,</i> _,) X 010 X (.0)			
Annual averag									o target e		5.59		(43)
not more that 125	_				_	_	io acriieve	a water us	se largel o	I			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in						<u> </u>							
(44)m= 84.25	81.18	78.12	75.06	71.99	68.93	68.93	71.99	75.06	78.12	81.18	84.25		
										m(44) _{1 12} =		919.05	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,n	n x nm x C	OTm / 3600	kWh/mon	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 124.94	109.27	112.76	98.3	94.32	81.39	75.42	86.55	87.58	102.07	111.42	120.99		-
If instantaneous w	ater heatii	ng at point	of use (no	hot water	r storage).	enter 0 in	boxes (46		Total = Su	m(45) _{1 12} =	• [1205.02	(45)
(46)m= 18.74	16.39	16.91	14.75	14.15	12.21	11.31	12.98	13.14	15.31	16.71	18.15		(46)
Water storage		10.01	11.70	11.10	12.21	11.01	12.00	10.11	10.01	10.71	10.10		(- /
Storage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	•			•			` '						
Otherwise if no Water storage		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
a) If manufact		eclared le	oss facto	or is kno	wn (kWł	n/dav):					0		(48)
Temperature fa					`	3,					0		(49)
Energy lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
b) If manufact			-										
Hot water stora	_			e 2 (kW	h/litre/da	ıy)					0		(51)
Volume factor	•		JII 4 .3								0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (54) in (5	55)									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)ı	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	x H	

Primary circuit lo	oss (annual) fr	om Table	e 3							0	l	(58)
Primary circuit lo			,	•	. ,	, ,						
(modified by fa		1	r —	solar wa				r	<u> </u>	ī	İ	
(59)m= 0	0 0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calc	ulated for each	month ((61)m =	(60) ÷ 30	65 × (41)m						
(61)m= 42.93	37.37 39.81	37.01	36.69	33.99	35.13	36.69	37.01	39.81	40.04	42.93	İ	(61)
Total heat requir	red for water h	eating ca	alculated	for eac	h month	(62)m =	: 0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	1
(62)m= 167.87	146.64 152.56	135.32	131.01	115.39	110.55	123.24	124.6	141.88	151.45	163.92	İ	(62)
Solar DHW input cal	Iculated using App	pendix G o	Appendix	H (negati	ve quantity	y) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add additional I	ines if FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)					
(63)m= 0	0 0	0	0	0	0	0	0	0	0	0	İ	(63)
Output from wat	er heater											
(64)m= 167.87	146.64 152.56	135.32	131.01	115.39	110.55	123.24	124.6	141.88	151.45	163.92	İ	
	•	•				Outp	out from wa	ater heate	r (annual) ₁	12	1664.43	(64)
Heat gains from	water heating	, kWh/m	onth 0.2	5 ′ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m]	
(65)m= 52.27	45.67 47.44	41.94	40.53	35.56	33.86	37.95	38.38	43.89	47.06	50.96	İ	(65)
include (57)m	in calculation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal gair	ns (see Table s	5 and 5a):								-	
Metabolic gains	·		,									
Jan	Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	İ	
	89.24 89.24	89.24	89.24	89.24	89.24	89.24	89.24	89.24	89.24	89.24	İ	(66)
Lighting gains (c	calculated in A	npendix	L. eguat	ion L9 o	r L9a). a	lso see	Table 5					
	12.92 10.51	7.95	5.95	5.02	5.42	7.05	9.46	12.02	14.02	14.95	İ	(67)
Appliances gain	L s (calculated i	n Annend	l ea	uation I	13 or I 1	3a) also	see Ta	hle 5				
··· — — —	157.18 153.11	144.45	133.52	123.24	116.38	114.76	118.83	127.49	138.42	148.7	İ	(68)
Cooking gains (!	<u> </u>	l equat	ion I 15	Į	l Nalso se	L e Table	5		<u> </u>		
	31.92 31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	1	(69)
Pumps and fans			002	02	1 02	02	0	0	002	002		, ,
(70)m= 3	3 3	3	3	3	3	3	3	3	3	3	İ	(70)
									Ů	Ů		(. 5)
Losses e.g. eva (71)m= -71.39	-71.39 -71.39	-71.39	-71.39	-71.39	-71.39	-71.39	-71.39	-71.39	-71.39	-71.39	İ	(71)
` '		-7 1.59	-71.53	-71.59	-7 1.55	-71.55	-71.55	-71.55	-71.59	-71.59		(, ,)
Water heating g	67.97 63.77	58.25	54.48	49.39	45.51	F1 01	E2 2	50.00	65.25	60.5	İ	(72)
` ′		58.25	54.48	<u> </u>	Į	51.01	53.3	58.99	65.35	68.5		(12)
Total internal g	· · · · · · · · · · · · · · · · · · ·	1 000 40	040 70		<u> </u>	•	+ (69)m + (. , .			İ	(72)
` '	290.83 280.15	263.42	246.72	230.42	220.08	225.59	234.37	251.27	270.57	284.92		(73)
6. Solar gains: Solar gains are cal	culated using sola	ar flux from	Table 6a	and assoc	iated equa	ations to co	onvert to th	e annlicat	le orientat	ion		
Orientation: Ac	-	Area		Flu	•	ilions to cc		ie applicat	FF		Gains	
	ble 6d	m ²			ble 6a	Т	g_ able 6b	T	able 6c		(W)	
Northeast _{0.9x}	0.77 ×	4.9	95	X 1	11.28	x	0.5	×	0.7	=	13.55	(75)
Northeast _{0.9x}	0.77 ×				22.97	×	0.5	x	0.7	=	27.57	(75)
												_

Nawthagat a F					_		7		_				— ,,
Northeast _{0.9x}	0.77	X	4.9	5	X	41.38	X	0.5	×	0.7	=	49.68	(75)
Northeast _{0.9x}	0.77	X	4.9	5	X	67.96	X	0.5	X	0.7	=	81.59	(75)
Northeast _{0.9x}	0.77	X	4.9	5	X	91.35	X	0.5	X	0.7		109.67	(75)
Northeast _{0.9x}	0.77	X	4.9	5	X	97.38	X	0.5	X	0.7	=	116.92	(75)
Northeast _{0.9x}	0.77	X	4.9	15	х	91.1	X	0.5	X	0.7	=	109.38	(75)
Northeast _{0.9x}	0.77	X	4.9	5	X	72.63	X	0.5	X	0.7	=	87.2	(75)
Northeast 0.9x	0.77	X	4.9	5	X	50.42	X	0.5	X	0.7	=	60.54	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x :	28.07	X	0.5	X	0.7	=	33.7	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x	14.2	X	0.5	X	0.7	=	17.05	(75)
Northeast 0.9x	0.77	X	4.9	15	x	9.21	X	0.5	X	0.7	=	11.06	(75)
Northwest _{0.9x}	0.77	X	1.6	57	x	11.28	X	0.5	X	0.7	=	9.14	(81)
Northwest _{0.9x}	0.77	X	1.6	57	X	22.97	X	0.5	X	0.7	=	18.61	(81)
Northwest 0.9x	0.77	x	1.6	57	x ·	41.38	X	0.5	x	0.7	=	33.52	(81)
Northwest 0.9x	0.77	x	1.6	57	x	67.96	X	0.5	x	0.7	=	55.05	(81)
Northwest 0.9x	0.77	x	1.6	57	x	91.35	X	0.5	x	0.7	=	74	(81)
Northwest _{0.9x}	0.77	x	1.6	57	x	97.38	X	0.5	x	0.7		78.89	(81)
Northwest _{0.9x}	0.77	X	1.6	57	x	91.1	X	0.5	x	0.7	<u> </u>	73.8	(81)
Northwest 0.9x	0.77	x	1.6	57	x	72.63	X	0.5	x	0.7	=	58.84	(81)
Northwest _{0.9x}	0.77	x	1.6	57	x	50.42	X	0.5	x	0.7	=	40.85	(81)
Northwest _{0.9x}	0.77	x	1.6	57	x =	28.07	X	0.5	x	0.7		22.74	(81)
Northwest _{0.9x}	0.77	x	1.6	57	х	14.2	X	0.5	x	0.7	-	11.5	(81)
Northwest _{0.9x}	0.77	x	1.6	57	x	9.21	j x	0.5	x	0.7		7.46	(81)
_							•						
Solar gains in	watts, ca	lculated	for eac	n month			(83)m	n = Sum(74)m	(82)m			_	
(83)m= 22.69	46.18	83.2	136.64	183.67	195.81	183.18	146	.03 101.38	56.44	28.55	18.53		(83)
Total gains – i	nternal a	nd solar	(84)m =	(73)m -	+ (83)m	, watts					_	•	
(84)m= 315.83	337.01	363.36	400.06	430.39	426.24	403.27	371	.63 335.75	307.7	1 299.12	303.45		(84)
7. Mean inter	nal temp	erature	(heating	season)								
Temperature	during h	eating p	eriods ir	the livi	ng area	from Tal	ble 9	, Th1 (°C)				21	(85)
Utilisation fac	tor for ga	ains for I	iving are	ea, h1,m	(see Ta	able 9a)							_
Jan	Feb	Mar	Apr	May	Jun	Jul	Α	ug Sep	Oct	Nov	Dec		
(86)m= 0.96	0.95	0.92	0.85	0.74	0.57	0.44	0.4	9 0.71	0.88	0.95	0.97		(86)
Mean interna	l tempera	ature in I	living are	ea T1 (fo	ollow ste	eps 3 to 7	7 in T	able 9c)					
(87)m= 19.39	19.56	19.89	20.33	20.7	20.91	20.97	20.		20.35	19.81	19.36]	(87)
Temperature	durina h	eating n	eriods ir	rest of	dwelling	r from Ta	ahle (Th2 (°C)				4	
(88)m= 20.24	20.24	20.24	20.25	20.25	20.26	20.26	20.		20.25	20.25	20.25	1	(88)
		ļ				<u>ļ</u>	<u> </u>				ļ.	J	
Utilisation fac	0.94	0.91	0.84	weiling, 0.7	0.52	ee Table	9a) 0.4	2 0.66	0.86	0.94	0.96	1	(89)
	L l	ļ				<u>ļ</u>	<u> </u>		ļ	1 0.34	0.90	J	(50)
Mean interna		i			<u> </u>	1	i 		 	1,0 ==	10.55	1	(00)
(90)m= 18.06	18.3	18.77	19.41	19.9	20.17	20.24	20.		19.44		18.02		(90)
									ıLA ≅ Ll'	ving area ÷ ()	0.43	(91)

NA	-14	/6-	41	- 1 1 1	II: \ 6 1	. A T 4	. /4 61	A) TO					
Mean intern (92)m= 18.64		19.26	19.81	20.25	111ng) = 11 20.49	20.56	+ (1 – TL 20.55	20.38	19.84	19.17	18.6		(92)
` '		l .								19.17	10.0		(32)
Apply adjus (93)m= 18.64	18.85	19.26	19.81	20.25	20.49	20.56	20.55	20.38	19.84	19.17	18.6		(93)
8. Space he			13.01	20.25	20.43	20.50	20.55	20.50	15.04	13.17	10.0		(00)
Set Ti to the			mneratur	e obtain	ned at et	an 11 of	Table O	h so tha	t Ti m=(76)m an	d re calc	ulato	
the utilisatio			•		icu at sit	ер птог	Table 3	0, 50 tila	it 11,111—(r O)III aii	u re-caic	uiate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fa	ctor for g	ains, hm											
(94)m= 0.94	0.93	0.9	0.82	0.7	0.54	0.4	0.45	0.67	0.85	0.92	0.95		(94)
Useful gains	s, hmGm	, W = (94	1)m x (84	4)m									
(95)m= 297.97	313.07	325.51	329.06	301.29	228.66	160.93	166.04	225.35	262.23	276.2	287.95		(95)
Monthly ave	rage exte	ernal tem	perature	from Ta	able 8								
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	te for me	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]		-		
(97)m= 624.4	605.72	552.38	465.74	363.78	247.11	166.04	173.48	264.78	393.11	516.49	620.07		(97)
Space heati	ng requir	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m= 242.86	196.67	168.79	98.41	46.49	0	0	0	0	97.38	173.01	247.1		_
							Tota	l per year	(kWh/year) = Sum(9	8)15,912 =	1270.69	(98)
Space heati	ng requir	ement in	kWh/m²	/year								23.88	(99)
9a. Energy re	eauiremei	nts – Indi	vidual h	eating s	vstems i	ncludina	micro-C	CHP)					
Space heat					,	<u> </u>		,					
Fraction of	•	at from se	econdar	y/supple	mentary	system						0	(201)
Eraction of													
riaction of	space nea	at from m	ain syst	em(s)			(202) = 1	- (201) =				1	(202)
	•		iain syst main svs	• •				- (201) = 02) × [1 -	(203)] =			1	╡ .
Fraction of t	otal heati	ng from	main sys	stem 1				, ,	(203)] =			1	(204)
Fraction of t	otal heati f main spa	ng from lace heat	main sys	stem 1 em 1	a evetem			, ,	(203)] =			90.3	(204)
Fraction of the Efficiency of Efficiency of Efficiency of Efficiency	otal heati	ng from lace heati	main sys	stem 1 em 1 y heating	· ·	າ, %	(204) = (2	02) × [1 –				90.3	(204) (206) (208)
Fraction of t Efficiency of Efficiency of Jan	otal heati f main spa f seconda Feb	ng from lace heatinglysupplement	main sys ing syste ementar Apr	stem 1 em 1 y heating May	Jun			, ,	(203)] =	Nov	Dec	90.3	(204) (206) (208)
Fraction of the Efficiency of Efficiency of Jan Space heati	otal heati f main spa f seconda Feb ng requir	ng from lace heatingly supplement (c	main systementar Apralculated	etem 1 em 1 y heating May d above	Jun	n, % Jul	(204) = (2 Aug	02) × [1 –	Oct			90.3	(204) (206) (208)
Efficiency of Efficiency of Jan Space heati	otal heati f main sp f seconda Feb ng requir 196.67	ng from ace heatingly/supplement (continued or 168.79	main systementary Apr Alculated	em 1 em 1 y heating May d above	Jun	າ, %	(204) = (2	02) × [1 –		Nov 173.01	Dec 247.1	90.3	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(9)]	otal heati f main sport f seconda Feb ng requir 6 196.67 8)m x (20	ng from ace heating/supplement (compared 168.79	main systementar Apr alculated 98.41 00 ÷ (20	etem 1 em 1 y heating May d above 46.49	Jun) 0	n, % Jul o	(204) = (2 Aug	02) × [1 –	Oct 97.38	173.01	247.1	90.3	(204) (206) (208)
Efficiency of Efficiency of Jan Space heati	otal heati f main sport f seconda Feb ng requir 6 196.67 8)m x (20	ng from ace heatingly/supplement (continued or 168.79	main systementary Apr Alculated	em 1 em 1 y heating May d above	Jun	n, % Jul	(204) = (2 Aug 0	02) × [1 – Sep 0	Oct 97.38	173.01 191.6	247.1	1 90.3 0 kWh/ye	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(9) 268.98]	otal heati f main sport f seconda Feb ng requir 6 196.67 8)m x (20	ng from acce heating/supplement (compared 168.79 (compared 186.92)	Apr alculated 98.41 00 ÷ (20	stem 1 em 1 y heating May d above 46.49 6) 51.48	Jun) 0	n, % Jul o	(204) = (2 Aug 0	02) × [1 –	Oct 97.38	173.01 191.6	247.1	90.3	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(9 268.98)]	otal heating main sport from secondar from s	mg from acce heating many/supplement (company 168.79 accordant) many from acceptance heating from a	main systementary Apr alculated 98.41 00 ÷ (20 108.98	stem 1 em 1 y heating May d above 46.49 6) 51.48	Jun) 0	n, % Jul o	(204) = (2 Aug 0	02) × [1 – Sep 0	Oct 97.38	173.01 191.6	247.1	1 90.3 0 kWh/ye	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(9) 268.99]} Space heating 268.99	otal heatiful main sports from secondar February 196.67 8)m x (20 217.79 ng fuel (secondary) } x 1	mg from acce heating/supplement (compared to 168.79 accordance to 168.92 accordance to 169.00	main systementary Apr alculated 98.41 00 ÷ (20 108.98	May dabove 46.49 51.48	Jun) 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – 0	97.38 107.84 ar) =Sum(2	173.01 191.6 211) _{15,10. 12}	247.1	1 90.3 0 kWh/ye	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(9 268.98)]	otal heating main sport from secondar from s	mg from acce heating many/supplement (company 168.79 accordant) many from acceptance heating from a	main systementary Apr alculated 98.41 00 ÷ (20 108.98	stem 1 em 1 y heating May d above 46.49 6) 51.48	Jun) 0	n, % Jul o	(204) = (2 Aug 0 Tota	02) × [1 – Sep 0 0 I (kWh/yea	Oct 97.38 107.84 ar) =Sum(2)	173.01 191.6 211) _{15,10. 12}	247.1	1 90.3 0 kWh/ye	(204) (206) (208) ar (211)
Fraction of the Efficiency of Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(98.95)	otal heatiful main sport from the secondar from	mg from acce heating/supplement (compared to 168.79 accordance to 168.92 accordance to 169.00	main systementary Apr alculated 98.41 00 ÷ (20 108.98	May dabove 46.49 51.48	Jun) 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – 0	97.38 107.84 ar) =Sum(2	173.01 191.6 211) _{15,10. 12}	247.1	1 90.3 0 kWh/ye	(204) (206) (208) ar
Fraction of the Efficiency of Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(98)m x (215)m= 0]} Water heating Efficiency of	otal heati f main spa f seconda Feb ng requir 6 196.67 8)m x (20 6 217.79 ng fuel (second) } x 1	ng from ace heatingly supplement (con 168.79 and 186.92 are condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary on the condary of the condar	main systementary Apr alculated 98.41 00 ÷ (20 108.98 y), kWh/ 8) 0	stem 1 em 1 y heating May d above 46.49 66) 51.48 month	Jun) 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – Sep 0 0 I (kWh/yea	97.38 107.84 ar) =Sum(2	173.01 191.6 211) _{15,10. 12}	247.1	1 90.3 0 kWh/ye	(204) (206) (208) ar (211)
Fraction of the Efficiency of Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(9) 268.96]} Space heating = {[(98)m x (2) (215)m= 0]} Water heating Output from the Efficiency of the Efficiency	otal heatiful main sports from the secondar seco	mg from mace heating/supplement (colors 168.79) 4)] } x 1 186.92 econdary 00 ÷ (20 0)	main systementary Apr alculated 98.41 00 ÷ (20 108.98 y), kWh/ 8) 0	stem 1 em 1 y heating May d above 46.49 6) 51.48 month 0	Jun) 0 0	o 0	(204) = (2 Aug 0 Tota 0 Tota	02) × [1 – 0	Oct 97.38 107.84 ar) =Sum(2	173.01 191.6 211) _{15,10. 12} 0	247.1	1 90.3 0 kWh/ye	(204) (206) (208) ar (211)
Fraction of the Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(98)m x (215)m=0]} Water heating Output from the Indian India	otal heati f main spa f seconda Feb ng requir 6 196.67 8)m x (20 6 217.79 ng fuel (second) } x 1 0 ng water heati	mg from mace heating mary/supplement (colors of the following from m	main systementary Apr alculated 98.41 00 ÷ (20 108.98 y), kWh/ 8) 0	stem 1 em 1 y heating May d above 46.49 66) 51.48 month	Jun) 0	n, % Jul 0	(204) = (2 Aug 0 Tota	02) × [1 – Sep 0 0 I (kWh/yea	97.38 107.84 ar) =Sum(2	173.01 191.6 211) _{15,10. 12}	247.1	1 90.3 0 kWh/ye	(204) (206) (208) ar (211) (211)
Fraction of the Efficiency of Efficiency of Efficiency of Space heating 242.86 (211)m = {[(9) 268.99]} Space heating = {[(98)m x (2) (215)m= 0]} Water heating Output from the Space heating of Efficiency of Space heating 167.87]	otal heating main sport from secondary from seconda	mg from acce heating mary/supplement (colors accendant) Mar	Apr alculated 98.41 00 ÷ (20 108.98 y), kWh/ 8) 0	May dabove 46.49 66) 51.48 month 0	Jun) 0 0 115.39	o 0 110.55	(204) = (2 Aug 0 Tota 123.24	02) × [1 – Sep 0 0 I (kWh/yea 124.6	Oct 97.38 107.84 ar) =Sum(2 0 ar) =Sum(2	173.01 191.6 211) _{15,10. 12} 0 215) _{15,10. 12}	247.1 273.64 = 0 =	1 90.3 0 kWh/ye	(204) (206) (208) ar (211) (211)
Fraction of the Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(9] 268.96]} Space heating 268.96 (215)m = 0 Water heating Output from 167.87 Efficiency of (217)m = 86.25	otal heati f main spa f seconda Feb ng requir 6 196.67 8)m x (20 6 217.79 ng fuel (second)] } x 1 0 ng water heati	mg from ace heatingly supplement (colors of the following supplement (colors of the following supplement (colors of the following supplement (colors of the following supplement	main systementary Apr alculated 98.41 00 ÷ (20 108.98 y), kWh/ 8) 0	stem 1 em 1 y heating May d above 46.49 6) 51.48 month 0	Jun) 0 0	o 0	(204) = (2 Aug 0 Tota 0 Tota	02) × [1 – 0	Oct 97.38 107.84 ar) =Sum(2	173.01 191.6 211) _{15,10. 12} 0	247.1	1 90.3 0 kWh/ye	(204) (206) (208) ar (211) (211)
Fraction of the Efficiency of Efficiency of Efficiency of Space heating 242.86 (211)m = {[(9) 268.99]} Space heating = {[(98)m x (2) (215)m= 0]} Water heating Output from the Space heating of Efficiency of Space heating Output from the Space he	otal heati f main spa f seconda Feb ng requir 6 196.67 8)m x (20 6 217.79 ng fuel (s 201)] } x 1 0 ng water hea water hea 86.08 r heating	mg from ace heatingly supplied in the ment (color form) 168.79 186.92 186.92 162.56 152.56 185.63 186.63	main systementary Apr alculated 98.41 00 ÷ (20 108.98 y), kWh/8) 0 ulated al 135.32 84.67 onth	May dabove 46.49 66) 51.48 month 0	Jun) 0 0 115.39	o 0 110.55	(204) = (2 Aug 0 Tota 123.24	02) × [1 – Sep 0 0 I (kWh/yea 124.6	Oct 97.38 107.84 ar) =Sum(2 0 ar) =Sum(2	173.01 191.6 211) _{15,10. 12} 0 215) _{15,10. 12}	247.1 273.64 = 0 =	1 90.3 0 kWh/ye	(204) (206) (208) ar (211) (211)
Fraction of the Efficiency of Efficiency of Jan Space heating 242.86 (211)m = {[(9] 268.95]} Space heating 268.95 (215)m = 0 Water heating Output from 167.87 (217)m = 86.25 (217)m = 86.25 (217)m = 86.25	otal heating the string requires the string requires to the string requires the string	mg from ace heatingly supplied in the ment (color form) 168.79 186.92 186.92 162.56 152.56 185.63 186.63	main systementary Apr alculated 98.41 00 ÷ (20 108.98 y), kWh/8) 0 ulated al 135.32 84.67 onth	May dabove 46.49 6) 51.48 month 0	Jun) 0 0 115.39	o 0 110.55	(204) = (2 Aug 0 Tota 123.24	02) × [1 – Sep 0 0 I (kWh/yea 124.6	Oct 97.38 107.84 ar) =Sum(2 0 ar) =Sum(2	173.01 191.6 211) _{15,10. 12} 0 215) _{15,10. 12}	247.1 273.64 = 0 =	1 90.3 0 kWh/ye	(204) (206) (208) ar (211) (211)
Fraction of the Efficiency of Efficiency of Idan Space heating 242.86 (211)m = {[(98)m x (215)m= 0]} Water heating Output from 167.87 Efficiency of (217)m= 86.25 Fuel for water (219)m = (64)	otal heating the string requires the string requires to the string requires the string	mg from mace heating mary/supplement (color) Mar	main systementary Apr alculated 98.41 00 ÷ (20 108.98 y), kWh/8) 0 ulated al 135.32 84.67 onth m	stem 1 em 1 y heating May d above 46.49 66) 51.48 month 0	Jun) 0 0 115.39	o 0 110.55	(204) = (2 Aug 0 Tota 123.24 81	02) × [1 – Sep 0 0 0 I (kWh/yea 124.6	Oct 97.38 107.84 107.84 0 ar) =Sum(2 141.88 84.54	173.01 191.6 211) _{15,10. 12} 0 215) _{15,10. 12}	247.1 273.64 = 0 = 163.92	1 90.3 0 kWh/ye	(204) (206) (208) ar (211) (211)

Annual totals		kWh/year	-	kWh/year	_
Space heating fuel used, main system 1				1407.19	
Water heating fuel used				1979.61]
Electricity for pumps, fans and electric keep-hot					
mechanical ventilation - balanced, extract or pos	itive input from outside		103.54		(230a)
central heating pump:		Ī	30		(230c)
Total electricity for the above, kWh/year	sum of (230a)) (230g) =		133.54	(231)
Electricity for lighting				256.89	(232)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	Energy kWh/year	Emission factors kg CO2/kWh	or	Emissions kg CO2/yea	r
Space heating (main system 1)	-		or =		r](261)
Space heating (main system 1) Space heating (secondary)	kWh/year	kg CO2/kWh		kg CO2/yea	
	kWh/year	kg CO2/kWh	=	kg CO2/yea	(261)
Space heating (secondary)	kWh/year (211) x (215) x	kg CO2/kWh 0.216 0.519	= [kg CO2/yea	(261)
Space heating (secondary) Water heating	kWh/year (211) x (215) x (219) x	kg CO2/kWh 0.216 0.519	= [303.95 0 427.6	(261) (263) (264)
Space heating (secondary) Water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) =	kg CO2/kWh 0.216 0.519 0.216	=	303.95 0 427.6 731.55	(261) (263) (264) (265)
Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (264) = (231) x (232) x	kg CO2/kWh 0.216 0.519 0.216	=	303.95 0 427.6 731.55 69.31	(261) (263) (264) (265) (267)

El rating (section 14)

(274)

			lloor F	Notaile:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 20		User D	Strom Softwa	are Vei	rsion:			0016363 on: 1.0.4.26	
Address	Flat 07, 51 Caltho		•	Address		-Lean				
Address: 1. Overall dwelling dim		pe Sireei	, LOND	OIN, VVC						
1. Overall awelling all	ichsions.		Δre	a(m²)		Δv He	ight(m)		Volume(m ³	3)
Ground floor				<u> </u>	(1a) x		2.2	(2a) =	140.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1	le)+(1r	n) 6	63.73	(4)			-		
Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	(3n) =	140.21	(5)
2. Ventilation rate:										
	main heating	secondar heating	'y	other		total			m³ per hou	ır
Number of chimneys	0 +	0] + [0] = [0	X	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	X :	20 =	0	(6b)
Number of intermittent	fans					0	X	10 =	0	(7a)
Number of passive ven	ts				Ī	0	x '	10 =	0	(7b)
Number of flueless gas	fires				Ī	0	x -	40 =	0	(7c)
								A i u a b		<u> </u>
La Cita attana along taga belanga	and the same of the same	(C-) (Ch) (7-\./7 - \./	(7-) –	_				nanges per ho	_
Infiltration due to chimn	eys, flues and fans = been carried out or is inten				continue fr	0 om (9) to		÷ (5) =	0	(8)
Number of storeys in		аса, ргоссс	<i>a to (17),</i> (ourier wise (orianae m	om (5) to	(10)		0	(9)
Additional infiltration	3 ()						[(9)	-1]x0.1 =	0	(10)
Structural infiltration:	0.25 for steel or timbe	r frame or	0.35 fo	r masoni	y constr	uction			0	(11)
	present, use the value corre	esponding to	the great	ter wall are	a (after					
• .	nings); if equal user 0.35 n floor, enter 0.2 (unse	aled) or 0	1 (seale	ed) else	enter ()				0	(12)
•	enter 0.05, else enter 0	,	. i (ocaic	<i>5a)</i> , cioc	Cittor o				0	(13)
•	ws and doors draught								0	(14)
Window infiltration	9	• • •		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value	e, q50, expressed in cu	ubic metre	es per ho	our per s	quare m	etre of e	envelope	area	3	(17)
If based on air permeat	oility value, then (18) = [(17) ÷ 20]+(8), otherw	rise (18) = (16)				0.15	(18)
	lies if a pressurisation test h	as been dor	ne or a de	gree air pe	rmeability	is being u	sed			_
Number of sides shelte Shelter factor	red			(20) = 1 -	io 075 x (1	19)1 =			1 0.00	(19)
Infiltration rate incorpor	ating shelter factor			(21) = (18	`	- /1			0.92	(20)
Infiltration rate modified	•	ed.							0.14	(= , /
Jan Feb	Mar Apr May	1	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind s		<u> </u>		<u> </u>	•				J	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
	20)						•	•	J	
Wind Factor (22a)m = ('	0.05	0.05	0.00	4	1.00	1 10	1 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	J	

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m		
0.18 0.17 0.15 0.15 0.13 0.13 0.14 0.15 0.16 0.16		
Calculate effective air change rate for the applicable case		_
If mechanical ventilation:	0.5	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 1	100]	(240)
(24a)m= 0.29		(24a)
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m = 0 0 0 0 0 0 0 0 0		(24b)
		(240)
c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)		
(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0		(24c)
d) If natural ventilation or whole house positive input ventilation from loft		, ,
if $(22b)m = 1$, then $(24d)m = (22b)m$ otherwise $(24d)m = 0.5 + [(22b)m^2 \times 0.5]$		
(24d)m= 0 0 0 0 0 0 0 0 0 0 0 0		(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)		
(25)m= 0.29 0.29 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.27 0.28		(25)
3. Heat losses and heat loss parameter:		
ELEMENT Gross Openings Net Area U-value A X U k-value	АХ	
area (m²) m² A ,m² W/m2K (W/K) kJ/m²·K	kJ/l	
Doors 1.98 x 1.4 = 2.772		(26)
Windows Type 1 $3.4 \times 1/[1/(1.2) + 0.04] = 3.89$		(27)
Windows Type 2 $1.8 \times 1/[1/(1.2) + 0.04] = 2.06$		(27)
Windows Type 3		(27)
Walls Type1 51.69 10.87 40.82 x 0.12 = 4.9		(29)
Walls Type2 9.19 1.98 7.21 x 0.12 = 0.83		(29)
Roof 63.73 0 63.73 x 0.12 = 7.65		(30)
Total area of elements, m ² 124.61		(31)
Party wall 28.69 x 0 = 0		(32)
Party floor 63.73		(32a)
Party ceiling 14.48		(32b)
* 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	?	_
Fabric heat loss, W/K = S (A x U) $(26) (30) + (32) =$	28.6	(33)
Heat capacity Cm = $S(A \times k)$ ((28) $(30) + (32) + (32a) + (3$	8126.04	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low	100	(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	18.69	(36)
if details of thermal bridging are not known (36) = $0.05 \times (31)$	10.03	
Total fabric heat loss (33) + (36) =	47.29	(37)

Γ	Jan	Feb	alculated Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
8)m=	13.62	13.46	13.3	12.5	12.34	11.54	11.54	11.37	11.86	12.34	12.66	12.98		(3
′ L		oefficier		12.0	12.04	11.04	11.04	11.07	<u> </u>		<u> </u>	12.00		(-
	60.91	60.75	60.59	59.79	59.63	58.83	58.83	58.66	59.15	= (37) + (59.63	59.95	60.27		
· L	00.01	00.70	00.00	00.70	00.00			00.00			Sum(39) ₁	 	59.75	(3
eat los	s para	meter (H	HLP), W	m²K						= (39)m ÷				`
0)m=	0.96	0.95	0.95	0.94	0.94	0.92	0.92	0.92	0.93	0.94	0.94	0.95		
umher	of day	e in moi	nth (Tab	la 1a)					,	Average =	Sum(40) ₁	12 /12=	0.94	(4
Г	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
· <u>L</u>	!										ļ			
1. Wate	er heat	ina ener	gy requi	rement:								kWh/ye	ar:	
													jo	
		pancy, I		[1 ovn	/	240 v /T	-Λ 12 O)2)] + 0.(1012 v /	Γ Γ Λ 12		.08		(•
		0, N = 1	T 1.70 X	[ı - exp	(-0.000)49 X (11	-A -13.8	<i>)</i> 2)] + 0.0) X C1 OC	IFA-13	.9)			
								(25 x N)				3.72		(
		-				-	-	to achieve	a water us	se target o	f			
i illore i	ınaı 125	ilites per p	person per		raier use, i	hot and co	ia)		ı		ı			
ĻL	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot water	usage ir	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	•					
4)m=	92.09	88.74	85.39	82.04	78.69	75.34	75.34	78.69	82.04	85.39	88.74	92.09		
orav oo	entant of	hot water	used cal	oulated m	anthly – 1	100 v V/d r	n v nm v [OTm / 3600			m(44) _{1 12} =		1004.6	(
· -				1	· ·	·	ī	ı	ı	,				
5)m=	136.56	119.44	123.25	107.45	103.1	88.97	82.44	94.61	95.74	111.57	121.79	132.25		— ,
instantai	neous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46		Fotal = Su	m(45) _{1 12} =	= L	1317.18	(4
_	20.48	17.92	18.49	16.12	15.47	13.35	12.37	14.19	14.36	16.74	18.27	19.84		(
1	torage		10.43	10.12	10.47	10.00	12.07	14.15	14.00	10.74	10.21	13.04		(
orage	volum	e (litres)	includin	ig any so	olar or W	WHRS	storage	within sa	ame ves	sel		0		(
comm	unity h	eating a	nd no ta	nk in dw	elling, e	nter 110	litres in	(47)						
herwi	se if no	stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
	torage													
) If ma	ınufact	urer's de	eclared l	oss facto	or is kno	wn (kWl	n/day):					0		(
empera	ature fa	actor fro	m Table	2b								0		(
			storage	-				(48) x (49)) =			0		(
				•		or is not								
		•	factor fr ee section		e 2 (kvv	h/litre/da	ay)					0		(
	-	from Tal		011 4.3										(
			m Table	2b							-	0		(
•			storage		ar			(47) x (51)) y (52) y (53) =				
		m water 54) in (5	_	, KVVII/yt	-ai			(T 1) X (31,	, A (OZ) X (JJ) –		0		()
,	, ,	, ,	culated f	or each	month			((56)m = (55) × (41)	m		U		(
	waye	iuss Cali	cuiai c u I	oi c acil				((50)))) – (· · · · · · · · · · · · · · · · · · ·	11				
ater st	0	0	0	0	0	0	0	0	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	ix 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	uit 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	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= 46.9	3 40.84	43.51	40.46	40.1	37.16	38.39	40.1	40.46	43.51	43.76	46.93		(61)
Total heat re	equired for	water he	eating ca	alculated	for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 183.4	19 160.28	166.76	147.91	143.21	126.13	120.84	134.71	136.2	155.09	165.55	179.18		(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	iter											
(64)m= 183.4	19 160.28	166.76	147.91	143.21	126.13	120.84	134.71	136.2	155.09	165.55	179.18		_
							Outp	out from wa	ater heate	r (annual)₁	12	1819.34	(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= 57.1	4 49.92	51.86	45.84	44.31	38.87	37.01	41.48	41.95	47.98	51.44	55.71		(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	eating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga	ains (Table	e 5), Wat	ts										
Jar		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 104.2	24 104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24		(66)
Lighting gair	ns (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5					
(67)m= 16.7	5 14.87	12.1	9.16	6.85	5.78	6.24	8.12	10.9	13.83	16.15	17.21		(67)
Appliances	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	-	-	•	
(68)m= 182.2	25 184.14	179.37	169.23	156.42	144.38	136.34	134.45	139.22	149.36	162.17	174.21		(68)
Cooking gai	ns (calcula	ated in A	ppendix	L, equat	ion L15	or L15a)), also se	ee Table	5			•	
(69)m= 33.4	2 33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42	33.42		(69)
Pumps and	fans gains	(Table 5	 ба)									•	
(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= -83.4	4 -83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4	-83.4		(71)
Water heating	ng gains (1	rable 5)								!	!	•	
(72)m= 76.8	74.29	69.7	63.67	59.55	53.99	49.75	55.76	58.26	64.48	71.44	74.87		(72)
Total intern	al gains =				(66)	m + (67)m	1 + (68)m +	+ (69)m + ((70)m + (7	1)m + (72)	m	•	
(73)m= 333.0	7 330.58	318.45	299.33	280.09	261.42	249.61	255.6	265.64	284.95	307.03	323.57		(73)
6. Solar ga	ins:												
Solar gains a	e calculated	using sola	r flux from	Table 6a	and associ	ated equa	tions to co	nvert to th	e applicat	ole orientat	ion.		
Orientation:	Access F Table 6d		Area m²		Flu Tal	x ole 6a	Т	g_ able 6b	T	FF able 6c		Gains (W)	

Northeast _{0.9x}	0.77	X	3.4	x	11.28	x	0.5	x	0.7	=	9.3	(75)
Northeast _{0.9x}	0.77	x	3.4	x	22.97	x	0.5	x	0.7	=	18.94	(75)
Northeast _{0.9x}	0.77	x	3.4	x	41.38	x	0.5	x	0.7	=	34.12	(75)
Northeast _{0.9x}	0.77	X	3.4	x	67.96	x	0.5	x	0.7	=	56.04	(75)
Northeast _{0.9x}	0.77	x	3.4	x	91.35	x	0.5	x	0.7		75.33	(75)
Northeast _{0.9x}	0.77	X	3.4	x	97.38	х	0.5	x	0.7	=	80.31	(75)
Northeast _{0.9x}	0.77	X	3.4	x	91.1	x	0.5	x	0.7	=	75.13	(75)
Northeast _{0.9x}	0.77	x	3.4	x	72.63	х	0.5	x	0.7	<u> </u>	59.89	(75)
Northeast _{0.9x}	0.77	X	3.4	x	50.42	х	0.5	x	0.7	=	41.58	(75)
Northeast 0.9x	0.77	x	3.4	x	28.07	x	0.5	x	0.7		23.15	(75)
Northeast _{0.9x}	0.77	X	3.4	x	14.2	x	0.5	x	0.7	=	11.71	(75)
Northeast _{0.9x}	0.77	X	3.4	x	9.21	x	0.5	x	0.7	=	7.6	(75)
Northwest _{0.9x}	0.77	X	1.8	x	11.28	x	0.5	x	0.7	_	14.78	(81)
Northwest 0.9x	0.77	x	2.07	x	11.28	x	0.5	x	0.7	=	5.66	(81)
Northwest _{0.9x}	0.77	x	1.8	x	22.97	x	0.5	x	0.7	=	30.08	(81)
Northwest _{0.9x}	0.77	x	2.07	x	22.97	x	0.5	x	0.7	=	11.53	(81)
Northwest _{0.9x}	0.77	x	1.8	x	41.38	x	0.5	x	0.7	=	54.2	(81)
Northwest _{0.9x}	0.77	X	2.07	x	41.38	X	0.5	x	0.7	=	20.78	(81)
Northwest _{0.9x}	0.77	X	1.8	x	67.96	x	0.5	x	0.7	=	89.01	(81)
Northwest _{0.9x}	0.77	X	2.07	x	67.96	x	0.5	x	0.7	=	34.12	(81)
Northwest _{0.9x}	0.77	X	1.8	x	91.35	x	0.5	X	0.7	=	119.64	(81)
Northwest _{0.9x}	0.77	X	2.07	x	91.35	x	0.5	X	0.7		45.86	(81)
Northwest _{0.9x}	0.77	X	1.8	x	97.38	X	0.5	X	0.7	=	127.55	(81)
Northwest _{0.9x}	0.77	X	2.07	x	97.38	X	0.5	X	0.7	=	48.89	(81)
Northwest _{0.9x}	0.77	X	1.8	x	91.1	X	0.5	x	0.7	=	119.32	(81)
Northwest 0.9x	0.77	X	2.07	X	91.1	X	0.5	X	0.7	=	45.74	(81)
Northwest _{0.9x}	0.77	X	1.8	x	72.63	X	0.5	X	0.7	=	95.12	(81)
Northwest _{0.9x}	0.77	X	2.07	x	72.63	X	0.5	X	0.7	=	36.46	(81)
Northwest _{0.9x}	0.77	X	1.8	x	50.42	X	0.5	x	0.7	=	66.04	(81)
Northwest 0.9x	0.77	X	2.07	X	50.42	X	0.5	X	0.7	=	25.32	(81)
Northwest _{0.9x}	0.77	X	1.8	X	28.07	X	0.5	X	0.7	=	36.76	(81)
Northwest _{0.9x}	0.77	X	2.07	x	28.07	X	0.5	X	0.7	=	14.09	(81)
Northwest 0.9x	0.77	X	1.8	x	14.2	X	0.5	X	0.7	=	18.59	(81)
Northwest _{0.9x}	0.77	X	2.07	x	14.2	X	0.5	X	0.7	=	7.13	(81)
Northwest _{0.9x}	0.77	X	1.8	X	9.21	X	0.5	x	0.7	=	12.07	(81)
Northwest 0.9x	0.77	X	2.07	X	9.21	X	0.5	X	0.7	=	4.63	(81)
Solar gains in w (83)m= 29.75		ated _{9.1}	for each mon 179.17 240.8	\neg	56.76 240.19	(83)m 191	1 = Sum(74)n .48 132.94		37.43	24.29	1	(83)
Total gains – int						191	.46 132.92	† '4	37.43	24.29	İ	(00)
		7.54	478.5 520.9	<u> </u>	18.18 489.8	447	.08 398.58	358.95	344.46	347.86		(84)
` '					1000				1		l	
7. Mean internations of the Temperature d	•	•	- J		area from Tol	nle 0	Th1 (°C)				24	(85)
Utilisation factor	_			_		ا ن عار	, iiii (C)				21	(00)
Stroma FSAP 2012		$\overline{}$		Ť		Δι	ug Sep	Oct	Nov	Dec	_	F -47
Stroma #SAP 2012	versioni 1.03	4.726 (S	6AP 9.92] - http://	WWW.	stromal.com		-9 00	1 000	1	1 200	ı Page	5 of 7

(86)m=	0.97	0.96	0.93	0.88	0.77	0.62	0.49	0.54	0.76	0.91	0.96	0.97		(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	19.19	19.56	20.08	20.54	20.83	20.94	20.92	20.68	20.11	19.48	18.97		(87)
Temp	erature	durina h	eating p	eriods ir	rest of	dwellina	from Ta	able 9, T	h2 (°C)		!		l	
(88)m=	20.12	20.12	20.12	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.13	20.13		(88)
l Itilie:	ation fac	tor for a	ains for	rest of d	welling	h2 m (se	e Tahle	(9a)					l	
(89)m=	0.96	0.95	0.93	0.86	0.74	0.56	0.41	0.46	0.71	0.89	0.95	0.97		(89)
	intorna	l tompor	oturo in	the rest	of dwalli	na T2 (f	ollow oto	no 2 to .	Tin Tabl	00)				
(90)m=	17.42	17.69	18.23	18.98	19.61	19.99	20.11	20.09	19.81	19.03	18.12	17.37		(90)
(00)111	17.72	17.00	10.20	10.00	10.01	10.00	20.11	20.00			g area ÷ (4	L	0.47	(91)
											3 (,	0.41	
			·		ī		l e	+ (1 – fL	r ´		10.50	10.10		(00)
(92)m=	18.16	18.39	18.85	19.5	20.04	20.39	20.5	20.48	20.22	19.54	18.76	18.12		(92)
(93)m=	18.16	18.39	18.85	19.5	20.04	20.39	20.5	4e, whe	20.22	19.54	18.76	18.12		(93)
			uirement		20.04	20.59	20.3	20.40	20.22	19.54	10.70	10.12		(00)
					re obtain	ed at ste	en 11 of	Table 9	h so tha	t Ti m=(76)m an	d re-calc	culate	
				using Ta		iou ut ot	5p 11 01	1 4510 01	o, oo aa	(11,111	7 0) 111 011	a ro oare	valato	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm):									•	
(94)m=	0.95	0.94	0.91	0.84	0.73	0.58	0.44	0.49	0.71	0.87	0.93	0.96		(94)
			<u> </u>	4)m x (84			i		·	i		i	ı	
(95)m=		366.62	388.03	402.89	380.91	299.81	216.21	220.79	283.92	313.38	321.7	332.33		(95)
			1	perature	1		400	1 40 4	444	40.0	7.4	4.0	1	(06)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	(06)	10.6	7.1	4.2		(96)
(97)m=	844.23	819.63	748.44	633.53	497.48	340.34	229.28	x [(93)m 239.2	361.79	532.82	698.86	839.03		(97)
` '			ļ		ļ		<u> </u>	24 x [(97		<u> </u>		000.00		(0.)
(98)m=	371.53	304.42	268.15	166.06	86.73	0	0.02	0	0	163.26	271.55	376.98		
` '				ļ				Tota	l per year	L(kWh/year	r) = Sum(9	8) _{15.912} =	2008.7	(98)
Snac	a haatin	a reauir	ament in	kWh/m²	² /vear					`		,	31.52	」 (99)
•		• •			-				NID)				31.32	
			its – Ina	ividuai n	eating s	ystems i	nciuaing	micro-C	HP)					
•	e heatir ion of so	_	nt from s	econdar	v/supple	mentary	svstem						0	(201)
				nain syst			-	(202) = 1	- (201) =				1	(202)
				main sys	` '			(204) = (2	, ,	(203)] =				(204)
			_	-				(204) - (2	02) " [1 —	(200)] -			1	≓
	•	•		ing syste			0.4						90.3	(206)
Efficie	ency of s	seconda	ry/suppl	ementar	y heating	g systen	າ, %			•		ř	0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space		· · ·		alculate				ī					ı	
	371.53	304.42	268.15	166.06	86.73	0	0	0	0	163.26	271.55	376.98		
(211)m		` `		00 ÷ (20				1					ı	(211)
	411.44	337.12	296.96	183.9	96.05	0	0	0	0	180.8	300.72	417.48		7,
								ıota	ıı (KVVN/yea	ar) =Sum(2	211) _{15,10. 12}		2224.48	(211)

Space heating fuel (secondary), kWh/month													
= {[(98)m x (201)] } x 100 ÷ (208)		T .	Ι.	Ι.		Π_	1						
(215)m= 0 0 0 0 0	0 0	O Tota	0 L (k\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	0 ar) =Sum(2	0	0		7(045)					
Make a bearing		TOLA	ii (KVVII/yea	ai) –Suiii(2	213) _{15,10. 12}	2	0	(215)					
Water heating Output from water heater (calculated above)													
	26.13 120.84	134.71	136.2	155.09	165.55	179.18							
Efficiency of water heater							81	(216)					
(217)m= 87 86.86 86.49 85.67 84.27	81 81	81	81	85.52	86.54	87.08		(217)					
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m= 210.91 184.53 192.81 172.66 169.93 1	55.71 149.18	166.31	168.14	181.35	191.31	205.77		_					
		Tota	I = Sum(2	19a) ₁₁₂ =			2148.61	(219)					
Annual totals kWh/year kWh/year Space heating fuel used, main system 1 2224.48													
		_ ¬											
Water heating fuel used							2148.61						
Electricity for pumps, fans and electric keep-hot							<u>.</u>						
mechanical ventilation - balanced, extract or pos	sitive input fror	m outside	Э			124.01		(230a)					
central heating pump:						30		(230c)					
Total electricity for the above, kWh/year		sum	of (230a)	(230g) =			154.01	(231)					
Electricity for lighting							295.76	(232)					
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	ar					
Space heating (main system 1)	(211) x			0.2	16	=	480.49	(261)					
Space heating (secondary)	(215) x			0.5	19	=	0	(263)					
Water heating	(219) x			0.2	16	=	464.1	(264)					
Space and water heating	(261) + (262)	+ (263) + (264) =				944.59	(265)					
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	79.93	(267)					
Electricity for lighting	(232) x			0.5	19	=	153.5	(268)					
Total CO2, kg/year			sum o	of (265) (2	271) =		1178.02	(272)					
Dwelling CO2 Emission Rate			(272)	÷ (4) =			18.48	(273)					

El rating (section 14)

(274)

		User Details:				
Assessor Name:	Chris Hocknell	Stroma Nu	mber:	STRO	016363	
Software Name:	Stroma FSAP 2012	Software V	ersion:	Versio	n: 1.0.4.26	
		roperty Address: Flat				
Address :	Flat 08, 51 Calthorpe Street	, LONDON, WC1X 0H	Н			
1. Overall dwelling dime	ensions:					
Ground floor		Area(m²) 7.67 (1a)	Av. Height(n	n) (2a) = [Volume(m³)	(3a)
				-		╣
First floor		138.42 (1b) >	2.5	(2b) =	346.05	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1r	1) 146.09 (4)		_		_
Dwelling volume		(3a)+((3b)+(3c)+(3d)+(3e)+	(3n) =	365.22	(5)
2. Ventilation rate:	main accorde	n. albau	i de la la la la la la la la la la la la la		m³ may have	
	main secondar heating heating	y other	total	_	m³ per hour	<u> </u>
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	ns		0	x 10 =	0	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fi	res		0	x 40 =	0	(7c)
				-	anges per ho	_
•	ys, flues and fans = (6a)+(6b)+(7 een carried out or is intended, proceed		0 from (9) to (16)	÷ (5) =	0	(8)
Number of storeys in the		a to (17), otherwise continu	c nom (5) to (10)	Г	0	(9)
Additional infiltration	0 (]	(9)-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame or	0.35 for masonry con	struction		0	(11)
if both types of wall are pa deducting areas of openia	resent, use the value corresponding to	the greater wall area (after	•	_		
	ilgs), ii equal user 0.35 iloor, enter 0.2 (unsealed) or 0.	.1 (sealed), else enter	0	Г	0	(12)
If no draught lobby, en	,	, ,,			0	(13)
Percentage of windows	s and doors draught stripped				0	(14)
Window infiltration		0.25 - [0.2 x (14)	÷ 100] =		0	(15)
Infiltration rate		(8) + (10) + (11)	+ (12) + (13) + (15) =		0	(16)
Air permeability value,	q50, expressed in cubic metre	s per hour per square	metre of envelo	pe area	3	(17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20] + (8)$	8), otherwise (18) = (16)			0.15	(18)
Air permeability value applie	s if a pressurisation test has been don	ne or a degree air permeabi	lity is being used			
Number of sides sheltere	ed	(00)	440)		0	(19)
Shelter factor		(20) = 1 - [0.075]	x (19)] =		1	(20)
Infiltration rate incorporat	_	$(21) = (18) \times (20)$	=		0.15	(21)
Infiltration rate modified f	<u> </u>		<u> </u>			
Jan Feb	Mar Apr May Jun	Jul Aug Se	p Oct No	v Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

Wind Factor (22a)m = (22)m ÷ 4								
	1.1 1.08	0.95	0.95 0.92	1	1.08	1.12	1.18	
Adiante dis Citantina ante dell'acciona	f l l	de de de ace	1) (04 -) -	(00 -)				
Adjusted infiltration rate (allowing to 0.19 0.19 0.18 0	or sneiter and	<u>i</u> _	$\frac{(21a) \times (21a) \times (21a)}{0.14}$	0.15	0.16	0.17	0.18	
Calculate effective air change rate				0.13	0.10	0.17	0.10	
If mechanical ventilation:								0.5 (23a)
If exhaust air heat pump using Appendix	, , ,	, , ,	, ,,	,) = (23a)			0.5 (23b)
If balanced with heat recovery: efficiency	-							73.1 (23c)
a) If balanced mechanical ventile			` 	- 	 		— `	-
` '	0.3	I	0.28 0.27	0.28	0.3	0.3	0.31	(24a)
b) If balanced mechanical ventile (24b)m= 0 0 0	ation without	neat recove	$\frac{\text{dery}(MV)(24)}{0}$	$\frac{b)m = (22)}{l}$	2b)m + (2 0	23D) 0	0	(24b)
c) If whole house extract ventilate					0	U	U	(240)
if (22b)m < 0.5 × (23b), then	•	•			.5 × (23b)		
	0 0	0	0 0	0	0	0	0	(24c)
d) If natural ventilation or whole	house positiv	e input ver	ntilation from	loft				
if (22b)m = 1, then (24d)m =	(22b)m othe	rwise (24d))m = 0.5 + [(2	22b)m² x	0.5]			
(24d)m = 0 0 0	0 0	0	0 0	0	0	0	0	(24d)
Effective air change rate - enter	` 		```	- ` 				
(25)m= 0.33 0.32 0.32 0	0.3	0.28	0.28 0.27	0.28	0.3	0.3	0.31	(25)
0. 1111								
3. Heat losses and heat loss para	ameter:							
· · · · · · · · · · · · · · · · · · ·	oenings m²	Net Area A ,m²	U-va W/m		A X U (W/ł	ζ)	k-value kJ/m²·ł	
ELEMENT Gross Op	enings					<) 		
ELEMENT Gross Operation of the Gross area (m²)	enings	A ,m²	W/m	2K	(W/ł	<) 		K kJ/K
ELEMENT Gross Operation of the Gross area (m²) Doors	enings	A ,m²	W/m × 1.4	2K = + 0.04] =	(W/ł 2.772	() 		(kJ/K (26)
ELEMENT Gross operation of the second of the	enings	A ,m ² 1.98 1.45	W/m x 1.4 x1/[1/(1.2)	2K = + 0.04] = + 0.04] =	2.772 1.66	() 		(kJ/K (26) (27)
ELEMENT Gross operation of the street of the	enings	A ,m ² 1.98 1.45 3.21	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2)	2K = + 0.04] = + 0.04] = + 0.04] =	2.772 1.66 3.68	() 		(26) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3	enings	A ,m ² 1.98 1.45 3.21 1.56	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2)	2K = + 0.04] = + 0.04] = + 0.04] = - 0.04] =	(W/F 2.772 1.66 3.68 1.79	() 		(26) (27) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1	enings	A ,m ² 1.98 1.45 3.21 1.56 1.38	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) +	2K = + 0.04] = + 0.04] = + 0.04] = - 0.04] =	2.772 1.66 3.68 1.79	() 		(26) (27) (27) (27) (27) (27b)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2	enings	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) +	2K = + 0.04] = + 0.04] = + 0.04] = - 0.04] = - 0.04] =	2.772 1.66 3.68 1.79 1.656	() 		(26) (27) (27) (27) (27) (27b) (27b)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor	penings m²	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) + x1/[1/(1.2) + x1/[1/(1.2) + x1/[1/(1.2) +	2K = + 0.04 =	2.772 1.66 3.68 1.79 1.656 1.584 2.0208	()		(26) (27) (27) (27) (27b) (27b) (28)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24	oenings m²	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2)	2K = + 0.04] =	2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61	() 		(26) (27) (27) (27) (27b) (27b) (28) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56	3.12 1.98	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58	W/m x 1.4 x1/[1/(1.2) x1/[1/	2K = + 0.04] =	2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31	() 		(26) (27) (27) (27) (27b) (27b) (28) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68	3.12 1.98	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12	2K = + 0.04 =	2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64	() 		(26) (27) (27) (27) (27b) (27b) (28) (29) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95	3.12 1.98 0	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.2	2K = + 0.04 =	(W/F 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25	3.12 1.98 0 16.57 2.7	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.55	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12	2K = + 0.04 =	(W/h 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08	()		(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25 Roof Type2 6.05	3.12 1.98 0 16.57 2.7	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.55 6.05	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12	2K = + 0.04 =	(W/h 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08	()		(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30) (30)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25 Roof Type2 6.05 Total area of elements, m²	3.12 1.98 0 16.57 2.7	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.55 6.05 307.57	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12	2K = + 0.04 =	(W/h 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08 12.91			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30) (30) (31)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25 Roof Type2 6.05 Total area of elements, m² Party wall	3.12 1.98 0 16.57 2.7	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.55 6.05 307.57 19.63	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12	2K = + 0.04 =	(W/h 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08 12.91			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30) (30) (31) (32)

* 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 Fabric heat loss, W/K = S (A x U) (26) (30) + (32) =(33)62.88 Heat capacity $Cm = S(A \times k)$ ((28) (30) + (32) + (32a) (32e) =(34)15227.24 Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low (35)100 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 46.14 (36)if details of thermal bridging are not known (36) = $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)109.02 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Jan Feb Mar Apr Mav Jun Jul Oct Nov Dec Aug Sen (38)38.36 36.1 33.39 33.39 32.93 34.29 36.55 (38)m=39.26 38.81 35.65 35.65 37.45 Heat transfer coefficient, W/K (39)m = (37) + (38)m 148.28 147.83 147.37 145.11 144.66 142.4 142.4 141.95 143.31 144.66 145.57 146 47 (39)m =(39)Average = $Sum(39)_{1}$ /12= 145 Heat loss parameter (HLP), W/m2K (40)m = (39)m ÷ (4)(40)m =1.01 1.01 1.01 0.99 0.97 0.97 0.97 0.98 0.99 1 (40)Average = $Sum(40)_{1/12}/12=$ 0.99 Number of days in month (Table 1a) Feb Mar May Aug Jan Jun .lul Sep Oct Nov Dec Apr 31 30 31 (41)(41)m=4. Water heating energy requirement: kWh/vear: Assumed occupancy, N 2.93 (42)if TFA > 13.9, N = 1 + 1.76 x [1 - $\exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 103.74 (43)Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Oct Jan Feb Mar Apr May Jun Jul Aug Sep Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) 114.11 109.96 105.81 101.66 97.51 93.36 93.36 97.51 101.66 105.81 109.96 114.11 (44)Total = $Sum(44)_{1}$ 12 = 1244.85 Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m=169.22 148 152.73 133.15 127.76 110.25 102.16 117.23 118.63 138.25 150.92 163.88 1632.19 (45)Total = $Sum(45)_{1}$ 12 = If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 22.2 22.91 20.74 24.58 (46)(46)m=25.38 19 97 19 16 16 54 15.32 17 58 17 79 22 64 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)n Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year	$(48) \times (49) = 0 (50)$												
b) If manufacturer's declared cylinder loss factor is not know	n:												
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 (52)												
Energy lost from water storage, kWh/year													
Enter (50) or (54) in (55)	$(47) \times (51) \times (52) \times (53) = 0 $ $0 $ (54) $0 $ (55)												
Water storage loss calculated 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 dedicated solar storage, (57)m = (56)m x [(50) – (H11)]													
(57)m= 0 0 0 0 0 0 0 0	0 0 0 0 0 (57)												
Drimany circuit loss (appual) from Table 3	0 (58)												
Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷													
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)													
(59)m =													
Combi loss calculated for each month (61) m = $(60) \div 365 \times (60)$	11)m												
(61)m= 50.96 46.03 50.96 49.32 49.69 46.04 47.5													
Total heat required for water heating calculated for each more													
(62)m= 220.18 194.03 203.69 182.47 177.45 156.29 149.													
Solar DHW input calculated using Appendix G or Appendix H (negative qua													
(add additional lines if FGHRS and/or WWHRS applies, see													
(63)m= 0 0 0 0 0 0	0 0 0 0 (63)												
Output from water heater													
(64)m= 220.18 194.03 203.69 182.47 177.45 156.29 149.													
	Output from water heater (annual) _{1 12} 2223.01 (64)												
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)													
(65)m= 69.01 60.72 63.52 56.6 54.9 48.17 45.8	6 51.4 51.77 58.71 62.51 67.23												
include (57)m in calculation of (65)m only if cylinder is in the	e 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 Ju	Aug Sep Oct Nov Dec												
(66)m= 146.39 146.39 146.39 146.39 146.39 146.39 146.39	9 146.39 146.39 146.39 146.39 (66)												
Lighting gains (calculated in Appendix L, equation L9 or L9a	also see Table 5												
(67)m= 29.4 26.12 21.24 16.08 12.02 10.15 10.8	3 14.25 19.13 24.29 28.35 30.22												
Appliances gains (calculated in Appendix L, equation L13 or	_13a), also see Table 5												
(68)m= 316.24 319.52 311.25 293.64 271.42 250.54 236.	8 233.3 241.57 259.17 281.4 302.28 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L1	ia), also see Table 5												
(69)m= 37.64 37.64 37.64 37.64 37.64 37.64 37.64	37.64 37.64 37.64 37.64 (69)												
Pumps and fans gains (Table 5a)													
(70)m= 3 3 3 3 3 3 3 3	3 3 3 3 (70)												
Losses e.g. evaporation (negative values) (Table 5)													
(71)m= -117.12 -117.12 -117.12 -117.12 -117.12 -117.12 -117.12 -117.12	2 -117.12 -117.12 -117.12 -117.12 (71)												

Water heati	ng gains (T	Table 5)												
(72)m= 92.7	 	85.38	78.61	73.8	T (66.9	61.64	69.	09 71.91	78.91	86.82	90.36]	(72)
Total intern	nal gains =			!		(66))m + (67)m	1 + (68	3)m + (69)m + (70)m +	(71)m + (72)	m	1	
(73)m= 508.3		487.78	458.26	427.15	3	397.5	379.11	386	.56 402.53	432.2	9 466.48	492.79	1	(73)
6. Solar ga	ins:													
		using solaı	r flux from	Table 6a	and	assoc	iated equa	itions	to convert to the	e applic	able orientat	ion.		
Orientation:			Area			Flu			g_		FF		Gains	
	Table 6d		m²			Tal	ble 6a		Table 6b		Table 6c		(W)	
Northeast 0.9	0.77	X	1.5	56	X	1	1.28	x	0.5	X	0.7	=	8.54	(75)
Northeast 0.9	0.77	X	1.5	56	X	2	22.97	X	0.5	X	0.7	=	17.38	(75)
Northeast 0.9	0.77	X	1.5	56	X	4	11.38	x	0.5	X	0.7	=	31.31	(75)
Northeast 0.9	0.77	X	1.5	56	X	6	67.96	x	0.5	X	0.7	=	51.43	(75)
Northeast 0.9	0.77	X	1.5	56	X	9	91.35	X	0.5	X	0.7	=	69.13	(75)
Northeast 0.9	0.77	x	1.5	56	X	9	97.38	x	0.5	×	0.7	=	73.7	(75)
Northeast 0.9	0.77	X	1.5	56	X		91.1	x	0.5	X	0.7	=	68.94	(75)
Northeast 0.9	0.77	X	1.5	56	X	7	72.63	X	0.5	X	0.7	=	54.96	(75)
Northeast 0.9	0.77	X	1.5	56	X	5	50.42	x	0.5	×	0.7	=	38.16	(75)
Northeast 0.9	0.77	X	1.5	56	X	2	28.07	x	0.5	X	0.7	=	21.24	(75)
Northeast 0.9	0.77	X	1.5	56	X		14.2	X	0.5	X	0.7	=	10.74	(75)
Northeast 0.9	0.77	X	1.5	56	X		9.21	x	0.5	×	0.7	=	6.97	(75)
Southeast 0.9	0.77	X	1.4	15	X	3	36.79	x	0.5	X	0.7	=	90.58	(77)
Southeast 0.9	0.77	x	1.4	15	X	6	62.67	x	0.5	X	0.7	=	154.29	(77)
Southeast 0.9	0.77	x	1.4	15	X	8	35.75	x	0.5	x	0.7	=	211.11	(77)
Southeast 0.9	0.77	X	1.4	15	X	1	06.25	x	0.5	X	0.7	=	261.58	(77)
Southeast 0.9	0.77	x	1.4	15	X	1	19.01	x	0.5	X	0.7	=	292.99	(77)
Southeast 0.9	0.77	X	1.4	15	X	1	18.15	x	0.5	X	0.7	=	290.87	(77)
Southeast 0.9	0.77	X	1.4	15	X	1	13.91	x	0.5	X	0.7	=	280.43	(77)
Southeast 0.9	0.77	x	1.4	15	X	1	04.39	x	0.5	×	0.7	=	257	(77)
Southeast 0.9	0.77	X	1.4	15	X	9	92.85	x	0.5	×	0.7	=	228.59	(77)
Southeast 0.9	0.77	X	1.4	15	X	6	9.27	x	0.5	X	0.7	=	170.53	(77)
Southeast 0.9	0.77	X	1.4	15	X	4	14.07	x	0.5	X	0.7	=	108.5	(77)
Southeast 0.9	0.77	X	1.4	15	X	3	31.49	x	0.5	X	0.7	=	77.52	(77)
Northwest 0.9	0.77	X	3.2	21	X	1	11.28	x	0.5	X	0.7	=	17.57	(81)
Northwest 0.9	0.77	x	3.2	21	X	2	22.97	x	0.5	x	0.7	=	35.76	(81)
Northwest 0.9	0.77	x	3.2	21	X	4	1.38	x	0.5	x	0.7		64.43	(81)
Northwest 0.9	0.77	X	3.2	21	x	6	37.96	x	0.5	X	0.7	=	105.82	(81)
Northwest 0.9	0.77	X	3.2	21	X	9	1.35	x	0.5	X	0.7	=	142.24	(81)
Northwest 0.9	0.77	X	3.2	21	X	9	97.38	x	0.5	X	0.7	=	151.64	(81)
Northwest 0.9	0.77	X	3.2	21	X		91.1	x	0.5	X	0.7	=	141.86	(81)
Northwest 0.9	0.77	X	3.2	21	X	7	72.63	x	0.5	X	0.7	=	113.09	(81)

Northwest _{0.9x}	0.77	_	0.04		, <u> </u>	-0.40	1	0.5	ا پ ا	0.7		70.54	(01)
Northwest 0.9x	0.77	X	3.21	=	-	50.42] X	0.5	X	0.7	=	78.51	(81)
<u> </u>	0.77	×	3.21	=	-	28.07] X	0.5	X	0.7	_ =	43.71	(81)
Northwest 0.9x	0.77	×	3.21	=		14.2] X]	0.5	×	0.7	=	22.11	(81)
Northwest 0.9x	0.77	×	3.21	╡	x	9.21	X	0.5	×	0.7	_ =	14.35	(81)
Rooflights 0.9x	1	×	1.38	_	x	26	X	0.5	×	8.0	_ =	12.92	(82)
Rooflights 0.9x	1	X	1.32	<u></u>	x	26	X	0.5	×	8.0	=	12.36	(82)
Rooflights 0.9x	1	X	1.38		x	54	X	0.5	X	0.8	=	26.83	(82)
Rooflights _{0.9x}	1	X	1.32	:	x	54	X	0.5	X	8.0	=	25.66	(82)
Rooflights _{0.9x}	1	X	1.38	:	x	96	X	0.5	x	8.0	=	47.69	(82)
Rooflights 0.9x	1	X	1.32		x	96	X	0.5	X	8.0	=	45.62	(82)
Rooflights _{0.9x}	1	X	1.38		х	150	X	0.5	X	8.0	=	74.52	(82)
Rooflights _{0.9x}	1	X	1.32		x	150	X	0.5	x	0.8	=	71.28	(82)
Rooflights 0.9x	1	X	1.38		x	192	x	0.5	x	0.8	=	95.39	(82)
Rooflights _{0.9x}	1	X	1.32		x	192	x	0.5	х	0.8		91.24	(82)
Rooflights 0.9x	1	X	1.38		x	200	х	0.5	x	8.0	=	99.36	(82)
Rooflights 0.9x	1	X	1.32		x	200	x	0.5	x	8.0	=	95.04	(82)
Rooflights 0.9x	1	x	1.38		x	189	x	0.5	x	0.8	<u> </u>	93.9	(82)
Rooflights 0.9x	1	x	1.32	=	x	189	x	0.5	x	0.8		89.81	(82)
Rooflights 0.9x	1	x	1.38	=	x	157	x	0.5	x	0.8	=	78	(82)
Rooflights 0.9x	1	X	1.32	=	x	157	x	0.5	x	0.8		74.61	(82)
Rooflights 0.9x	1	x	1.38		x	115	x	0.5	x	0.8		57.13	(82)
Rooflights 0.9x	1	×	1.32	Ħ.	x 🗀	115	X	0.5	= x	0.8	╡ -	54.65	(82)
Rooflights 0.9x	1	×	1.38	=	x	66	X	0.5	x	0.8	= =	32.79	(82)
Rooflights 0.9x	1	×	1.32		x 🗀	66) x	0.5	×	0.8	_ =	31.36	(82)
Rooflights 0.9x	1	= x	1.38	\dashv	x 🗀	33)]	0.5	x	0.8	_ =	16.39	(82)
Rooflights 0.9x	1	X	1.32	=	x 🗀	33]]	0.5	= x	0.8	= =	15.68	(82)
Rooflights 0.9x	1	×	1.38	=	x	21)] x	0.5	= x	0.8	╡ -	10.43	(82)
Rooflights _{0.9x}	<u>·</u>	X	1.32	=	x	21]]	0.5	x	0.8	╡ .	9.98	(82)
	· · · · · · · · · · · · · · · · · · ·		1.02]	0.0		0.0		0.00	(02)
Solar gains in v	watts. calc	ulated	for each me	onth			(83)m	n = Sum(74)m	(82)m				
(83)m= 141.96		100.17	i	0.98	710.61	674.94	577		299.63	173.42	119.25]	(83)
Total gains – ir	nternal and	d solar	(84)m = (73	3)m +	- (83)m	, watts		I		- I		ı	
(84)m= 650.27	765.83 8	887.96	1022.88 111	8.14	1108.11	1054.05	964	.22 859.57	731.92	639.9	612.04		(84)
7. Mean inter	nal temper	rature (heating sea	ason)		•		,	•	,		•	
Temperature		,				from Tal	ole 9.	. Th1 (°C)				21	(85)
Utilisation fac	_	•			•			, ,					`
Jan	Feb	Mar		Лау	Jun	Jul	Α	ug Sep	Oct	Nov	Dec]	
(86)m= 0.98		0.95		.81	0.67	0.53	0.5		0.93	0.97	0.99	1	(86)
· · ·	tomporati	uro in li	ving area T		llow etc	no 2 to -	I 7 in T	able 0e)	<u> </u>	Į.		I	
Mean internal		19.34		1 (10	20.78	20.92	20.		19.93	19.19	18.61	1	(87)
` '				!				Į.	1 .0.00	1 .0.10	1 .0.01	J	()
Temperature							_	<u> </u>	00.00	20.00	20.00	1	/Q0\
(88)m= 20.07	20.07	20.08	20.09 20	.09	20.1	20.1	20.	11 20.1	20.09	20.09	20.08]	(88)

Utilisatio	n factor f	or ga	ins for r	est of d	wellina l	n2 m (se	e Table	9a)						
	0.98	<u> </u>	0.94	0.88	0.77	0.6	0.44	0.5	0.74	0.92	0.97	0.98		(89)
∟_ Mean int	ternal ten	npera	ture in t	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to 7	rin Tabl	e 9c)				
	6.87 17.		17.88	18.72	19.42	19.89	20.04	20.02	19.68	18.76	17.68	16.83		(90)
		!							f	LA = Livin	g area ÷ (4	1) =	0.38	(91)
Mean int	ternal ten	nera	iture (fo	r the wh	ole dwel	lina) = fl	I A × T1	+ (1 – fl	A) × T2			ı		_
	7.54 17.		18.43	19.17	19.8	20.22	20.37	20.35	20.03	19.2	18.25	17.5		(92)
Apply ad	t Ijustment	to th	e mean	internal	tempera	ature fro	m Table	4e, whe	re appro	priate				
· · · · —	7.54 17.	_	18.43	19.17	19.8	20.22	20.37	20.35	20.03	19.2	18.25	17.5		(93)
8. Space	heating	requi	irement											
	the mea			•		ed at ste	ep 11 of	Table 9b	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
		eb T	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	n factor f			•	may	0011	<u> </u>	7.09	ООР					
	0.97 0.9		0.92	0.86	0.76	0.61	0.47	0.52	0.74	0.9	0.96	0.97		(94)
Useful g	ains, hm0	Gm ,	W = (94	I)m x (84	 1)m		l							
(95)m= 63	30.8 730	.53	819.65	880.5	848.41	680.13	496.94	505.15	634.56	656.53	612.05	596.31		(95)
Monthly	average	exter	nal 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 los	s rate for	mea	n intern	al tempe	erature, l	_m , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m= 190	63.25 191°	7.28	1758.2	1490.61	1171.93	800.62	537.14	560.2	849.14	1244.29	1623.27	1947.53		(97)
Space he	eating red	quire	ment fo	r each m	nonth, k\	Wh/mon	th = 0.02	24 x [(97))m – (95)m] x (4	1)m			
(98)m= 99	79	7.5	698.28	439.28	240.7	0	0	0	0	437.29	728.08	1005.31		_
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	5337.78	(98)
Space he	eating red	quire	ment in	kWh/m²	/year								36.54	(99)
9a. Energ	y require	ment	s – Indi	vidual h	eating sy	⁄stems i	ncluding	micro-C	HP)					
Space h	_													_
Fraction	of space	heat	from se	econdar	y/supple	mentary	system						0	(201)
Fraction	of space	heat	from m	ain syst	em(s)			(202) = 1 -	- (201) =				1	(202)
Fraction	of total h	eatin	g from r	main sys	stem 1			(204) = (20	02) × [1 –	(203)] =			1	(204)
Efficienc	y of main	spac	ce heati	ng syste	em 1								90.3	(206)
Efficienc	y of seco	ndar	y/supple	ementar	y heating	g system	າ, %						0	(208)
	Jan F	eb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space he	eating red	quire	ment (c	alculate	d above)									
99	79	7.5	698.28	439.28	240.7	0	0	0	0	437.29	728.08	1005.31		
(211)m =	{[(98)m x	(204	l)] } x 1	00 ÷ (20	6)									(211)
109	97.83 883	5.17	773.29	486.47	266.56	0	0	0	0	484.27	806.29	1113.3		
								Tota	I (kWh/yea	ar) =Sum(2	211) _{15,10. 12}	=	5911.17	(211)
Space he	eating fue	el (se	condary	y), kWh/	month							•		_
= {[(98 <u>)</u> m	x (201)] }	x 10	00 ÷ (20	8)										
(215)m=	0 ()	0	0	0	0	0	0	0	0	0	0		_
								Tota	I (kWh/yea	ar) =Sum(2	215) _{15,10. 12}	=	0	(215)

Water heating														
Output from water heater (calculate 220.18 194.03 203.69 182		156.29	149.74	166.92	167.95	189.21	200.23	214.84						
Efficiency of water heater		l	<u> </u>	<u> </u>		l	l	l	81	(216)				
(217)m= 88.45 88.32 88.02 87.3	6 86.1	81	81	81	81	87.27	88.12	88.51		(217)				
Fuel for water heating, kWh/month $(219)m = (64)m \times 100 \div (217)m$	•								•					
(219)m= 248.92 219.7 231.41 208.	38 206.09	192.95	184.86	206.08	207.34	216.8	227.23	242.73		_				
				Tota	I = Sum(2				2593	(219)				
Annual totals Space heating fuel used, main system 1 kWh/year kWh 5911.														
Water heating fuel used 2593														
Water heating fuel used									2593	_				
Electricity for pumps, fans and electric keep-hot														
mechanical ventilation - balanced, extract or positive input from outside 395.45 (230a)														
central heating pump:								30		(230c)				
Total electricity for the above, kWh/	/ear			sum	of (230a)	(230g) =			425.45	(231)				
Electricity for lighting									519.29	(232)				
12a. CO2 emissions – Individual h	eating syste	ems incl	uding mi	cro-CHF)									
			ergy /h/year			Emiss kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	ır				
Space heating (main system 1)		(21	1) x			0.2	16	=	1276.81	(261)				
Space heating (secondary)		(21	5) x			0.5	19	=	0	(263)				
Water heating		(21	9) x			0.2	16	=	560.09	(264)				
Space and water heating		(26	1) + (262)	+ (263) + (264) =				1836.9	(265)				
Electricity for pumps, fans and elect	ric keep-ho	t (23	1) x			0.5	19	=	220.81	(267)				
Electricity for lighting		(23)	2) x			0.5	19	=	269.51	(268)				
Total CO2, kg/year					sum o	of (265) (2	271) =		2327.22	(272)				

 $(272) \div (4) =$

Dwelling CO2 Emission Rate

El rating (section 14)

15.93

84

(273)

(274)

Appendix B Energy Assessment 51 Calthorpe Street

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

			User E	Netaile:						
A Name	Obvio Haalu	11	USELL		- NI	.		OTDO	040000	
Assessor Name:	Chris Hock			Strom					016363	
Software Name:	Stroma FSA			Softwa				versic	n: 1.0.4.26	
			Property			-Green				
Address :		althorpe Stree	et, LOND	ON, WC	1X 0HH					
1. Overall dwelling dime	ensions:									
			Are	a(m²)		Av. He	ight(m)	_	Volume(m ³	<u></u>
Ground floor				71.6	(1a) x		2.7	(2a) =	193.32	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	71.6	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	193.32	(5)
2. Ventilation rate:										
	main heating	seconda heating		other		total			m³ per hou	r
Number of chimneys	0	+ 0	+	0] = [0	Х	40 =	0	(6a)
Number of open flues	0	+ 0	= + =	0	Ī - [0	×	20 =	0	(6b)
Number of intermittent fa	ans					3	x	10 =	30	(7a)
Number of passive vents	3				F	0	×	10 =	0	(7b)
Number of flueless gas f	ires				F	0	×	40 =	0	(7c)
					_			A in a h	angee ner he	
Indituation due to object			(70) (7b) ((7 0) –	_				nanges per ho	_
Infiltration due to chimne						30		÷ (5) =	0.16	(8)
If a pressurisation test has be Number of storeys in t			ea 10 (17),	otrierwise (conunue ii	om (9) to	(10)			(9)
Additional infiltration	ne awening (ns	,					I(O))-1]x0.1 =	0	(10)
Structural infiltration: 0) 25 for steel or	timber frame o	or 0 35 fo	r maconi	n, consti	ruction	[(9))-1]XU.1 –	0	= '
if both types of wall are p					•	uction			0	(11)
deducting areas of openi			io ino groun	.cra a.c	a (a.i.o.					
If suspended wooden	floor, enter 0.2	(unsealed) or (0.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	iter 0.05, else e	nter 0							0	(13)
Percentage of window	s and doors dra	aught stripped							0	(14)
Window infiltration				0.25 - [0.2	2 x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed	d in cubic metr	es per ho	our per s	quare m	etre of e	envelope	area	5	(17)
If based on air permeabi	•		•	•	•				0.41	(18)
Air permeability value applie	-					is being u	sed		0.41	(,
Number of sides sheltere			•	,	,	Ü			2	(19)
Shelter factor				(20) = 1 -	[0.075 x (19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter fact	or		(21) = (18) x (20) =				0.34	(21)
Infiltration rate modified	for monthly wind	d speed								
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table	- e 7					_			
(22)m= 5.1 5	4.9 4.4	4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Eactor (220)m = (2										
Wind Factor (22a)m = $(2^{2})^{2}$		1.00 0.05	T 0.05	1 0 02	T .	T	T	T	1	

1.1

1.08

0.95

0.95

0.92

1.08

1.12

1.18

1.23

(22a)m=

1.27

1.25

Adjusted infiltra	ation rate (allo	wina for s	helter an	nd wind s	:need) =	(21a) x	(22a)m					
0.44	0.43 0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4]	
Calculate effec	_	e rate for	the appli	cable ca	ise	<u> </u>	ļ.	!	<u> </u>	<u>!</u>]	
	al ventilation:										0	(23a)
	eat pump using A							o) = (23a)			0	(23b)
	n heat recovery: e	-	_								0	(23c)
	d mechanical	1	1	<u> </u>	, 	- ^ `	ŕ	- 		```) ÷ 100]	
(24a)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24a)
· ·	ed mechanical		1	1	- 	- ` `	ŕ	- 	- 	ı	1	(0.41)
(24b)m= 0	0 0	0	0	0	0	0	0	0	0	0		(24b)
,	ouse extract v		•	•				E v (00h	. \			
	$0 < 0.5 \times (23b)$, then (24	$\frac{C}{C} = (230)$		wise (24)	C = (22)	0) m + 0.	.5 × (230	0	0	1	(24c)
()											J	(240)
,	ventilation or v n = 1, then (24		•	•				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 rate -	enter (24a	a) or (24l	o) or (24	c) or (24	d) in box	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 los	s paramet	er:									
ELEMENT	Gross	Openir		Net Ar	ea	U-val	ue	AXU		k-value	9	AXk
	area (m²)		n²	A ,r	m²	W/m2	!K	(W/I	K)	kJ/m².		kJ/K
Doors				3	X	1.6	=	4.8				(26)
Windows Type	1			2.36	х1.	/[1/(1.6)+	0.04] =	3.55				(27)
Windows Type	2			1.93	x1.	/[1/(1.6)+	0.04] =	2.9				(27)
Windows Type	3			1.8	х1.	/[1/(1.6)+	0.04] =	2.71				(27)
Floor				71.6	X	0.12	=	8.592				(28)
Walls Type1	52.87	13.3	8	39.49) x	0.23	=	9.08	$\overline{}$			(29)
Walls Type2	32.34	0		32.34	1 x	0.12	-	3.74				(29)
Total area of e	elements, m²			156.8	1							(31)
Party wall				20.9	x	0		0				(32)
Party ceiling				71.6								(32b)
* for windows and ** include the area					ated using	ı formula 1	/[(1/U-valu	ue)+0.04] a	as given in	paragrapl	n 3.2	`
Fabric heat los			по апа раг	uuons		(26) (30) + (32) =				41.83	(33)
Heat capacity	•	,					((28)	(30) + (32	2) + (32a)	(32e) =	16100.4	
Thermal mass	,		÷ TFA) ir	n kJ/m²K				tive Value	, , ,	(0-0)	250	(35)
For design assess	sments where the	details of the	,			ecisely the				able 1f	230	(00)
can be used inste												
Thermal bridge	, ,			•	^						23.52	(36)
if details of thermater Total fabric he		KIIUWII (36)	= v.us X (3) I <i>)</i>			(33) +	(36) =			65.35	(37)
Ventilation hea		ed monthl	у					i = 0.33 × (25)m x (5))		`` ′
Jan	Feb Ma	1	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
		<u> </u>					· ·		•		•	

	T						I						(22)
(38)m= 38.05	37.81	37.58	36.48	36.27	35.31	35.31	35.14	35.68	36.27	36.69	37.12		(38)
Heat transfer			104.00	104.00	100.00	100.00	100.10	· · · ·	= (37) + (3		100 17		
(39)m= 103.4	103.16	102.92	101.82	101.62	100.66	100.66	100.48	101.03	101.62	102.03	102.47	404.00	(39)
Heat loss par	ameter (I	HLP), W	/m²K	_			_		= (39)m ÷	Sum(39) ₁ (4)	12 / 12=	101.82	
(40)m= 1.44	1.44	1.44	1.42	1.42	1.41	1.41	1.4	1.41	1.42	1.43	1.43		_
Number of da	vs in mo	nth (Tab	le 1a)					/	Average =	Sum(40) ₁	12 /12=	1.42	(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 requi	irement:								kWh/ye	ear:	
Assumed occ	upanev	NI											(40)
if TFA > 13	.9, N = 1		[1 - exp	(-0.0003	349 x (TF	A -13.9)2)] + 0.0	0013 x (ΓFA -13.		28		(42)
Annual avera	•	ater usag	ge in litre	es per da	y Vd,av	erage =	(25 x N)	+ 36		88	3.45		(43)
Reduce the annu	_				_	-	to achieve	a water us	e target o	f			
		,	, ,							·			
Jan Hot water usage	Feb	Mar day for ea	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	· ·		ı				` ′	00.00	00.00	00.70	07.0		
(44)m= 97.3	93.76	90.22	86.68	83.15	79.61	79.61	83.15	86.68	90.22	93.76	97.3	1061.44	7(44)
Energy content of	f hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x C	OTm / 3600			m(44) _{1 12} = ables 1b, 1		1001.44	(44)
(45)m= 144.29	126.2	130.22	113.53	108.94	94	87.11	99.96	101.15	117.88	128.68	139.74		
If instantaneous	water heati	na at noint	of use (no	hot water	etoraga)	enter () in	hoves (46		Γotal = Su	m(45) _{1 12} =	=	1391.71	(45)
	1	· ·		1					47.00	100			(46)
(46)m= 21.64 Water storage	18.93 e loss:	19.53	17.03	16.34	14.1	13.07	14.99	15.17	17.68	19.3	20.96		(46)
Storage volur) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community	heating a	ınd no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if r	o stored	hot wate	er (this in	icludes i	nstantar	eous co	mbi boil	ers) ente	er '0' in (47)			
Water storage													
a) If manufac				or is kno	wn (kWr	n/day):					0		(48)
Temperature											0		(49)
Energy lost fr b) If manufac		_	-		or is not		(48) x (49)) =		1	10		(50)
Hot water sto			•							0.	02		(51)
If community	-			`		,				<u> </u>			` ,
Volume factor	r from Ta	ble 2a								1.	.03		(52)
Temperature	factor fro	m Table	2b							0	.6		(53)
Energy lost fr		•	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter (50) or	. , .	•								1.	.03		(55)
Water storage	e loss cal	culated 1	for 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 contain	ns 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	x 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 (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	nostat)
(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 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= 199.57 176.12 185.5 167.03 164.21 147.5 142.39 155.24 154.65 173.16	
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contrib	
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)	and the matter meaning)
(63)m= 0 0 0 0 0 0 0 0 0 0	0 0 (63)
Output from water heater	
(64)m= 199.57 176.12 185.5 167.03 164.21 147.5 142.39 155.24 154.65 173.16	3 182.17 195.01
Output from water hea	
Heat gains from water heating, kWh/month 0.25 $^{\prime}$ [0.85 \times (45)m + (61)m] + 0.8 \times [(46)r	,
	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is	from community neating
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct	
(66)m= 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22 114.22	2 114.22 114.22 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 19.08 16.95 13.78 10.43 7.8 6.58 7.11 9.25 12.41 15.76	18.4 19.61 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 201 203.09 197.83 186.64 172.52 159.24 150.37 148.29 153.54 164.73	3 178.86 192.13 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42 34.42	34.42 34.42 (69)
Pumps and fans gains (Table 5a)	· · · · · · · · · · · · · · · · · · ·
(70)m= 0 0 0 0 0 0 0 0 0	0 0 (70)
Losses e.g. evaporation (negative values) (Table 5)	
(71)m= -91.37 -91.37 -91.37 -91.37 -91.37 -91.37 -91.37 -91.37 -91.37	7 -91.37 -91.37 (71)
Water heating gains (Table 5)	
(72)m= 123.92 121.88 117.64 111.87 108.12 102.85 98.37 104.11 106.15 112.12	2 118.86 121.89 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m +$	
(73)m= 401.27 399.18 386.51 366.21 345.7 325.94 313.12 318.91 329.37 349.88	· · · · · · · · · · · · · · · · · · ·
6. Solar gains:	3 373.30 330.9
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applic	able orientation.
Orientation: Access Factor Area Flux g_	FF Gains
0 =	Table 6c (W)
Southeast 0.9x 0.77 x 2.36 x 36.79 x 0.63 x	0.7 = 53.07 (77)
2	
Southeast 0.9x 0.77 x 2.36 x 62.67 x 0.63 x	0.7 = 90.41 (77)

		7		,		_						_
Southeast 0.9x	0.77	X	2.36	X	85.75	×	0.63	×	0.7	=	123.7	(77)
Southeast 0.9x	0.77	X	2.36	X	106.25	X	0.63	x	0.7	=	153.27	(77)
Southeast 0.9x	0.77	X	2.36	X	119.01	X	0.63	x	0.7	=	171.67	(77)
Southeast 0.9x	0.77	X	2.36	X	118.15	X	0.63	x	0.7	=	170.43	(77)
Southeast _{0.9x}	0.77	X	2.36	X	113.91	X	0.63	X	0.7	=	164.31	(77)
Southeast _{0.9x}	0.77	X	2.36	X	104.39	X	0.63	x	0.7	=	150.58	(77)
Southeast 0.9x	0.77	X	2.36	X	92.85	X	0.63	x	0.7	=	133.94	(77)
Southeast 0.9x	0.77	X	2.36	X	69.27	X	0.63	x	0.7	=	99.92	(77)
Southeast _{0.9x}	0.77	X	2.36	X	44.07	X	0.63	x	0.7	=	63.57	(77)
Southeast 0.9x	0.77	X	2.36	X	31.49	X	0.63	x	0.7	=	45.42	(77)
Southwest _{0.9x}	0.77	X	1.8	X	36.79		0.63	x	0.7	=	20.24	(79)
Southwest _{0.9x}	0.77	X	1.8	X	62.67		0.63	x	0.7	=	34.48	(79)
Southwest _{0.9x}	0.77	X	1.8	X	85.75		0.63	x [0.7		47.17	(79)
Southwest _{0.9x}	0.77	X	1.8	x	106.25		0.63	x [0.7	=	58.45	(79)
Southwest _{0.9x}	0.77	X	1.8	x	119.01		0.63	x	0.7	-	65.47	(79)
Southwest _{0.9x}	0.77	X	1.8	x	118.15	_	0.63	x	0.7	=	64.99	(79)
Southwest _{0.9x}	0.77	X	1.8	x	113.91	_	0.63	x	0.7	=	62.66	(79)
Southwest _{0.9x}	0.77	X	1.8	X	104.39	_	0.63	×	0.7		57.43	(79)
Southwest _{0.9x}	0.77	X	1.8	X	92.85	=	0.63		0.7		51.08	(79)
Southwest _{0.9x}	0.77	X	1.8	X	69.27	=	0.63	x [0.7	=	38.1	(79)
Southwest _{0.9x}	0.77	X	1.8	X	44.07	=	0.63	x [0.7	=	24.24	(79)
Southwest _{0.9x}	0.77	X	1.8	X	31.49	=	0.63	- x	0.7		17.32	(79)
Northwest _{0.9x}	0.77	X	1.93	X	11.28	×	0.63	x	0.7	_	13.31	(81)
Northwest _{0.9x}	0.77	X	1.93	X	22.97	×	0.63	x [0.7		27.09	(81)
Northwest _{0.9x}	0.77	X	1.93) 	41.38	x	0.63	x	0.7		48.81	(81)
Northwest _{0.9x}	0.77	X	1.93	X	67.96	×	0.63	x [0.7	=	80.17	(81)
Northwest _{0.9x}	0.77	X	1.93	X	91.35	×	0.63	x [0.7	=	107.76	(81)
Northwest _{0.9x}	0.77	X	1.93	X	97.38	= x	0.63	- x	0.7	-	114.88	(81)
Northwest _{0.9x}	0.77	X	1.93	X	91.1	= x	0.63	- x	0.7		107.47	(81)
Northwest 0.9x	0.77	X	1.93) x	72.63	= x	0.63	x	0.7		85.68	(81)
Northwest _{0.9x}	0.77	X	1.93) X	50.42	= x	0.63	╡ょ┞	0.7		59.48	(81)
Northwest 0.9x	0.77	X	1.93	X	28.07	= x	0.63	= x	0.7		33.11	(81)
Northwest 0.9x	0.77	X	1.93] X	14.2	= x	0.63	╡╻╏	0.7	= =	16.75	(81)
Northwest _{0.9x}	0.77	X	1.93] X	9.21	= x	0.63	-	0.7		10.87	(81)
L	-	_		J					-			` ′
Solar gains in w	atts, calcul	lated	for each mon	th		(83)n	n = Sum(74)m	(82)m				
ĭ 		$\overline{}$	291.88 344.9	_	50.31 334.4	4 293	3.68 244.5	171.13	104.56	73.61		(83)
Total gains – in	ternal and	solar	(84)m = (73)r	n + (83)m , watts	3	•		•		1	
(84)m= 487.89	551.15 60	6.2	658.09 690.6	6	76.25 647.5	66 612	2.59 573.87	521.01	477.94	464.51		(84)
7. Mean intern	al tempera	ture (heating seaso	on)								
Temperature o	•	•			area from T	able 9	, Th1 (°C)				21	(85)
Utilisation factor	•	•		_			` ,					
Jan		/lar	Apr Ma	Ť	Jun Jul	∸r —	ug Sep	Oct	Nov	Dec		
			, , ,	-			<u> </u>				1	

(86)m=	1	0.99	0.99	0.97	0.91	0.79	0.64	0.68	0.88	0.97	0.99	1		(86)
Mean	interna	I temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.46	19.61	19.89	20.26	20.61	20.86	20.96	20.95	20.76	20.31	19.82	19.43		(87)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	19.73	19.73	19.73	19.75	19.75	19.76	19.76	19.76	19.75	19.75	19.74	19.74		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.98	0.95	0.87	0.69	0.48	0.53	0.81	0.96	0.99	1		(89)
Mean	interna	I temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	17.71	17.94	18.33	18.87	19.35	19.66	19.74	19.74	19.56	18.96	18.25	17.68		(90)
									1	fLA = Livin	g area ÷ (4	4) =	0.32	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	A) × T2	_	_	_		
(92)m=	18.27	18.48	18.84	19.32	19.76	20.05	20.14	20.13	19.95	19.4	18.76	18.25		(92)
				internal							1		ı	(00)
(93)m=	18.27	18.48	18.84	19.32	19.76	20.05	20.14	20.13	19.95	19.4	18.76	18.25		(93)
			uirement		ro obtair	and at at	on 11 of	Table 0	n so tha	t Ti m=/	76)m an	d re-calc	vulato	
				using Ta		ieu ai sii	ер птог	Table 9), 50 illa	ıt 11,111–(rojili 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:		1	1	1					· I	
(94)m=		0.99	0.98	0.95	0.87	0.72	0.53	0.58	0.82	0.96	0.99	0.99		(94)
		hmGm 544.54	, W = (94 591.92	4)m x (84 622.47	4)m 602.25	485.81	343.41	355.82	471.89	497.93	471.96	404.00	1	(95)
(95)m= Mont		l	l	perature		l	343.41	333.62	47 1.09	497.93	47 1.90	461.88		(93)
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an interr	nal tempe	erature,	Lm , W :	-[(39)m	x [(93)m	– (96)m]				
(97)m=	1444.89	1401.06	1269.87	1061.12	819.06	548.96	356.28	374.84	590.88	894.4	1189.77	1439.19		(97)
Spac	e heatin	g require		r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)m – (95)m] x (4			•	
(98)m=	714.51	575.58	504.39	315.83	161.31	0	0	0	0	294.97	516.83	727.12		_
								Tota	l per year	(kWh/year	·) = Sum(9	8) _{15,912} =	3810.53	(98)
Spac	e heatin	g require	ement in	kWh/m²	/year								53.22	(99)
9b. En	ergy red	quiremer	nts – Coi	mmunity	heating	scheme)							
				ating, spa							unity sch	neme.		7(204)
	-			condary		•		(Table T	1) 'U' IT N	one			0	(301)
Fraction	on of spa	ace heat	from co	mmunity	system	1 – (30	1) =						1	(302)
includes	s boilers, h	eat pump	s, geotheri	mal and wa	aste heat f					up to four	other heat	sources; t	he latter	
Fraction	on of hea	at from C	Commun	ity heat	pump								1	(303a)
Fractio	on of hea	at from C	Commun	ity heat	pump (V	Vater)							0.8	(303a)
Fractio	on of cor	mmunity	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 con	trol and	charging	method	(Table	4c(3)) fo	r commı	unity hea	iting sys	tem			1	(305)
												•		_

Distribution loss factor (Table 12s) for some	nitu banting avators	1.05	7(206)
Distribution loss factor (Table 12c) for commu		1.05	(306)
Distribution loss factor (Table 12c) for commu	nity heating system (water)	1.05	(306)
Space heating Annual space heating requirement		kWh/year 3810.53	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	4001.06	 ☐(307a)
Efficiency of secondary/supplementary heating		0	
Space heating requirement from secondary/su		0	(309)
Water heating			
Annual water heating requirement		2042.55	
If DHW from community scheme: Water heat from CHP (Water)	(64) x (303a) x (305) x (306) =	1715.74	(310a)
Water heat from heat source 2 (Water)	(64) x (303a) x (305) x (306) =	428.94	(310b)
Electricity used for heat distribution	0.01 × [(307a) (307e) + (310a) (310e)] =	40.01	(313)
Electricity used for heat distribution (Water)	0.01 × [(307a) (307e) + (310a) (310e)] =	21.45	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling syste	m, if not enter 0) = $(107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling mechanical ventilation - balanced, extract or p	,	0	(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) =	0	(331)
Energy for lighting (calculated in Appendix L)		336.96	(332)
12b. CO2 Emissions – Community heating sch	heme		
	Energy Emission factor kWh/year kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water h Efficiency of heat source 1 (%)	eating (not CHP) If there is CHP using two fuels repeat (363) to (366) for the second fuel	290	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x 0.52 =	716.05	(367)
Electrical energy for heat distribution	[(313) x 0.52 =	20.77	(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 repeat (363) to (366) for the second fuel	290	(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 100 ÷ (367b) x 0 =	307.06	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x 0.52 =	222.62	(368)
Electrical energy for heat distribution	[(313) x 0.52 =	11.13	(372)
Total CO2 associated with community system	s (363) (366) + (368)(372) =	1277.62	(373)
CO2 associated with space heating (secondar	y) (309) x 0 =	0	(374)

CO2 associated with water from immer	taneous heater (312) x	0.52	=	0	(375)			
Total CO2 associated with space and v			1277.62	(376)				
CO2 associated with electricity for pum	CO2 associated with electricity for pumps and fans within dwelling (331)) x							
CO2 associated with electricity for light	ing	(332))) x	0.52	=	174.88	(379)		
Total CO2, kg/year	sum of (376) (382) =				1452.51	(383)		
Dwelling CO2 Emission Rate	(383) ÷ (4) =				20.29	(384)		
El rating (section 14)				83.31	(385)			

		User Details:					
Assessor Name:	Chris Hocknell	Stroma Nu	mber:	STRO	016363		
Software Name:	Stroma FSAP 2012	Software V	ersion:	Versio	sion: 1.0.4.26		
		roperty Address: Flat (
Address :	Flat 02, 51 Calthorpe Street	, LONDON, WC1X 0H	Н				
1. Overall dwelling dime	ensions:						
Ground floor		Area(m²) 68.42 (1a) x	Av. Height(m	1) (2a) = [Volume(m³)	(3a)	
First floor](3b)	
	a);/1b);/1a);/1d);/1a); /1r		2.2	(20) -	65.76	(3b)	
·	a)+(1b)+(1c)+(1d)+(1e)+(1r	,				_	
Dwelling volume		(3a)+((3b)+(3c)+(3d)+(3e)+	(3n) =	279.91	(5)	
2. Ventilation rate:	main secondar	v other	total		m³ per hour		
	heating heating	<i>.</i>		Γ	nii per noui	_	
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	ns		3	x 10 =	30	(7a)	
Number of passive vents			0	x 10 =	0	(7b)	
Number of flueless gas fi	res		0	x 40 =	0	(7c)	
				A in a b	angaa nay ba		
La Cita attana aleea da a la bassa a	(Ca) (Cb) (C	7-11/7611/7-1-		-	anges per ho	_	
•	ys, flues and fans = (6a)+(6b)+(7 neen carried out or is intended, procee		30 e from (9) to (16)	÷ (5) =	0.11	(8)	
Number of storeys in the	•	a to (11), otherwise continue		Γ	0	(9)	
Additional infiltration	0 ()		[0	(9)-1]x0.1 =	0	(10)	
Structural infiltration: 0	.25 for steel or timber frame or	0.35 for masonry con	struction		0	(11)	
if both types of wall are pa deducting areas of openia	resent, use the value corresponding to	the greater wall area (after				_	
	floor, enter 0.2 (unsealed) or 0.	.1 (sealed), else enter	0	Γ	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 x (14)	÷ 100] =		0	(15)	
Infiltration rate		(8) + (10) + (11) +	+ (12) + (13) + (15) =		0	(16)	
Air permeability value,	q50, expressed in cubic metre	s per hour per square	metre of envelop	oe area	5	(17)	
If based on air permeabil	ity value, then (18) = [(17) ÷ 20]+(8	8), otherwise (18) = (16)		Ī	0.36	(18)	
Air permeability value applie	es if a pressurisation test has been dor	ne or a degree air permeabil	lity is being used	-		_	
Number of sides sheltere	ed				2	(19)	
Shelter factor		(20) = 1 - [0.075]	x (19)] =		0.85	(20)	
Infiltration rate incorporat	ting shelter factor	$(21) = (18) \times (20)$	=		0.3	(21)	
Infiltration rate modified f	or monthly wind speed	, ,					
Jan Feb	Mar Apr May Jun	Jul Aug Se	p Oct No	v Dec			
Monthly average wind sp	eed from Table 7						

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

Wind Factor (2	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		
A 1: (1: 6:1)		·		· · ·			(0.1.)	(00.)					
Adjusted infiltra	o.38	e (allowi	ng for sr 0.33	o.33	d wind s	0.29	(21a) x 0.28	(22a)m 0.3	0.33	0.34	0.36		
Calculate effec		l					0.20	0.3	0.33	0.34	0.36		
If mechanica		_										0	(23a)
If exhaust air he	eat pump ı	using Appe	endix N, (2	3b) = (23a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If balanced with	heat reco	overy: effic	iency in %	allowing for	or in-use f	actor (fron	n Table 4h) =				0	(23c)
a) If balance	d mecha	anical ve	entilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (2)	2b)m + (23b) × [′	1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance		i					<u> </u>	ŕ	2b)m + (2	- 	ı		
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole he				•	•				E (00l-				
if (22b)m	1 < 0.5 ×	(23b), t	nen (240	(230) = (230)); otnerv	wise (24)	C) = (220)	o) m + 0	.5 × (23b	0)	0		(24c)
(1)	-				-						U		(240)
d) If natural v if (22b)m									0.51				
(24d)m= 0.57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(24d)
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	x (25)					
(25)m= 0.57	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56		(25)
3. Heat losses	s and he	eat loss i	oaramete	er:									
3. Heat losses	Gros	SS	Openin	gs	Net Ar		U-valı W/m2		A X U	K)	k-value		A X k
		SS		gs	A ,r	n²	W/m2		(W/I	K)	k-value kJ/m²·ł		kJ/K
ELEMENT Doors	Gros area	SS	Openin	gs	A ,r	m² x	W/m2	2K =	(W/I	K)			kJ/K (26)
ELEMENT Doors Windows Type	Gros area	SS	Openin	gs	A ,r	m² x x1	W/m2 1.4 /[1/(1.6)+	eK = 0.04] =	(W/I 2.772 3.97	K)			kJ/K (26) (27)
ELEMENT Doors Windows Type Windows Type	Gros area 1	SS	Openin	gs	A ,r 1.98 2.64	m² x x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] =	2.772 3.97 2.17	K)			(26) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type	Gros area 1 2 2	SS	Openin	gs	A ,r 1.98 2.64 1.44 2.55	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] =	2.772 3.97 2.17 3.83	K)			kJ/K (26) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type	Gros area 1 2 2 2 3 4 4	SS	Openin	gs	A ,r 1.98 2.64 1.44 2.55 2.34	m² x 1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] =	2.772 3.97 2.17 3.83 3.52	K)			kJ/K (26) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 1 2 2 3 4 4 5	SS	Openin	gs	A ,r 1.98 2.64 1.44 2.55 2.34 0.81	m² x 1	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] =	2.772 3.97 2.17 3.83 3.52 1.22	K)			kJ/K (26) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 1 2 2 3 4 4 2 5	SS	Openin	gs	A ,r 1.98 2.64 1.44 2.55 2.34 0.81	x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22	K)			kJ/K (26) (27) (27) (27) (27) (27) (27) (27)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 1 2 2 3 4 4 2 5	SS	Openin	gs	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49	x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor	Gros area 1 2 2 3 4 4 5 5 6 6 7	ss (m²)	Openin m	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type	Gros area 1 2 2 3 4 4 5 5 6 6 7 60.8	ss (m²)	Openin m	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
ELEMENT Doors Windows Type	Gros area 1 2 2 3 4 4 5 5 6 6 7	ss (m²)	Openin m	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29)
ELEMENT Doors Windows Type	Gros area 1 2 2 3 4 4 5 5 6 6 7 60.8	88 (m²) 83	Openin m	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23	0.04] = 0.04]	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Roof	Gros area 1 1 2 2 3 3 4 4 4 5 5 6 6 7 60.8 29.2 2.83 20.6	88 (m²)	13.0° 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12	K	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Roof Total area of e	Gros area 1 1 2 2 3 3 4 4 4 5 5 6 6 7 60.8 29.2 2.83 20.6	88 (m²)	13.0 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	K	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15 0.34				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Walls Type1 Walls Type2 Walls Type3 Roof Total area of e Party wall	Gros area 1 1 2 2 3 3 4 4 4 5 5 6 6 7 60.8 29.2 2.83 20.6	88 (m²)	13.0 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83 20.68	x1. x1. x1. x1. x1. x1. x1. x1. x1. x1.	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	K	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15 0.34				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (29) (30)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Floor Walls Type1 Walls Type2 Walls Type3 Roof Total area of e Party wall Party floor	Gros area 1 1 2 2 3 3 4 4 4 5 5 6 6 7 60.8 29.2 2.83 20.6	88 (m²)	13.0 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83 20.68 132.0	x1. x1. x1. x1. x1. x2. x2. x3. x4. x4. x4. x4. x4. x4. x4. x4. x4. x4	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.12 0.12 0.11	K	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15 0.34 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31)
ELEMENT Doors Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Windows Type Walls Type1 Walls Type2 Walls Type3 Roof Total area of e Party wall	Gros area 1 1 2 2 3 3 4 4 4 5 5 6 6 7 60.8 29.2 2.83 20.6	88 (m²)	13.0 1.98	gs ²	A ,r 1.98 2.64 1.44 2.55 2.34 0.81 0.74 2.49 18.51 47.79 27.25 2.83 20.68 132.0	x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x1 x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.12 0.12 0.11	K	(W/I 2.772 3.97 2.17 3.83 3.52 1.22 1.11 3.74 2.2212 10.99 3.15 0.34 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31) (32)

* 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 Fabric heat loss, W/K = S (A x U) (26) (30) + (32) =(33)41.11 Heat capacity $Cm = S(A \times k)$ ((28) (30) + (32) + (32a) (32e) =(34)13532.85 Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium (35)250 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 19.81 (36)if details of thermal bridging are not known (36) = $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)60.92 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Jan Feb Mar Apr Mav Jun Jul Oct Nov Dec Aug Sen (38)53.11 52.84 52.57 51.34 50.03 50.03 49.83 50.44 51.57 52.06 (38)m=51.11 51.11 Heat transfer coefficient, W/K (39)m = (37) + (38)m 112.25 112.98 114.02 113.75 113.49 112.02 110 94 110.94 110 74 111.36 112.02 112.49 (39)m =(39)Average = $Sum(39)_{1}$ /12= 112.25 Heat loss parameter (HLP), W/m2K (40)m = (39)m ÷ (4)(40)m =1.16 1.16 1.15 1.14 1.13 1.13 1.13 1.13 1.14 1.14 1.15 (40)Average = $Sum(40)_{1/12}/12=$ 1.14 Number of days in month (Table 1a) Feb Mar May Aug Jan Jun .lul Sep Oct Nov Dec Apr 31 30 31 (41)(41)m=4. Water heating energy requirement: kWh/vear: Assumed occupancy, N 2.72 (42)if TFA > 13.9, N = 1 + 1.76 x [1 - $\exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 98.88 (43)Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Oct Jan Feb Mar Apr May Jun Jul Aug Sep Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) 108.77 104.81 100.86 96.9 92.95 88.99 88.99 92.95 96.9 100.86 104.81 108.77 (44)Total = $Sum(44)_{1}$ 12 = 1186.55 Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m=161.3 141.07 145.57 126.91 121.78 105.08 97.38 111.74 113.08 131.78 143.85 156.21 1555.75 (45)Total = $Sum(45)_{1}$ 12 = If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 21.16 (46)(46)m=24.19 21 84 19 04 18 27 15.76 14.61 16 76 16.96 19 77 21.58 23 43 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)n Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year	· · · · · · · · · · · · · · · · · · ·	50)
b) If manufacturer's declared cylinder loss factor is not known		- 4 \
Hot water storage loss factor from Table 2 (kWh/litre/day) If community heating see section 4.3	0.02	51)
Volume factor from Table 2a	1.03 (5	52)
Temperature factor from Table 2b	0.6 (5	53)
Energy lost from water storage, kWh/year	$(47) \times (51) \times (52) \times (53) = 1.03$ (5	54)
Enter (50) or (54) in (55)	1.03 (5	55)
Water storage loss calculated 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 (5	66)
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= 32.01 28.92 32.01 30.98 32.01 30.98 32.01	32.01 30.98 32.01 30.98 32.01 (5	57)
Primary circuit loss (annual) from Table 3	0 (5	58)
Primary circuit loss calculated for each month (59) m = $(58) \div 3$	365 × (41)m	
(modified by factor from Table H5 if there is solar water hea	ting and a cylinder thermostat)	
(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 (5	9)
Combi loss calculated for each month (61)m = (60) ÷ 365 × (4	1)m	
(61)m= 0 0 0 0 0 0 0		61)
Total heat required for water heating calculated for each month	h (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m	
(62)m= 216.57 191 200.85 180.41 177.05 158.58 152.69		32)
Solar DHW input calculated using Appendix G or Appendix H (negative quan		
(add additional lines if FGHRS and/or WWHRS applies, see A		
(63)m= 0 0 0 0 0 0 0		3)
Output from water heater		
(64)m= 216.57 191 200.85 180.41 177.05 158.58 152.69	5 167.02 166.57 187.06 197.34 211.49	
	Output from water heater (annual) 1 12 2206.59 (6	64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)	m + (61)ml + 0.8 x [(46)m + (57)m + (59)m l	
(65)m= 97.85 86.85 92.62 84.99 84.71 77.74 76.6		35)
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):	and make the matter to morn definition by meaning	
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul	Aug Sep Oct Nov Dec	
(66)m= 136.17 136.17 136.17 136.17 136.17 136.17 136.17	 	66)
Lighting gains (calculated in Appendix L, equation L9 or L9a),		,
(67)m= 24.55 21.81 17.74 13.43 10.04 8.47 9.16		6 7)
Appliances gains (calculated in Appendix L, equation L13 or L		,
(68)m= 253.57 256.2 249.57 235.45 217.63 200.89 189.7		88)
		٠,
Cooking gains (calculated in Appendix L, equation L15 or L15 (69)m= 36.62 36.62 36.62 36.62 36.62 36.62 36.62		S9)
	30.02 30.02 30.02 30.02	0)
Pumps and fans gains (Table 5a)		′O\
(70)m= 0 0 0 0 0 0 0	0 0 0 0 0 (7	7 0)
Losses e.g. evaporation (negative values) (Table 5)	1 400 00 400 00 400 00 400 00 400 00	74.\
(71)m= -108.93 -108.93 -108.93 -108.93 -108.93 -108.93 -108.93 -108.93	3 -108.93 -108.93 -108.93 -108.93 -108.93 (7	'1)

Water heatir	ng gains (T	able 5)												
(72)m= 131.5	``	124.5	118.05	113.86	10	07.97	102.96	109	.38 111.66	118.3	3 125.87	129.25]	(72)
Total intern				<u> </u>					B)m + (69)m + (J	
(73)m= 473.4	_	455.65	430.78	405.38	38	31.18	365.66	372	, , , , ,	410.2	· / · /	460.71]	(73)
6. Solar ga	ins:													
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.														
Orientation:	Access F	actor	Area			Flu	X		g_		FF		Gains	
	Table 6d		m²			Tal	ole 6a		Table 6b		Table 6c		(W)	
Southeast 0.9	x 0.77	X	2.6	64	x	3	6.79	x	0.63	×	0.7	=	29.69	(77)
Southeast 0.9	× 0.77	X	1.4	14	x	3	6.79	X	0.63	x	0.7	=	16.19	(77)
Southeast 0.9	x 0.77	Х	2.6	64	x	6	2.67	x	0.63	x	0.7	=	50.57	(77)
Southeast 0.9	× 0.77	X	1.4	14	x	6	2.67	x	0.63	×	0.7		27.58	(77)
Southeast 0.9	× 0.77	Х	2.6	64	x	8	5.75	x	0.63	×	0.7	=	69.19	(77)
Southeast 0.9	x 0.77	Х	1.4	14	x	8	5.75	x	0.63	x	0.7	=	37.74	(77)
Southeast 0.9	× 0.77	X	2.6	64	x	10	06.25	x	0.63	×	0.7	=	85.73	(77)
Southeast 0.9	× 0.77	X	1.4	14	x	10	06.25	x	0.63	×	0.7	=	46.76	(77)
Southeast 0.9	x 0.77	Х	2.6	64	x	1	19.01	x	0.63	×	0.7	=	96.02	(77)
Southeast 0.9	× 0.77	X	1.4	14	x	1	19.01	x	0.63	X	0.7	=	52.37	(77)
Southeast 0.9	× 0.77	X	2.6	64	x	1	18.15	x	0.63	×	0.7	=	95.33	(77)
Southeast 0.9	x 0.77	Х	1.4	14	x	1	18.15	x	0.63	x	0.7	=	52	(77)
Southeast 0.9	× 0.77	X	2.6	64	x	1	13.91	x	0.63	×	0.7	=	91.9	(77)
Southeast 0.9	× 0.77	X	1.4	14	x	1	13.91	x	0.63	×	0.7	=	50.13	(77)
Southeast 0.9	x 0.77	Х	2.6	64	x	10	04.39	x	0.63	x	0.7	=	84.22	(77)
Southeast 0.9	× 0.77	X	1.4	14	x	10	04.39	x	0.63	×	0.7	=	45.94	(77)
Southeast 0.9	× 0.77	X	2.6	64	x	9	2.85	x	0.63	×	0.7	=	74.91	(77)
Southeast 0.9	x 0.77	Х	1.4	14	x	9	2.85	x	0.63	×	0.7		40.86	(77)
Southeast 0.9	× 0.77	X	2.6	64	x	6	9.27	x	0.63	X	0.7	=	55.89	(77)
Southeast 0.9	X 0.77	X	1.4	14	x	6	9.27	X	0.63	×	0.7	=	30.48	(77)
Southeast 0.9	X 0.77	X	2.6	64	x	4	4.07	x	0.63	X	0.7	=	35.56	(77)
Southeast 0.9	X 0.77	X	1.4	14	X	4	4.07	X	0.63	X	0.7	=	19.39	(77)
Southeast 0.9	X 0.77	X	2.6	64	X	3	1.49	X	0.63	X	0.7	=	25.4	(77)
Southeast 0.9	X 0.77	X	1.4	14	x	3	1.49	x	0.63	X	0.7	=	13.86	(77)
Southwest _{0.9}	X 0.77	X	2.4	19	X	3	6.79		0.63	X	0.7	=	28	(79)
Southwest _{0.9}	X 0.77	X	2.4	19	X	6	2.67		0.63	X	0.7	=	47.69	(79)
Southwest _{0.9}	X 0.77	X	2.4	19	x	8	5.75		0.63	X	0.7	=	65.26	(79)
Southwest _{0.9}	X 0.77	X	2.4	19	x	10	06.25		0.63	X	0.7	=	80.85	(79)
Southwest _{0.9}	x 0.77	X	2.4	19	x	1	19.01		0.63	X	0.7	=	90.56	(79)
Southwest _{0.9}	× 0.77	x	2.4	19	x	1	18.15		0.63	X	0.7	=	89.91	(79)
Southwest _{0.9}	× 0.77	x	2.4	19	x	1	13.91		0.63	X	0.7	=	86.68	(79)
Southwest _{0.9}	× 0.77	X	2.4	19	x	1(04.39		0.63	X	0.7	=	79.44	(79)

Southwest _{0.9x}	0.77	1 ,	0.40	1	00.05	1	0.00	١ ,,	0.7	1 =	70.00	(79)
Southwest _{0.9x}	0.77] X]	2.49	X 1	92.85] 1	0.63	X	0.7	<u> </u> 1	70.66	=
Southwest _{0.9x}	0.77] X]	2.49	X 1	69.27] 1	0.63	X	0.7] = 1 _	52.71	(79)
Southwest _{0.9x}	0.77] X]	2.49] X]	44.07] 1	0.63	X	0.7] = 1 _	33.54	(79)
<u> </u>	0.77	J X	2.49	X	31.49] 1	0.63	X	0.7] = 	23.96	(79)
Northwest 0.9x	0.77	X	2.55	X	11.28	X	0.63	X	0.7	=	8.79	(81)
Northwest 0.9x	0.77	」 X ¬	2.34	X	11.28	X	0.63	X	0.7] = 1	8.07	(81)
Northwest 0.9x	0.77	X	0.81	X	11.28	X 	0.63	X	0.7] = 1	2.79	(81)
Northwest 0.9x	0.77	X	0.74	X	11.28	X	0.63	X	0.7	=	2.55	(81)
Northwest 0.9x	0.77	X	2.55	X	22.97	X	0.63	X	0.7	=	17.9	(81)
Northwest 0.9x	0.77	X	2.34	X	22.97	X	0.63	X	0.7	=	16.42	(81)
Northwest 0.9x	0.77	X	0.81	X	22.97	X	0.63	X	0.7	=	5.69	(81)
Northwest 0.9x	0.77	X	0.74	X	22.97	X	0.63	X	0.7	=	5.19	(81)
Northwest _{0.9x}	0.77	X	2.55	X	41.38	X	0.63	X	0.7	=	32.25	(81)
Northwest _{0.9x}	0.77	X	2.34	X	41.38	X	0.63	X	0.7	=	29.59	(81)
Northwest _{0.9x}	0.77	X	0.81	X	41.38	X	0.63	X	0.7	=	10.24	(81)
Northwest _{0.9x}	0.77	X	0.74	X	41.38	X	0.63	X	0.7	=	9.36	(81)
Northwest _{0.9x}	0.77	X	2.55	X	67.96	X	0.63	X	0.7	=	52.96	(81)
Northwest _{0.9x}	0.77	X	2.34	X	67.96	X	0.63	X	0.7	=	48.6	(81)
Northwest _{0.9x}	0.77	X	0.81	X	67.96	X	0.63	X	0.7	=	16.82	(81)
Northwest 0.9x	0.77	X	0.74	X	67.96	X	0.63	X	0.7	=	15.37	(81)
Northwest _{0.9x}	0.77	X	2.55	X	91.35	X	0.63	x	0.7	=	71.19	(81)
Northwest _{0.9x}	0.77	X	2.34	x	91.35	X	0.63	x	0.7	=	65.32	(81)
Northwest _{0.9x}	0.77	X	0.81	X	91.35	x	0.63	x	0.7	=	22.61	(81)
Northwest _{0.9x}	0.77	X	0.74	X	91.35	X	0.63	x	0.7	=	20.66	(81)
Northwest _{0.9x}	0.77	X	2.55	X	97.38	X	0.63	x	0.7	=	75.89	(81)
Northwest _{0.9x}	0.77	X	2.34	X	97.38	X	0.63	x	0.7	=	69.64	(81)
Northwest _{0.9x}	0.77	X	0.81	X	97.38	x	0.63	x	0.7	=	24.11	(81)
Northwest _{0.9x}	0.77	X	0.74	X	97.38	X	0.63	x	0.7	=	22.02	(81)
Northwest _{0.9x}	0.77	X	2.55	x	91.1	x	0.63	x	0.7	=	71	(81)
Northwest 0.9x	0.77	X	2.34	x	91.1	x	0.63	x	0.7] =	65.15	(81)
Northwest _{0.9x}	0.77	X	0.81	x	91.1	X	0.63	x	0.7] =	22.55	(81)
Northwest _{0.9x}	0.77	x	0.74	x	91.1	x	0.63	x	0.7] =	20.6	(81)
Northwest 0.9x	0.77	X	2.55	x	72.63	x	0.63	x	0.7] =	56.6	(81)
Northwest _{0.9x}	0.77	X	2.34	x	72.63	x	0.63	x	0.7	Ī =	51.94	(81)
Northwest _{0.9x}	0.77	X	0.81	x	72.63	x	0.63	X	0.7	j =	17.98	(81)
Northwest _{0.9x}	0.77	X	0.74	x	72.63	x	0.63	x	0.7	i =	16.42	(81)
Northwest _{0.9x}	0.77	X	2.55	x	50.42	x	0.63	x	0.7	=	39.29	(81)
Northwest _{0.9x}	0.77	X	2.34	x	50.42	x	0.63	x	0.7	=	36.06	(81)
Northwest _{0.9x}	0.77	×	0.81	×	50.42	×	0.63	x	0.7	i =	12.48	(81)
Northwest _{0.9x}	0.77	X	0.74	×	50.42	x	0.63	x	0.7	=	11.4	(81)
Northwest _{0.9x}	0.77	x	2.55	×	28.07	x	0.63	x	0.7	=	21.87	(81)
<u></u>		_						ı		•		_

Northwest	0.9x 0.77	X	2.3	34	x	28.07	x [0.63	x	0.7	=	20.07	(81)
Northwest	0.9x 0.77	x	8.0	31	x	28.07	x [0.63	x [0.7	=	6.95	(81)
Northwest	0.9x 0.77	x	0.7	'4	x	28.07	x	0.63	х	0.7	=	6.35	(81)
Northwest	0.9x 0.77	x	2.5	55	x	14.2	x [0.63	x [0.7	=	11.06	(81)
Northwest	0.9x 0.77	х	2.3	34	x	14.2	x [0.63	x [0.7		10.15	(81)
Northwest	0.9x 0.77	x	8.0	i1	x	14.2	x	0.63	х	0.7	=	3.51	(81)
Northwest	0.9x	X	0.7	'4	x	14.2	x	0.63	x	0.7		3.21	(81)
Northwest	0.9x	x	2.5	55	x	9.21	x	0.63	x	0.7	=	7.18	(81)
Northwest	0.9x	x	2.3	34	x	9.21	x	0.63	x	0.7	=	6.59	(81)
Northwest	0.9x	х	0.8	31	x	9.21	x	0.63	x	0.7	=	2.28	(81)
Northwest	0.9x	X	0.7	'4	x	9.21	x	0.63	x	0.7	=	2.08	(81)
Solar g <u>ai</u>	ns in watts, ca	alculated	for eac	n month			(83)m =	Sum(74)m	(82)m			-	
` ′	96.08 171.04	253.62	347.09	418.74	428.		352.5	4 285.67	194.32	116.43	81.36		(83)
Total gai	ns – internal a	and solar	(84)m =	(73)m ·	+ (83)	m , watts					ı	1	
(84)m= 5	69.58 642.14	709.27	777.86	824.12	810.0	7 773.68	724.7	4 670.85	604.6	555.45	542.07		(84)
7. Mean	internal temp	perature i	(heating	season)								
Temper	ature during h	neating p	eriods ir	the livii	ng are	a from Ta	ble 9, ⁻	Γh1 (°C)				21	(85)
Utilisatio	on factor for g	ains for I	iving are	ea, h1,m	(see	Table 9a)		_				•	
	Jan Feb	Mar	Apr	May	Ju	n Jul	Aug	g Sep	Oct	Nov	Dec		
(86)m=	1 1	0.99	0.97	0.92	0.78	0.61	0.66	0.89	0.98	1	1		(86)
Mean in	ternal temper	ature in l	living are	ea T1 (fo	ollow	steps 3 to	7 in Ta	ble 9c)					
(87)m= 1	19.73 19.86	20.1	20.43	20.73	20.9	2 20.98	20.97	20.83	20.45	20.03	19.7		(87)
Temper	ature during h	neating p	eriods ir	rest of	dwelli	ng from Ta	able 9,	Th2 (°C)					
· -	19.95	19.96	19.97	19.97	19.9	-	19.98		19.97	19.96	19.96		(88)
Utilisatio	on factor for g	ains for r	est of d	welling.	h2.m	see Table	9a)	•	•	•		•	
(89)m=	1 1	0.99	0.96	0.88	0.69		0.54	0.83	0.97	1	1		(89)
L. Mean in	ternal temper	ature in t	the rest	of dwalli	na T2	(follow st	one 3 t	o 7 in Tabl	la Oc)	1	ļ		
	18.25 18.45	18.8	19.28	19.69	19.9	`	19.97		19.32	18.71	18.23		(90)
(00)			101.20			1			<u> </u>	ng area ÷ (0.33	(91)
					\	0 A T4		(I A) TO					`
	ternal temper	19.23	r tne wn 19.65	20.03	111ng) =	1	+ (1 –	1LA) × 12 20.16	19.7	19.15	18.71]	(92)
` ′	djustment to t						<u> </u>		l	19.13	10.71		(32)
—	18.74 18.92	19.23	19.65	20.03	20.2		20.3	20.16	19.7	19.15	18.71		(93)
` '	e heating requ									1 10110			
	the mean int			e obtain	ned at	step 11 of	Table	9b. so tha	at Ti.m=	(76)m an	d re-calc	culate	
	sation factor fo												
	Jan Feb	Mar	Apr	May	Ju	n Jul	Aug	g Sep	Oct	Nov	Dec		
_	on factor for g					_				_		1	
(94)m=	1 0.99	0.99	0.96	0.88	0.71	0.52	0.58	0.84	0.97	0.99	1		(94)
		M - M	1)m y (84	1)m									
	gains, hmGm	<u> </u>	<u> </u>					0 500 :-	F	T	E / 2	1	(05)
(95)m= 5	67.71 638.06	698.9	745.61	727.09	578.5		418.8	8 562.43	586.32	551.8	540.68		(95)
(95)m= 5 Monthly		698.9	745.61	727.09		<u> </u>	418.8	8 562.43	586.32	551.8 7.1	540.68]	(95) (96)

	2) (00) 1		
Heat loss rate for mean internal temperature, Lm, $W = [(39) \text{m x}](9)$ (97)m= 1646.4 1594.75 1444.74 1207.24 933.06 627.11 411 43			(97)
Space heating requirement for each month, kWh/month = 0.024 x			(-)
	0 0 321.82 578.52 817.7		
	Total per year (kWh/year) = Sum(98) ₁₅₉₁₂ =	4204	(98)
Space heating requirement in kWh/m²/year		42.76	(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		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		ne 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/yea	<u>r</u>
Space heating Annual space heating requirement	[kWh/year	,
•	(98) x (304a) x (305) x (306) =		(307a)
Annual space heating requirement		4204	
Annual space heating requirement Space heat from Community heat pump		4204 4414.2	(307a)
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T	able 4a or Appendix E)	4204 4414.2 0	(307a) (308
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating	able 4a or Appendix E)	4204 4414.2 0	(307a) (308
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme:	Table 4a or Appendix E) (98) x (301) x 100 ÷ (308) =	4204 4414.2 0 0 2206.59	(307a) (308 (309)
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water)	(98) x (301) x 100 ÷ (308) = (64) x (303a) x (305) x (306) =	4204 4414.2 0 0 2206.59 1853.54	(307a) (308 (309) (310a)
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution	(98) x (301) x 100 ÷ (308) = (64) x (303a) x (305) x (306) = (64) x (303a) x (305) x (306) =	4204 4414.2 0 0 2206.59 1853.54 463.38	(307a) (308 (309) (310a) (310b)
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution	(able 4a or Appendix E) (98) x (301) x 100 ÷ (308) = (64) x (303a) x (305) x (306) = (64) x (303a) x (305) x (306) = (64) x (307a) (307e) + (310a) (310e)] =	4204 4414.2 0 0 2206.59 1853.54 463.38 44.14	(307a) (308 (309) (310a) (310b) (313)
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water)	(able 4a or Appendix E) (98) x (301) x 100 ÷ (308) = (64) x (303a) x (305) x (306) = (64) x (303a) x (305) x (306) = (64) x (307a) (307e) + (310a) (310e)] =	4204 4414.2 0 0 2206.59 1853.54 463.38 44.14 23.17	(307a) (308 (309) (310a) (310b) (313) (313)
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water) Cooling System Energy Efficiency Ratio	(able 4a or Appendix E) (able 5a or Able 5a	4204 4414.2 0 0 2206.59 1853.54 463.38 44.14 23.17 0	(307a) (308 (309) (310a) (310b) (313) (313) (314)
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water) Cooling System Energy Efficiency Ratio Space cooling (if there is a fixed cooling system, if not enter 0) Electricity for pumps and fans within dwelling (Table 4f):	(able 4a or Appendix E) (able 5a or Able 5a	4204 4414.2 0 0 2206.59 1853.54 463.38 44.14 23.17 0	(307a) (308 (309) (310a) (310b) (313) (313) (314) (315)
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water) Cooling System Energy Efficiency Ratio Space cooling (if there is a fixed cooling system, if not enter 0) Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outs	(able 4a or Appendix E) (able 5a or Able 5a	4204 4414.2 0 0 2206.59 1853.54 463.38 44.14 23.17 0 0	(307a) (308 (309) (310a) (310b) (313) (313) (314) (315)
Annual space heating requirement Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from T Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water) Cooling System Energy Efficiency Ratio Space cooling (if there is a fixed cooling system, if not enter 0) Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outs warm air heating system fans	(able 4a or Appendix E) (able 5a or Able 5a	4204 4414.2 0 0 0 2206.59 1853.54 463.38 44.14 23.17 0 0	(307a) (308 (309) (310a) (310b) (313) (313) (314) (315) (330a) (330b)

Energy for lighting (calculated in Appendix L) (332)433.62 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 (%) 290 (367a) CO2 associated with heat source 1 $[(307b)+(310b)] \times 100 \div (367b) \times$ 789.99 (367)0.52 Electrical energy for heat distribution (372)[(313) x]0.52 22.91 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 (%) (367a) 290 If there is CHP using two fuels repeat (363) to (366) for the second fuel Efficiency of heat source 2 (%) 100 (367b) CO2 associated with heat source 1 (367) $[(307b)+(310b)] \times 100 \div (367b) \times$ 331.72 0 CO2 associated with heat source 2 $[(307b)+(310b)] \times 100 \div (367b) \times$ (368)0.52 240.5 Electrical energy for heat distribution [(313) x](372)0.52 12.02 Total CO2 associated with community systems (363) (366) + (368)...(372)(373)1397.14 CO2 associated with space heating (secondary) (309) x(374)0 0 CO2 associated with water from immersion heater or instantaneous heater (312) x 0.52 (375)Total CO2 associated with space and water heating (373) + (374) + (375) =1397.14 (376)CO2 associated with electricity for pumps and fans within dwelling (331)) x (378)0.52 0 CO2 associated with electricity for lighting (332))) x 0.52 225.05 (379)sum of (376) (382) = Total CO2, kg/year (383)1622.18 $(383) \div (4) =$ **Dwelling CO2 Emission Rate** (384)16.5

El rating (section 14)

84.83

(385)

		User Details:				
Accessor	Obside I I e alon all			OTDO	040000	
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 2012	Stroma Nur Software V			016363 n: 1.0.4.26	
Software Name.		roperty Address: Flat 0		V CI SIO	11. 1.0.4.20	
Address :	Flat 03, 51 Calthorpe Street,					
1. Overall dwelling dime		LONDON, WORK OF				
		Area(m²)	Av. Height(m)	Volume(m³)	
Ground floor		56.13 (1a) x	3.33	(2a) =	186.91	(3a)
First floor		45.8 (1b) x	2.2	(2b) =	100.76	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1n) 101.93 (4)				
Dwelling volume		(3a)+(3	3b)+(3c)+(3d)+(3e)+.	(3n) =	287.67	(5)
2. Ventilation rate:						
	main secondar heating heating	y other	total		m³ per hour	•
Number of chimneys	0 + 0	+ 0 =	0	(40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	(20 =	0	(6b)
Number of intermittent far	ns		3	(10 =	30	(7a)
Number of passive vents			0	(10 =	0	(7b)
Number of flueless gas fire	res		0	(40 =	0	(7c)
				Δir ch	anges per ho	ıır
Infiltration due to chimne	/s, flues and fans = (6a)+(6b)+(7a	a)+(7b)+(7c) =	30	÷ (5) =	0.1] ₍₈₎
•	een carried out or is intended, proceed			. (3) –	0.1](0)
Number of storeys in the	ne dwelling (ns)				0	(9)
Additional infiltration			[(9	9)-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber frame or	0.35 for masonry cons	struction		0	(11)
if both types of wall are pr deducting areas of openin	esent, use the value corresponding to	the greater wall area (after				
	loor, enter 0.2 (unsealed) or 0.	1 (sealed), else enter ()		0	(12)
If no draught lobby, ent	er 0.05, else enter 0				0	(13)
Percentage of windows	and doors draught stripped			Ī	0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷	- 100] =	ļ	0	(15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	-	0	(16)
Air permeability value,	q50, expressed in cubic metre	s per hour per square	metre of envelop	e area	5	(17)
	ity value, then (18) = [(17) ÷ 20]+(8		·	Ī	0.35	(18)
Air permeability value applies	s if a pressurisation test has been don	e or a degree air permeabili	ty is being used			_
Number of sides sheltere	d				3	(19)
Shelter factor		(20) = 1 - [0.075 x]	(19)] =		0.78	(20)
Infiltration rate incorporati	ing shelter factor	(21) = (18) x (20)	=		0.27	(21)
Infiltration rate modified for	or monthly wind speed					
Jan Feb	Mar Apr May Jun	Jul Aug Sep	Oct Nov	Dec		
Monthly average wind spe	eed from Table 7					

4.3

3.8

3.8

3.7

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 infi	Itration rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.35	0.34	0.34	0.3	0.3	0.26	0.26	0.25	0.27	0.3	0.31	0.32		
Calculate ef		•	rate for t	he appli	cable ca	ise		•			•		(220)
If exhaust air			endix N. (2	3b) = (23a	a) × Fmv (e	eguation (N	N5)) . othe	rwise (23b) = (23a)			0	(23a) (23b)
If balanced w									, (,			0	(23c)
a) If balan		-	-	_					2b)m + (23b) × [1 – (23c)		(200)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If balan	ced mech	anical ve	ntilation	without	heat red	covery (N	лV) (24t	o)m = (22	2b)m + (23b)		ı	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole	house ex	tract ven	tilation o	or positiv	e input	ventilatio	n from o	outside	-	-			
if (22b)m < 0.5 ×	(23b), t	hen (240	<u> </u>	<u> </u>	<u> </u>	c) = (22l	o) m + 0.	5 × (23b) 	1	1	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natura	al ventilation) m = 1, the				•				0 51				
(24d)m= 0.56	`	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55]	(24d)
Effective a	ir change	rate - er	ıter (24a) or (24k	o) or (24	c) or (24	d) in bo	x (25)				l	
(25)m= 0.56		0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(25)
												ı	
3 Heat Inco	see and he	at lose r	narameta	ar.									
	ses and he Gros	•			Net Ar	ea	U-val	ue	AXU		k-value	2	ΑΧk
3. Heat loss		SS	oaramete Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²·		A X k kJ/K
	Gros	SS	Openin	gs		m²				K)			
ELEMENT	Gros area	SS	Openin	gs	A ,r	m² x	W/m2	2K = [(W/	K)			kJ/K
ELEMENT Doors	Gros area pe 1	SS	Openin	gs	A ,r	m ² x x 1	W/m2	2K = [0.04] = [(W/	K)			kJ/K (26)
ELEMENT Doors Windows Ty	Gros area pe 1 pe 2	SS	Openin	gs	A ,r 1.98	m ² x x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1/2 x1	W/m2 1.4 /[1/(1.6)+	2K = [0.04] = [0.04] = [2.772 3.97	K)			kJ/K (26) (27)
ELEMENT Doors Windows Ty Windows Ty	Gros area pe 1 pe 2	SS	Openin	gs	A ,r 1.98 2.64 2.28	m ² x x10 x10 x10 x10	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+	2K = [0.04] = [0.04] = [2.772 3.97 3.43	K)			kJ/K (26) (27) (27)
Doors Windows Ty Windows Ty Windows Ty	Gros area pe 1 pe 2 pe 3	ss (m²)	Openin	gs ²	A ,r 1.98 2.64 2.28 2.34	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+	EK = [0.04] = [0.04] = [0.04] = [2.772 3.97 3.43 3.52	K)			(26) (27) (27) (27)
ELEMENT Doors Windows Ty Windows Ty Windows Ty Floor	pe 1 pe 2 pe 3	ss (m²)	Openin m	gs ²	A ,r 1.98 2.64 2.28 2.34 59.1	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	2K = [0.04] = [0.04] = [0.04] = [= = [2.772 3.97 3.43 3.52 7.092	K)			(26) (27) (27) (27) (27) (28)
Doors Windows Ty Windows Ty Windows Ty Floor Walls Type1	pe 1 pe 2 pe 3	ss (m²)	Openin m	gs ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23	eK = [0.04] = [0.04] = [0.04] = [0.04] = [= = [(W// 2.772 3.97 3.43 3.52 7.092 13.34	K)			(26) (27) (27) (27) (28) (29)
Doors Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2	Pe 1 pe 2 pe 3 70.5	55 (m²) 52 55	12.54 1.98	gs ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67	x10 x10 x x1	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12	2K = [0.04] = [0.04] = [0.04] = [= 0.04] = [= = [2.772 3.97 3.43 3.52 7.092 13.34 3.66	K)			(26) (27) (27) (27) (28) (29) (29)
ELEMENT Doors Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2 Roof	Pe 1 pe 2 pe 3 70.5	55 (m²) 52 55	12.54 1.98	gs ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12	2K = [0.04] = [0.04] = [0.04] = [= 0.04] = [= = [2.772 3.97 3.43 3.52 7.092 13.34 3.66	K)			(26) (27) (27) (27) (28) (29) (29) (30)
Doors Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2 Roof Total area of	Pe 1 pe 2 pe 3 70.5	55 (m²) 52 55	12.54 1.98	gs ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.58	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = [0.04] = [0.04] = [0.04] = [= 0.04] = [= = [= = [(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	K)			(26) (27) (27) (27) (28) (29) (29) (30) (31) (32)
ELEMENT Doors Windows Ty Windows Ty Floor Walls Type1 Walls Type2 Roof Total area of Party wall	pe 1 pe 2 pe 3 70.5 33.6 20.5 f elements	55 (m²) 52 55	12.54 1.98	gs ²	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.55 183.8	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = [0.04] = [0.04] = [0.04] = [= 0.04] = [= = [= = [(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	K)			(26) (27) (27) (27) (28) (29) (29) (30) (31) (32) (32a)
ELEMENT Doors Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor	pe 1 pe 2 pe 3 70.5 33.6 20.5 f elements	52 55 55 5, m ²	Openin m 12.54 1.98 0	gs 4 1 1 1 1 1 1 1 1 1 1 1 1 1	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.58 183.8 51.98 5.32 43.87	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = [0.04] = [0.04] = [0.04] = [0.04] = [(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	K)	kJ/m²·		(26) (27) (27) (27) (28) (29) (29) (30) (31) (32) (32a)
ELEMENT Doors Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling * for windows a	pe 1 pe 2 pe 3 70.5 20.5 f elements	52 55 55 65 65 65 65 65 65 65 65 65 65 65	12.54 1.98 0	gs 4 1 1 1 1 1 1 1 1 1 1 1 1 1	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.58 183.8 51.98 5.32 43.87	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = [0.04] = [0.04] = [0.04] = [0.04] = [(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	K)	kJ/m²·		(26) (27) (27) (27) (28) (29) (29) (30) (31) (32) (32a)
ELEMENT Doors Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling * for windows a ** include the a	pe 1 pe 2 pe 3 70.5 33.6 20.5 f elements and roof windereas on both oss, W/K	SS (m²) 55 55 5, m² ows, use e sides of in = S (A x	12.54 1.98 0	gs 4 1 1 1 1 1 1 1 1 1 1 1 1 1	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.58 183.8 51.98 5.32 43.87	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = [0.04] = [0.04] = [0.04] = [0.04] = [(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	K)	kJ/m²· l	K	kJ/K (26) (27) (27) (28) (29) (30) (31) (32) (32a)
ELEMENT Doors Windows Ty Windows Ty Windows Ty Floor Walls Type1 Walls Type2 Roof Total area of Party wall Party floor Party ceiling * for windows a ** include the a Fabric heat I	pe 1 pe 2 pe 3 70.5 33.6 20.5 f elements and roof windereas on both loss, W/K: by Cm = S(ows, use esides of interest (A x k)	12.54 1.98 0 effective winternal walk	gs 1 ² andow U-vals and part	A ,r 1.98 2.64 2.28 2.34 59.1 57.98 31.67 20.58 183.8 51.98 5.32 43.87	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ 0.12 0.23 0.12 0.1	2K = [0.04] = [0.04] = [0.04] = [0.04] = [(W// 2.772 3.97 3.43 3.52 7.092 13.34 3.66 2.05	K)	kJ/m²· l	13.2	kJ/K (26) (27) (27) (28) (29) (30) (31) (32a) (32b)

can be used inste				ucina An	nondiy l	Z						07.57	— (20)
Thermal bridge if details of therma	•	,		• .	•	N.						27.57	(36)
Total fabric he	0 0	are not kin	OWII (00) -	- 0.00 X (0	1)			(33) +	(36) =			75.35	(37)
Ventilation 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= 53.28	53.06	52.84	51.8	51.6	50.7	50.7	50.53	51.04	51.6	51.99	52.41	1	(38)
Heat transfer of	coefficier	nt, W/K	•	•		•	•	(39)m	= (37) + (37)	38)m	•	•	
(39)m= 128.63	128.41	128.18	127.14	126.95	126.04	126.04	125.88	126.39	126.95	127.34	127.76		
Heat loss para	meter (H	HLP), W/	′m²K						Average = = (39)m ÷	` '	12 /12=	127.14	(39)
(40)m= 1.26	1.26	1.26	1.25	1.25	1.24	1.24	1.23	1.24	1.25	1.25	1.25		_
Number of dev	a in ma	oth /Tab	lo 1o\					,	Average =	Sum(40) ₁	12 /12=	1.25	(40)
Number of day Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31	1	(41)
, ,		<u> </u>			<u> </u>	<u> </u>	<u> </u>		<u> </u>			1	
4. Water heat	tina enei	rav reaui	irement:								kWh/y	ear:	
	J											1	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13.		.76	J	(42)
Annual averag	e hot wa										0.67	1	(43)
Reduce the annua not more that 125	_				_	_	to achieve	a water us	se target o	f		.	
	· · ·			<u> </u>		•		Con	Oat	Nov	Dag	1	
Jan Hot water usage ii	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	J	
(44)m= 109.64	105.65	101.66	97.68	93.69	89.7	89.7	93.69	97.68	101.66	105.65	109.64	1	
. ,					<u> </u>	<u> </u>	<u> </u>	-	I Total = Su	l m(44) _{1 12} =	<u> </u>	1196.06	(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= 162.59	142.2	146.74	127.93	122.75	105.93	98.16	112.64	113.98	132.84	145	157.46		_
If instantaneous w	vater heatii	na at noint	of use (no	n hot water	r storage)	enter () in	hoves (46		Total = Su	m(45) _{1 12} =	=	1568.22	(45)
(46)m= 24.39	21.33	22.01	19.19	18.41	15.89	14.72	16.9		19.93	21.75	23.62	1	(46)
Water storage	l	22.01	19.19	10.41	15.69	14.72	10.9	17.1	19.93	21.75	23.02]	(40)
Storage volum	e (litres)) includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0]	(47)
If community h	eating a	ınd no ta	ınk in dw	elling, e	nter 110) litres in	(47)					_	
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage a) If manufact		eclared l	nee facti	nr is kna	wn (k\//h	n/day).					0	1	(48)
Temperature f				JI 13 KI10	wii (ikwii	"day).					0]	(49)
Energy lost fro				ear			(48) x (49)	١ =]	(50)
b) If manufact		_	-		or is not	known:	(10) X (40)	•			10	J	(50)
Hot water stora	-			e 2 (kW	h/litre/da	ay)				0.	.02]	(51)
If community he Volume factor	_		on 4.3								00	1	(50)
Temperature factor			2b							-	.03 6	1	(52) (53)
- 4-2-3-6-3			-									1	(55)

Energy lost from	water stora	age, kWh/y	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter (50) or (54)	4) in (55)								1.	03		(55)
Water storage lo	ss calculate	ed for each	month			((56)m = ((55) × (41)r	m				
(56)m= 32.01	28.92 32.0	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contains of	edicated solar	storage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 32.01	28.92 32.0	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit lo	ss (annual)	from Table	e 3							0		(58)
Primary circuit lo	ss calculat	ed for each	month (59)m = ((58) ÷ 36	65 × (41))m					
(modified by fa	actor from 1	able H5 if t	there is s	olar wat	ter heatii	ng and a	cylinde	thermo	stat)			
(59)m= 23.26	21.01 23.2	26 22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss calci	ulated for ea	ach 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 requir	ed for wate	r heating ca	alculated	for eac	h month	(62)m =	0.85 × (45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 217.87	192.13 202.	02 181.43	178.03	159.42	153.43	167.91	167.48	188.11	198.49	212.74		(62)
Solar DHW input cal	culated using	Appendix G o	r Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)	•	
(add additional li	nes if FGH	RS 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 wat	er heater											
(64)m= 217.87	192.13 202.	02 181.43	178.03	159.42	153.43	167.91	167.48	188.11	198.49	212.74		
	•	•				Outp	out from wa	ater heate	r (annual) ₁	12	2219.06	(64)
Heat gains from	water heati	na. kWh/m	onth 0.2	5 ′ [0 85	× (45)m	+ (61)m	n1 + 0 8 v	r [(46)m	+ (57)m	+ (59)m	1	
		,	· · · · · · · · · · · · · · · · · · ·	J [0.00	(10)11	. (01)	ıj . O.O A	(TO)	' (3 <i>1)</i> III	. (33)111	j	
(65)m= 98.28	87.22 93.0	-	85.04	78.02	76.86	81.67	80.69	88.39	91.01	96.58]	(65)
(65)m= 98.28 include (57)m	87.22 93.0	01 85.33	85.04	78.02	76.86	81.67	80.69	88.39	91.01	96.58		(65)
` ′	87.22 93.0 in calculation	91 85.33 on of (65)m	85.04 only if c	78.02	76.86	81.67	80.69	88.39	91.01	96.58		(65)
include (57)m 5. Internal gair	87.22 93.0 in calculations (see Tab	91 85.33 On of (65)m le 5 and 5a	85.04 only if c	78.02	76.86	81.67	80.69	88.39	91.01	96.58		(65)
include (57)m	87.22 93.0 in calculations (see Tab	85.33 on of (65)m le 5 and 5a Vatts	85.04 only if c	78.02	76.86	81.67	80.69	88.39	91.01	96.58		(65)
include (57)m 5. Internal gair Metabolic gains Jan	87.22 93.0 in calculations (see Tab (Table 5), V	85.33 on of (65)m le 5 and 5a Vatts ar Apr	85.04 only if c	78.02 ylinder i	76.86 s in the 0	81.67 dwelling	80.69 or hot w	88.39 ater is fr	91.01 rom com	96.58 munity h		(65)
include (57)m 5. Internal gair Metabolic gains Jan (66)m= 137.83	87.22 93.0 in calculations (see Tabout (Table 5), Value Feb Mail 137.83 137.	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83	85.04 only if c): May 137.83	78.02 ylinder is Jun 137.83	76.86 s in the o	81.67 dwelling Aug 137.83	80.69 or hot w Sep 137.83	88.39 ater is fr	91.01 om com	96.58 munity h		
include (57)m 5. Internal gain Metabolic gains Jan (66)m= 137.83 Lighting gains (c	87.22 93.0 in calculations (see Tabout (Table 5), Value Feb Mail 137.83 137.	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83	85.04 only if c): May 137.83	78.02 ylinder is Jun 137.83	76.86 s in the o	81.67 dwelling Aug 137.83	80.69 or hot w Sep 137.83	88.39 ater is fr	91.01 om com	96.58 munity h		
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 137.83 Lighting gains (c) (67)m= 25.53	87.22 93.0 in calculations (see Tab (Table 5), V Feb M: 137.83 137. calculated in 22.67 18.4	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 44 13.96	85.04 only if c): May 137.83 L, equati 10.44	78.02 ylinder is Jun 137.83 on L9 on 8.81	76.86 s in the o Jul 137.83 r L9a), a 9.52	Aug 137.83 Iso see	80.69 or hot w Sep 137.83 Table 5	88.39 ater is fr Oct 137.83	91.01 om com Nov 137.83	96.58 munity h		(66)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 137.83 Lighting gains (c) (67)m= 25.53 Appliances gains	87.22 93.0 in calculations (see Tab (Table 5), V Feb M: 137.83 137. calculated in 22.67 18.4	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 Appendix 14 13.96 d in Append	85.04 only if c): May 137.83 L, equati 10.44	78.02 ylinder is Jun 137.83 on L9 on 8.81	76.86 s in the o Jul 137.83 r L9a), a 9.52	Aug 137.83 Iso see	80.69 or hot w Sep 137.83 Table 5	88.39 ater is fr Oct 137.83	91.01 om com Nov 137.83	96.58 munity h		(66)
include (57)m 5. Internal gairs Metabolic gains Jan (66)m= 137.83 Lighting gains (67)m= 25.53 Appliances gains (68)m= 259.41	87.22 93.0 in calculations (see Tab (Table 5), Variety Feb Min (137.83 1	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 14 13.96 d in Append 32 240.88	85.04 only if c): May 137.83 L, equati 10.44 dix L, eq 222.65	78.02 ylinder is Jun 137.83 on L9 on 8.81 uation L 205.52	76.86 s in the o Jul 137.83 r L9a), a 9.52 13 or L1 194.07	81.67 dwelling Aug 137.83 lso see 12.37 3a), also	80.69 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16	88.39 ater is fr Oct 137.83 21.09 ble 5 212.6	91.01 om com Nov 137.83	96.58 munity h		(66) (67)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 137.83 Lighting gains (c (67)m= 25.53 Appliances gains (68)m= 259.41 Cooking gains (c	87.22 93.0 in calculations (see Tab (Table 5), Variety Feb Min (137.83 1	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 4 13.96 d in Append 32 240.88 a Appendix	85.04 only if c): May 137.83 L, equati 10.44 dix L, eq 222.65	78.02 ylinder is Jun 137.83 on L9 on 8.81 uation L 205.52	76.86 s in the o Jul 137.83 r L9a), a 9.52 13 or L1 194.07	81.67 dwelling Aug 137.83 lso see 12.37 3a), also	80.69 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16	88.39 ater is fr Oct 137.83 21.09 ble 5 212.6	91.01 om com Nov 137.83	96.58 munity h		(66) (67)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 137.83 Lighting gains (c (67)m= 25.53 Appliances gains (68)m= 259.41 Cooking gains (c (69)m= 36.78	87.22 93.0 in calculations (see Tab (Table 5), V Feb Ma 137.83 137. calculated in 22.67 18.4 s (calculate 262.1 255. calculated in 36.78 36.7	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 4 13.96 d in Appendix 2 240.88 a Appendix 3 36.78	85.04 only if c): May 137.83 L, equati 10.44 dix L, equati 222.65 L, equat	78.02 ylinder is Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a	Aug 137.83 Iso see 12.37 3a), also 191.38	80.69 or hot w Sep 137.83 Table 5 16.61 o see Table 198.16 ee Table	88.39 ater is fr Oct 137.83 21.09 ole 5 212.6 5	91.01 om com Nov 137.83 24.61	96.58 munity h Dec 137.83 26.24		(66) (67) (68)
include (57)m 5. Internal gairs Metabolic gains Jan (66)m= 137.83 Lighting gains (667)m= 25.53 Appliances gains (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fans	87.22 93.0 in calculations (see Tab (Table 5), V Feb Ma 137.83 137. calculated in 22.67 18.4 s (calculate 262.1 255. calculated in 36.78 36.7	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 4 13.96 d in Appendi 32 240.88 a Appendix 8 36.78 le 5a)	85.04 only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equat 36.78	Jun 137.83 5 on L9 of 8.81 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78	Aug 137.83 Iso see 12.37 3a), also 191.38), also se 36.78	80.69 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78	88.39 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78	91.01 om com Nov 137.83 24.61 230.83	96.58 munity h Dec 137.83 26.24 247.96		(66) (67) (68) (69)
include (57)m 5. Internal gairs Metabolic gains Jan (66)m= 137.83 Lighting gains (constant of the constan	87.22 93.0 in calculations (see Tab (Table 5), V Feb M: 137.83 137. calculated in 22.67 18.4 s (calculated in 36.78 36.7 gains (Table 0 0	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 4 13.96 d in Appendix 6 240.88 an Appendix 78 36.78 le 5a) 0	85.04 only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equat 36.78	78.02 ylinder is Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a	Aug 137.83 Iso see 12.37 3a), also 191.38	80.69 or hot w Sep 137.83 Table 5 16.61 o see Table 198.16 ee Table	88.39 ater is fr Oct 137.83 21.09 ole 5 212.6 5	91.01 om com Nov 137.83 24.61	96.58 munity h Dec 137.83 26.24		(66) (67) (68)
include (57)m 5. Internal gairs Metabolic gains Jan (66)m= 137.83 Lighting gains (66)m= 25.53 Appliances gains (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fans (70)m= 0 Losses e.g. eval	87.22 93.0 in calculations (see Tab (Table 5), V Feb Mi 137.83 137. calculated in 22.67 18.4 s (calculated in 36.78 36.78 36.7 gains (Table 0 0 0 coration (ne	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 4 13.96 d in Appendix 6 240.88 a Appendix 78 36.78 le 5a) o egative value	85.04 only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equati 36.78 0 les) (Tab	78.02 ylinder is Jun 137.83 on L9 on 8.81 uation L 205.52 ion L15 36.78 0 le 5)	76.86 s in the o Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78	81.67 dwelling Aug 137.83 lso see 12.37 3a), also 191.38), also se 36.78	80.69 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78	88.39 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78	91.01 om com Nov 137.83 24.61 230.83	96.58 munity h Dec 137.83 26.24 247.96 36.78		(66) (67) (68) (69) (70)
include (57)m 5. Internal gair Metabolic gains Jan (66)m= 137.83 Lighting gains (667)m= 25.53 Appliances gains (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fans (70)m= 0 Losses e.g. eval (71)m= -110.27	87.22 93.0 in calculations (see Tab (Table 5), V Feb Ma 137.83 137. calculated in 22.67 18.4 calculated in 36.78 36.7 gains (Table 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 4 13.96 d in Appendix 6 32 240.88 a Appendix 78 36.78 le 5a)	85.04 only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equat 36.78	78.02 ylinder is Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15 36.78	Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78	Aug 137.83 Iso see 12.37 3a), also 191.38), also se 36.78	80.69 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78	88.39 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78	91.01 om com Nov 137.83 24.61 230.83	96.58 munity h Dec 137.83 26.24 247.96		(66) (67) (68) (69)
include (57)m 5. Internal gains Metabolic gains Jan (66)m= 137.83 Lighting gains (c (67)m= 25.53 Appliances gains (68)m= 259.41 Cooking gains (c (69)m= 36.78 Pumps and fans (70)m= 0 Losses e.g. eval (71)m= -110.27 - Water heating gains	87.22 93.0 in calculations (see Tab (Table 5), V Feb Ma 137.83 137. calculated in 22.67 18.4 s (calculated in 36.78 36.78 36.7 gains (Table 110.27 -110.24) calculated in 36.78 36.7	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 4 13.96 d in Appendix 78 36.78 le 5a) 0 egative valu 27 -110.27 5)	85.04 only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equat 36.78 0 es) (Tab	78.02 ylinder is Jun 137.83 fon L9 of 8.81 uation L 205.52 ion L15 36.78 0 le 5) -110.27	76.86 s in the of Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a 36.78 0	81.67 dwelling Aug 137.83 lso see 12.37 3a), also 191.38), also se 36.78	80.69 or hot w Sep 137.83 Table 5 16.61 o see Table 198.16 ee Table 36.78 0	88.39 ater is fr Oct 137.83 21.09 ole 5 212.6 5 36.78 0	91.01 om com Nov 137.83 24.61 230.83 36.78	96.58 munity h Dec 137.83 26.24 247.96 36.78		(66) (67) (68) (69) (70) (71)
include (57)m 5. Internal gair Metabolic gains Jan (66)m= 137.83 Lighting gains (66)m= 25.53 Appliances gains (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fans (70)m= 0 Losses e.g. eval (71)m= -110.27 - Water heating gains (72)m= 132.1	87.22 93.0 in calculations (see Tab (Table 5), V Feb Mi 137.83 137. calculated in 22.67 18.4 s (calculated in 36.78 36.7 gains (Table 0 0 0 coration (ne 110.27 -110. ains (Table 129.8 125.	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 a Appendix 4 13.96 d in Appendix 78 36.78 le 5a) 0 egative valu 27 -110.27 5)	85.04 only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equati 36.78 0 les) (Tab	78.02 ylinder is Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15 36.78 0 le 5) -110.27	76.86 s in the of Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78 0 -110.27	81.67 dwelling Aug 137.83 lso see 12.37 3a), also 191.38 0, also se 36.78 0	80.69 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78 0 -110.27	88.39 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78 0 -110.27	91.01 om com Nov 137.83 24.61 230.83 36.78 0 -110.27	96.58 munity h Dec 137.83 26.24 247.96 36.78 0 -110.27		(66) (67) (68) (69) (70)
include (57)m 5. Internal gair Metabolic gains Jan (66)m= 137.83 Lighting gains (conditions) (67)m= 25.53 Appliances gains (68)m= 259.41 Cooking gains (conditions) (69)m= 36.78 Pumps and fans (70)m= 0 Losses e.g. eval (71)m= -110.27 - Water heating gains (72)m= 132.1 Total internal gains	87.22 93.0 in calculations (see Tab (Table 5), V Feb Mail 137.83 137. calculated in 22.67 18.4 s (calculated in 36.78 36.7 gains (Table 110.27 -110. ains (Table 129.8 125. ains =	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 n Appendix 14 13.96 d in Appendix 18 36.78 le 5a) 0 egative valu 27 -110.27 5) 02 118.52	85.04 only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equat 36.78 0 es) (Tab -110.27	78.02 ylinder is Jun 137.83 on L9 on 8.81 uation L 205.52 ion L15 36.78 0 le 5) -110.27 108.36 (66)	76.86 s in the of Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78 0 -110.27	81.67 dwelling Aug 137.83 lso see 12.37 3a), also 191.38), also se 36.78 0 -110.27	80.69 or hot w Sep 137.83 Table 5 16.61 o see Tall 198.16 ee Table 36.78 0 -110.27 112.07 + (69)m + (88.39 ater is fr Oct 137.83 21.09 ole 5 212.6 5 36.78 0 -110.27 118.8 70)m + (7	91.01 om com Nov 137.83 24.61 230.83 36.78 0 -110.27 126.4 1)m + (72)	96.58 munity h Dec 137.83 26.24 247.96 36.78 0 -110.27		(66) (67) (68) (69) (70) (71)
include (57)m 5. Internal gair Metabolic gains Jan (66)m= 137.83 Lighting gains (667)m= 25.53 Appliances gains (68)m= 259.41 Cooking gains (69)m= 36.78 Pumps and fans (70)m= 0 Losses e.g. eval (71)m= -110.27 Water heating gains (72)m= 132.1 Total internal gains	87.22 93.0 in calculations (see Tab (Table 5), V Feb Mi 137.83 137. calculated in 22.67 18.4 s (calculated in 36.78 36.7 gains (Table 0 0 0 coration (ne 110.27 -110. ains (Table 129.8 125.	85.33 on of (65)m le 5 and 5a Vatts ar Apr 83 137.83 n Appendix 14 13.96 d in Appendix 18 36.78 le 5a) 0 egative valu 27 -110.27 5) 02 118.52	85.04 only if c): May 137.83 L, equati 10.44 dix L, equ 222.65 L, equat 36.78 0 es) (Tab	78.02 ylinder is Jun 137.83 on L9 of 8.81 uation L 205.52 ion L15 36.78 0 le 5) -110.27	76.86 s in the of Jul 137.83 r L9a), a 9.52 13 or L1 194.07 or L15a) 36.78 0 -110.27	81.67 dwelling Aug 137.83 lso see 12.37 3a), also 191.38 0, also se 36.78 0	80.69 or hot w Sep 137.83 Table 5 16.61 o see Tal 198.16 ee Table 36.78 0 -110.27	88.39 ater is fr Oct 137.83 21.09 ble 5 212.6 5 36.78 0 -110.27	91.01 om com Nov 137.83 24.61 230.83 36.78 0 -110.27	96.58 munity h Dec 137.83 26.24 247.96 36.78 0 -110.27		(66) (67) (68) (69) (70) (71)

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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 Fable 6c		Gains (W)	
Northeast _{0.9x} 0.77	X	2.34	x	11.28	X	0.63	x [0.7	=	8.07	(75)
Northeast _{0.9x} 0.77	X	2.34	x	22.97	X	0.63	= x [0.7	=	16.42	(75)
Northeast 0.9x 0.77	x	2.34	x	41.38	X	0.63	×	0.7	=	29.59	(75)
Northeast 0.9x 0.77	x	2.34	x	67.96	X	0.63	x	0.7	-	48.6	(75)
Northeast _{0.9x} 0.77	x	2.34	x	91.35	X	0.63	x [0.7	=	65.32	(75)
Northeast 0.9x 0.77	X	2.34	x	97.38	X	0.63	x [0.7	=	69.64	(75)
Northeast _{0.9x} 0.77	X	2.34	x	91.1	X	0.63	x [0.7		65.15	(75)
Northeast _{0.9x} 0.77	X	2.34	x	72.63	X	0.63	x [0.7	=	51.94	(75)
Northeast _{0.9x} 0.77	X	2.34	x	50.42	X	0.63	x [0.7	=	36.06	(75)
Northeast _{0.9x} 0.77	x	2.34	x	28.07	X	0.63	x	0.7	=	20.07	(75)
Northeast _{0.9x} 0.77	x	2.34	x	14.2	X	0.63	x	0.7	=	10.15	(75)
Northeast _{0.9x} 0.77	X	2.34	x	9.21	X	0.63	x [0.7	=	6.59	(75)
Southeast 0.9x 0.77	X	2.64	x	36.79	X	0.63	x [0.7	=	89.06	(77)
Southeast 0.9x 0.77	X	2.64	x	62.67	X	0.63	x [0.7	=	151.7	(77)
Southeast 0.9x 0.77	X	2.64	x	85.75	X	0.63	x [0.7		207.56	(77)
Southeast 0.9x 0.77	x	2.64	x	106.25	X	0.63	x [0.7	=	257.18	(77)
Southeast 0.9x 0.77	X	2.64	x	119.01	X	0.63	x [0.7	=	288.06	(77)
Southeast 0.9x 0.77	x	2.64	x	118.15	X	0.63	x [0.7	=	285.98	(77)
Southeast 0.9x 0.77	X	2.64	x	113.91	X	0.63	x [0.7	=	275.71	(77)
Southeast 0.9x 0.77	X	2.64	x	104.39	X	0.63	x [0.7	=	252.67	(77)
Southeast 0.9x 0.77	x	2.64	x	92.85	X	0.63	x [0.7	=	224.74	(77)
Southeast 0.9x 0.77	X	2.64	x	69.27	X	0.63	x	0.7	=	167.66	(77)
Southeast 0.9x 0.77	X	2.64	X	44.07	X	0.63	x	0.7	=	106.67	(77)
Southeast 0.9x 0.77	X	2.64	x	31.49	X	0.63	x [0.7	=	76.21	(77)
Southwest _{0.9x} 0.77	X	2.28	X	36.79]	0.63	x	0.7	=	25.64	(79)
Southwest _{0.9x} 0.77	X	2.28	x	62.67]	0.63	x	0.7	=	43.67	(79)
Southwest _{0.9x} 0.77	X	2.28	x	85.75]	0.63	x	0.7	=	59.75	(79)
Southwest _{0.9x} 0.77	X	2.28	x	106.25]	0.63	x	0.7	=	74.04	(79)
Southwest _{0.9x} 0.77	X	2.28	x	119.01]	0.63	x [0.7	=	82.93	(79)
Southwest _{0.9x} 0.77	X	2.28	X	118.15]	0.63	x	0.7	=	82.33	(79)
Southwest _{0.9x} 0.77	X	2.28	X	113.91]	0.63	x [0.7	=	79.37	(79)
Southwest _{0.9x} 0.77	X	2.28	X	104.39]	0.63	×	0.7	=	72.74	(79)
Southwest _{0.9x} 0.77	X	2.28	X	92.85]	0.63	x [0.7	=	64.7	(79)
Southwest _{0.9x} 0.77	X	2.28	X	69.27]	0.63	x [0.7	=	48.27	(79)
Southwest _{0.9x} 0.77	X	2.28	X	44.07]	0.63	x [0.7	=	30.71	(79)
Southwest _{0.9x} 0.77	X	2.28	x	31.49]	0.63	x	0.7	=	21.94	(79)
Solar gains in watts, calcula	$\overline{}$		$\overline{}$			n = Sum(74)m	(82)m	1.		ı	(05)
(83)m= 122.76 211.79 296.		379.81 436.3		37.95 420.23	377	.35 325.5	236	147.53	104.74		(83)
Total gains – internal and so	_	` ' 			7	20 740 7	650.01	E00.70	E70 44	1	(QA)
(84)m= 604.15 690.72 760.0	13	817.52 848.04	+ 8	24.98 791.48	755	.23 716.7	652.84	593.73	573.11		(84)

7. Me	an inter	nal temp	perature	(heating	season)								
Temp	erature	during h	neating p	eriods ir	n the livii	ng area	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for l	living are	ea, h1,m	(see Ta	ble 9a)		, ,					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.98	0.93	0.82	0.66	0.7	0.9	0.98	1	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=	19.6	19.75	20	20.33	20.65	20.88	20.97	20.96	20.79	20.38	19.93	19.58		(87)
Temp	erature	durina h	neating p	eriods ir	rest of	dwelling	from Ta	able 9, T	h2 (°C)	•		•		
(88)m=	19.87	19.87	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.88	19.88		(88)
Utilisa	ation fac	tor for g	ains for i	rest of d	welling	h2 m (se	e Table	9a)						
(89)m=	1	0.99	0.99	0.97	0.9	0.73	0.51	0.56	0.83	0.97	0.99	1		(89)
				the rest	مد طبیرماا:	n = T0 /f	ماامید مغم		7 in Tabl	L		<u> </u>		
(90)m=	18.02	18.24	18.6	19.08	19.52	19.8	19.88	ps 3 to 1	7 IN Tabi	19.16	18.51	17.98		(90)
(50)111–	10.02	10.24	10.0	13.00	10.02	10.0	13.00	10.07	<u> </u>	fLA = Livin	<u> </u>		0.27	(91)
											g a. oa (.,	0.27	(01)
			· ·	1	1		i	+ (1 – fL	<u> </u>		Ι			(00)
(92)m=	18.45	18.65	18.98	19.42	19.82	20.09	20.17	20.17	20	19.49	18.89	18.41		(92)
		r	r	ı	r			4e, whe		r i	40.00	40.44		(02)
(93)m=	18.45	18.65	18.98	19.42	19.82	20.09	20.17	20.17	20	19.49	18.89	18.41		(93)
		ting requ			vo obtoin		11 of	Table O	th-	4 T:/	76\m an	d == ==l=	loto	
		factor fo		•		ieu ai sii	ер птог	rable 9i	o, so ma	ıt 11,111 – (rojili ali	d re-calc	suiale	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa		tor for g		<u> </u>	<u>, , , , , , , , , , , , , , , , , , , </u>	ļ.	!		<u>'</u>		ļ.			
(94)m=	1	0.99	0.98	0.96	0.9	0.75	0.55	0.6	0.84	0.97	0.99	1		(94)
Usefu	ıl gains,	hmGm ,	, W = (94	4)m x (8	4)m			•		•		•		
(95)m=	601.81	685.46	747.6	784.23	759.03	616.12	436.52	453.32	603.31	631.11	589.15	571.36		(95)
Month	nly 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 rate	e for mea	an intern	al tempo	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	1820	1765.45	1599.59	1337.12	1031.03	692.6	450.46	474.09	746.16	1129.01	1501.77	1815.98		(97)
•			1	i	T T			24 x [(97)m – (95	í - `				
(98)m=	906.33	725.75	633.88	398.08	202.37	0	0	0	0	370.44	657.09	926		_
								Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	4819.94	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								47.29	(99)
9b. En	ergy red	quiremer	nts – Cor	mmunity	heating	scheme								
								ting prov			unity sch	neme.		_
Fractio	n of spa	ace heat	from se	condary	/supplen	nentary l	neating ((Table 1	1) '0' if n	one			0	(301)
Fractio	n of spa	ace heat	from co	mmunity	system	1 – (30	1) =						1	(302)
	-	-								up to four	other heat	sources; ti	he latter	
			_			rom powe	r stations.	See Appe	ndix C.			ĺ		(202-)
riactio	iii 0i 11 0 8	at from C	JUIIIIUN	пу пеас	pullip								1	(303a)

Fraction of heat from Community heat pump (Water)		0.8	303a)
Fraction of community heat from heat source 2 (Water	er)	0.2	303b)
Fraction of total space heat from Community heat pur	mp (302) x (303a) =	1 (3	304a)
Factor for control and charging method (Table 4c(3))	for community heating system	1 (3	305)
Distribution loss factor (Table 12c) for community hea	ating system	1.05	306)
Distribution loss factor (Table 12c) for community hea	ating system (Water)	1.05	306)
Space heating		kWh/year	
Annual space heating requirement	L	4819.94	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	5060.94 (3	307a)
Efficiency of secondary/supplementary heating system	m in % (from Table 4a or Appendix E)	0 (3	308
Space heating requirement from secondary/supplement	entary system (98) x (301) x 100 ÷ (308) =	0 (3	309)
Water heating	_		
Annual water heating requirement		2219.06	
If DHW from community scheme: Water heat from CHP (Water)	(64) x (303a) x (305) x (306) =	1864.01	310a)
Water heat from heat source 2 (Water)	(64) x (303a) x (305) x (306) =	466 (3	310b)
Electricity used for heat distribution	0.01 × [(307a) (307e) + (310a) (310e)] =	50.61 (3	313)
Electricity used for heat distribution (Water)	0.01 × [(307a) (307e) + (310a) (310e)] =	23.3 (3	313)
Cooling System Energy Efficiency Ratio	Ī	0 (3	314)
Space cooling (if there is a fixed cooling system, if no	ot enter 0) = (107) ÷ (314) =	0 (3	315)
Electricity for pumps and fans within dwelling (Table 4 mechanical ventilation - balanced, extract or positive		0 (3	330a)
warm air heating system fans	Ī	0 (3	330b)
pump for solar water heating	Ī	0 (3	330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	0 (3	331)
Energy for lighting (calculated in Appendix L)	Ī	450.84 (3	332)
12b. CO2 Emissions – Community heating scheme			
	Energy Emission factor E kWh/year kg CO2/kWh	Emissions g CO2/year	
CO2 from other courses of appeal and water heating	,	.g CO2/year	
CO2 from other sources of space and water heating (Efficiency of heat source 1 (%)	is CHP using two fuels repeat (363) to (366) for the second fuel	290 (3	367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x 0.52 =	905.73 (3	367)
Electrical energy for heat distribution	[(313) x 0.52 =	26.27 (3	372)
Water heating from separate community system			
CO2 from other sources of space and water heating Efficiency of heat source 1 (%)	(not CHP) is CHP using two fuels repeat (363) to (366) for the second fuel	290 (3	367a)
Efficiency of heat source 2 (%)	is CHP using two fuels repeat (363) to (366) for the second fuel	100 (3	367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x 0 =	333.59 (3	367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x		368)
	. , , , , , , , , , , , , , , , , , , ,	(,

Electrical energy for heat distribution		[(313) x	0.52	=	12.09	(372)
Total CO2 associated with community sys	stems	(363) (366) + (368)(372)		=	1519.54	(373)
CO2 associated with space heating (second	ondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion	on heater or instantan	neous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and wat	ter heating	(373) + (374) + (375) =			1519.54	(376)
CO2 associated with electricity for pumps	and fans within dwel	lling (331)) x	0.52	=	0	(378)
CO2 associated with electricity for lighting	9	(332))) x	0.52	=	233.99	(379)
Total CO2, kg/year	sum of (376) (382) =				1753.53	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.2	(384)
El rating (section 14)					84.01	(385)

		User Details:				
Account Name	Chris Hocknell	Stroma Nur	mhor:	STDO:	016363	
Assessor Name: Software Name:	Stroma FSAP 2012	Suroma Nur Software Ve			n: 1.0.4.26	
Software Name.		operty Address: Flat 0		VCISIO	11. 1.0.4.20	
Address :	Flat 04, 51 Calthorpe Street,	·				
Overall dwelling dime	•					
		Area(m²)	Av. Height(m))	Volume(m³)	
Ground floor		83.77 (1a) x	3.06	(2a) =	256.34	(3a)
First floor		20.32 (1b) x	2.2	(2b) =	44.7	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1n)	104.09 (4)				_
Dwelling volume		(3a)+(3	3b)+(3c)+(3d)+(3e)+	(3n) =	301.04	(5)
2. Ventilation rate:				L		_
	main secondary heating heating	y other	total		m³ per hour	
Number of chimneys		+ 0 =	0	40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	20 =	0	(6b)
Number of intermittent far	ns		4	10 =	40	(7a)
Number of passive vents			0	10 =	0	(7b)
Number of flueless gas fir	res		0	40 =	0	(7c)
				4		_
LeCtion the section of	flores and fores (Ca)((Ch))(77	-> - (7 -> - (7-> -		-	anges per ho	_
•	ys, flues and fans = (6a)+(6b)+(7a een carried out or is intended, proceed		40 from (9) to (16)	÷ (5) =	0.13	(8)
Number of storeys in th	•	(,,	(0) (0)	ſ	0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timber frame or	0.35 for masonry cons	truction	Ī	0	(11)
if both types of wall are pr deducting areas of openin	resent, use the value corresponding to	the greater wall area (after		-		_
	loor, enter 0.2 (unsealed) or 0.	1 (sealed), else enter ()	Γ	0	(12)
If no draught lobby, ent	,	, ,,		Ì	0	(13)
Percentage of windows	and doors draught stripped				0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷	100] =	Ì	0	(15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	Ī	0	(16)
Air permeability value,	q50, expressed in cubic metres	s per hour per square i	metre of envelop	e area	5	(17)
If based on air permeabili	ty value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		Ī	0.38	(18)
Air permeability value applies	s if a pressurisation test has been done	e or a degree air permeabilit	ty is being used	_		_
Number of sides sheltere	d				1	(19)
Shelter factor		(20) = 1 - [0.075 x]	(19)] =		0.92	(20)
Infiltration rate incorporati	ing shelter factor	(21) = (18) x (20) =	=	[0.35	(21)
Infiltration rate modified for		, ,	, ,			
Jan Feb	Mar Apr May Jun	Jul Aug Sep	Oct Nov	Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4.3

4.5

4.7

Wind F	actor (2	2a)m =	(22)m ÷	4										
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjuste	ed infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
	0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42]	
		<i>tive air</i> al ventila	•	rate for t	he appli	cable ca	se	•	•	•	•	•	,	(220)
				endix N. (2	(23a) = (23a	a) × Fmv (e	eguation (N5)) , othe	rwise (23b) = (23a)			0	(23a) (23b)
			•	· ·	, ,		. ,	n Table 4h	•	, (,			0	(23c)
a) If	balance	d mecha	anical ve	entilation	with he	at recove	ery (MV	HR) (24a	a)m = (2:	2b)m + (23b) × [1 – (23c)		(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat red	covery (I	MV) (24b	o)m = (2:	2b)m + (2	23b)	•	•	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
,					•	•		on from o						
Ī			<u> </u>	<u> </u>	ŕ	ŕ	· `		i 	.5 × (23b	ŕ	Ι.	1	(0.1.)
(24c)m=	0	0	0		0	0	0	0	0	0	0	0]	(24c)
,					•	•		on from 0.5 + [(2		0.51				
(24d)m=		0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	1	(24d)
Effec	ctive air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	ld) in bo	x (25)	<u> </u>	<u> </u>	<u>!</u>	J	
(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(25)
3. Hea	at losse:	s and he	eat loss r	paramet	er:								_	
ELEN	IENT	Gros area	_	Openin m	gs	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	IENT		_	Openin	gs		m²				K)			
Doors	IENT ws Type	area	_	Openin	gs	A ,r	m² x	W/m2	2K =	(W/I	K)			kJ/K
Doors Window		area	_	Openin	gs	A ,r	m² x x1	W/m2	2K = = 0.04] =	(W/I 2.772	K)			kJ/K (26)
Doors Window Window	ws Type	area	_	Openin	gs	A ,r	m² x x1 x1	W/m2 1.4 /[1/(1.6)+	2K = 0.04] =	2.772 2.17	K)			kJ/K (26) (27)
Doors Window Window	ws Type ws Type	area	_	Openin	gs	A ,r 1.98 1.44 2.64	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] = 0.04] = 0.04] =	2.772 2.17 3.97	K)			kJ/K (26) (27) (27)
Doors Window Window Window	ws Type ws Type ws Type	area 1 2 2 3 4	_	Openin	gs	A ,r 1.98 1.44 2.64 0.69	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+	2K = 0.04] =	2.772 2.17 3.97 1.04	K)			kJ/K (26) (27) (27) (27)
Doors Window Window Window Window Window	ws Type ws Type ws Type ws Type	area	_	Openin	gs	A ,r 1.98 1.44 2.64 0.69 1.8	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+	2K = 0.04] =	2.772 2.17 3.97 1.04 2.06	K)			kJ/K (26) (27) (27) (27) (27)
Doors Window Window Window Window Window Window	ws Type ws Type ws Type ws Type ws Type	area 1 2 3 4 4 5 5 6 6	_	Openin	gs	A ,r 1.98 1.44 2.64 0.69 1.8	m ²	W/m ² 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+	EK = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65	K)			kJ/K (26) (27) (27) (27) (27) (27)
Doors Window Window Window Window Window Window	ws Type ws Type ws Type ws Type ws Type	area 1 2 3 4 4 5 5 6 6	_	Openin	gs	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+	EK = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65 9.92				kJ/K (26) (27) (27) (27) (27) (27) (27)
Doors Window Window Window Window Window Window Window	ws Type ws Type ws Type ws Type ws Type ws Type	area 1 2 3 4 4 5 5 6 6	(m²)	Openin	gs ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+	2K = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38				kJ/K (26) (27) (27) (27) (27) (27) (27) (27)
Doors Window Window Window Window Window Window Window Floor	ws Type ws Type ws Type ws Type ws Type ws Type ws Type	area 1 2 3 4 4 5 5 6 6 7	(m²)	Openin n	gs ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+	2K = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (27
Doors Window Window Window Window Window Window Window Window Window Window Window Window Window Window Window Window Window Window	ws Type ws Type ws Type ws Type ws Type ws Type fype1 Type2	area 1 2 3 4 5 6 7	(m²)	Openin m	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66	m²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.6)+ 0.12	2K = 0.04] = 0	2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28)
Doors Window Win	ws Type ws Type ws Type ws Type ws Type ws Type fype1 Type2	area 1 2 3 4 5 6 7 55.6	(m²)	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92	m²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ 0.12 0.23 0.12	2K = 0.04] = 0	(W/I 2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524 10.73 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29)
Doors Window Window Window Window Window Window Window Window Window Window Window Window Window Rloor Walls 1 Walls 1 Roof	ws Type ws Type ws Type ws Type ws Type fype1 Type2 Type3	area 1 2 3 4 4 5 5 6 6 7 55.6 19.9 36.4	(m²)	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92 24.52	m²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	EK =	(W/I 2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524 10.73 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (29) (29)
Doors Window Window Window Window Window Window Window Window Window Window Window Window Window Rloor Walls 1 Walls 1 Roof	ws Type ws Type ws Type ws Type ws Type fype1 Type2 Type3 rea of e	area 1 2 3 4 4 5 6 6 7 55.6 19.9 36.4 13.0	(m²)	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92 24.52	m ²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ 0.12 0.23 0.12 0.12	EK =	(W/I 2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524 10.73 2.07				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (29) (29) (29)
Doors Window Window Window Window Window Window Window Window Window Window Window Window Window Tloor Walls 1 Walls 1 Roof Total a	ws Type ws Type ws Type ws Type ws Type fype1 fype2 fype3 rea of e vall	area 1 2 3 4 4 5 6 6 7 55.6 19.9 36.4 13.0	(m²)	9.01 1.98	gs 1 ²	A ,r 1.98 1.44 2.64 0.69 1.8 1.44 8.66 4.24 83.77 46.66 17.92 24.52 13.01	m²	W/m2 1.4 /[1/(1.6)+ /[1/(1.6)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.2)+ /[1/(1.6)+ 0.12 0.12 0.12	2K = 0.04] = 0	(W/I 2.772 2.17 3.97 1.04 2.06 1.65 9.92 6.38 10.0524 10.73 2.07 2.94				kJ/K (26) (27) (27) (27) (27) (27) (27) (27) (28) (29) (29) (30) (31)

(26) (30) + (32) =

Fabric heat loss, W/K = S (A x U)

57.05

(33)

	$S(A \times k)$						((28)	(30) + (32	2) + (32a)	(32e) =	18376.29	(34)
Thermal mass param	` ,	⊃ = Cm +	÷ TFA) ir	ı kJ/m²K				tive Value:		, ,	250	(35)
For design assessments v	•		,			ecisely the				able 1f	230	
can be used instead of a c					,	,						
Thermal bridges : S (L x Y) cal	culated	using Ap	pendix l	K						31.32	(36)
if details of thermal bridgir	g are not kn	own (36) :	= 0.05 x (3	1)								_
Total fabric heat loss							, ,	(36) =			88.36	(37)
Ventilation heat loss	calculated	monthly	У				(38)m	= 0.33 × (25)m x (5)		1	
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 59.8 59.41	59.02	57.21	56.87	55.29	55.29	55	55.9	56.87	57.56	58.27		(38)
Heat transfer coeffici	ent, W/K						(39)m	= (37) + (3	38)m		_	
(39)m= 148.16 147.77	147.38	145.57	145.23	143.66	143.66	143.37	144.27	145.23	145.92	146.64		_
Heat loss parameter	(HLP), W	/m²K						Average = = (39)m ÷	` '	12 /12=	145.57	(39)
(40)m= 1.42 1.42	1.42	1.4	1.4	1.38	1.38	1.38	1.39	1.4	1.4	1.41]	
Number of days in m	onth (Tab	le 1a)			•		,	Average =	Sum(40) ₁	12 /12=	1.4	(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)
	_										J	
4. Water heating en	ergy requ	irement:								kWh/y	ear:	
Assumed occupancy	, N										1	
if TFA > 13.9, N = if TFA £ 13.9, N =	1 + 1.76 x 1			·		, , -		ΓFA -13.		77]	(42)
	1 + 1.76 x 1 vater usaç re hot water	ge in litre	es per da 5% if the a	ay Vd,av	erage =	(25 x N)	+ 36		9)).09]	(42)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres pe	1 + 1.76 x 1 vater usaç re hot water r person per	ge in litre usage by r day (all w	es per da 5% if the d vater use, I	y Vd,av welling is not and co	erage = designed t ld)	(25 x N) to achieve	+ 36 a water us	se target o	9)	0.09]	` ,
if TFA £ 13.9, N = Annual average hot v Reduce the annual average	1 + 1.76 x 1 vater usag re hot water r person per Mar	ge in litre usage by r day (all w	es per da 5% if the d vater use, f	ny Vd,av lwelling is not and co Jun	erage = designed t ld) Jul	(25 x N) to achieve	+ 36		9)]	` ,
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p	1 + 1.76 x 1 vater usaç e hot water r person per Mar er day for ea	ge in litre usage by r day (all w Apr ach month	es per da 5% if the a vater use, I May Vd,m = fa	y Vd,av welling is not and co Jun ctor from	erage = designed to ld) Jul Table 1c x	(25 x N) to achieve Aug (43)	+ 36 a water us Sep	Ge target of	9)	0.09 Dec]	` ,
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per	1 + 1.76 x 1 vater usaç e hot water r person per Mar er day for ea	ge in litre usage by r day (all w	es per da 5% if the d vater use, f	ny Vd,av lwelling is not and co Jun	erage = designed t ld) Jul	(25 x N) to achieve	+ 36 a water us Sep 98.09	se target o	Nov	Dec 110.1	1201.08	` ,
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p	1 + 1.76 x 1 vater usage hot water reperson per Mar er day for each 102.09	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the day vater use, I May Vd,m = fac 94.08	ay Vd,av welling is not and co Jun ctor from 1	erage = designed to ld) Jul Table 1c x 90.08	(25 x N) to achieve Aug (43) 94.08	+ 36 a water us Sep 98.09	Oct 102.09 Total = Sui	Nov 106.09 m(44) _{1 12} =	Dec 110.1	1201.08	(43)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres per (44)m= 110.1 106.09	1 + 1.76 x 1 vater usage hot water reperson per Mar er day for each 102.09	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the day vater use, I May Vd,m = fac 94.08	ay Vd,av welling is not and co Jun ctor from 1	erage = designed to ld) Jul Table 1c x 90.08	(25 x N) to achieve Aug (43) 94.08	+ 36 a water us Sep 98.09	Oct 102.09 Total = Sui	Nov 106.09 m(44) _{1 12} =	Dec 110.1	1201.08	(43)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p (44)m= 110.1 106.09 Energy content of hot water (45)m= 163.27 142.8	1 + 1.76 x 1 vater usage hot water r person per Mar er day for ea 102.09 er used - cal 147.36	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the a vater use, l May Vd,m = fa 94.08 onthly = 4.	y Vd,av lwelling is not and co Jun ctor from 7 90.08	erage = designed to designed t	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11	+ 36 a water us Sep 98.09 0 kWh/mor 114.46	Oct 102.09 Total = Suith (see Tai	Nov 106.09 m(44) _{1 12} = 1bles 1b, 1 145.61	Dec 110.1 c, 1d) 158.12	1201.08	(43)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p (44)m= 110.1 106.09 Energy content of hot water (45)m= 163.27 142.8	1 + 1.76 x 1 vater usage hot water r person per Mar er day for ea 102.09 er used - cal 147.36	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the a vater use, l May Vd,m = fa: 94.08 onthly = 4.	y Vd,av lwelling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11 boxes (46)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 1 to (61)	Oct 102.09 Total = Sun 133.39 Total = Sun	Nov 106.09 m(44) _{1 12} = shles 1b, 1 145.61 m(45) _{1 12} =	Dec 110.1 c, 1d) 158.12		(43) (44) (45)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p (44)m= 110.1 106.09 Energy content of hot wate (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42	1 + 1.76 x 1 vater usage hot water r person per Mar er day for ea 102.09 er used - cal 147.36	ge in litre usage by r day (all w Apr ach month 98.09	es per da 5% if the a vater use, l May Vd,m = fa 94.08 onthly = 4.	y Vd,av lwelling is not and co Jun ctor from 7 90.08	erage = designed to designed t	(25 x N) to achieve Aug (43) 94.08 97m / 3600 113.11	+ 36 a water us Sep 98.09 0 kWh/mor 114.46	Oct 102.09 Total = Sunth (see Tail 133.39	Nov 106.09 m(44) _{1 12} = 1bles 1b, 1 145.61	Dec 110.1 c, 1d) 158.12		(43)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p (44)m= 110.1 106.09 Energy content of hot water (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss:	1 + 1.76 x 1 vater usage hot water r person per Mar er day for each 102.09 147.36 1ting at point 22.1	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 f of use (no	es per da 5% if the a vater use, I May Vd,m = fa 94.08	y Vd,av welling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37 x storage),	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79	(25 x N) to achieve Aug (43) 94.08 07m / 3600 113.11 boxes (46) 16.97	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 10 to (61) 17.17	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) _{1 12} = sibles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p (44)m= 110.1 106.09 Energy content of hot water (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss: Storage volume (litre	1 + 1.76 x 1 vater usage hot water r person per Mar er day for each 147.36 147.36 147.36 122.1 s) includir	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 f of use (no	es per da 5% if the orater use, I May Vd,m = far 94.08	y Vd,av lwelling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37 x storage), 15.96	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage	(25 x N) to achieve Aug (43) 94.08 113.11 boxes (46) 16.97 within sa	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 10 to (61) 17.17	Oct 102.09 Total = Sur 133.39 Total = Sur 20.01	Nov 106.09 m(44) _{1 12} = sibles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12		(43) (44) (45)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p (44)m= 110.1 106.09 Energy content of hot water (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss: Storage volume (litre If community heating Otherwise if no store	1 + 1.76 x 1 vater usage hot water r person per Mar er day for each 102.09 147.36 147.36 1ting at point 22.1 s) includir and no ta	ge in litre usage by r day (all w Apr ach month 98.09 culated mo 128.47 t of use (no 19.27 and any so ank in dw	es per da 5% if the of vater use, I May Vd,m = fa 94.08 onthly = 4. 123.27 o hot water 18.49 olar or W velling, e	y Vd,av welling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37 storage), 15.96	erage = designed to designed t	(25 x N) to achieve Aug (43) 94.08 77m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 17.17 ame ves	Oct 102.09 Total = Sun 133.39 Total = Sun 20.01	Nov 106.09 m(44) _{1 12} = sbles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p (44)m= 110.1 106.09 Energy content of hot water (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss: Storage volume (litre If community heating	1 + 1.76 x 1 vater usage hot water r person per er day for each of the last section o	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 f of use (no 19.27 and any se ank in dw er (this in	es per da 5% if the a vater use, I May Vd,m = fa: 94.08 94.08 123.27 hot water 18.49 olar or Welling, encludes i	y Vd,av lwelling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37 15.96 /WHRS nter 110	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 94.08 77m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 17.17 ame ves	Oct 102.09 Total = Sun 133.39 Total = Sun 20.01	Nov 106.09 m(44) _{1 12} = sbles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p (44)m= 110.1 106.09 Energy content of hot water (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss: Storage volume (litre If community heating Otherwise if no store Water storage loss:	1 + 1.76 x 1 vater usage hot water r person per mer day for each of the second of the	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 for use (no 19.27 and any se ank in dw er (this in	es per da 5% if the a vater use, I May Vd,m = fa: 94.08 94.08 123.27 hot water 18.49 olar or Welling, encludes i	y Vd,av lwelling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37 15.96 /WHRS nter 110	erage = designed to ld) Jul Table 1c x 90.08 m x nm x E 98.57 enter 0 in 14.79 storage 0 litres in neous co	(25 x N) to achieve Aug (43) 94.08 77m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 17.17 ame ves	Oct 102.09 Total = Sun 133.39 Total = Sun 20.01	Nov 106.09 m(44) _{1 12} = 12bles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 23.72		(43) (44) (45) (46) (47)
if TFA £ 13.9, N = Annual average hot v Reduce the annual average not more that 125 litres per Jan Feb Hot water usage in litres p (44)m= 110.1 106.09 Energy content of hot water (45)m= 163.27 142.8 If instantaneous water head (46)m= 24.49 21.42 Water storage loss: Storage volume (litre) If community heating Otherwise if no store Water storage loss: a) If manufacturer's and the storage loss: a) If manufacturer's and the storage loss: a) If manufacturer's and the storage loss: a)	1 + 1.76 x 1 vater usage hot water r person per Mar er day for each 102.09 102.09 147.36 147.36 1ting at point 22.1 s) includir and no tail dhot water declared I com Table	ge in litre usage by r day (all w Apr ach month 98.09 culated me 128.47 t of use (not 19.27 ank in dw er (this ir oss factor 2b	es per da 5% if the of water use, I May Vd,m = fact 94.08 123.27 hot water 18.49 color or W welling, encludes in or is known	y Vd,av lwelling is not and co Jun ctor from 7 90.08 190 x Vd,r 106.37 15.96 /WHRS nter 110	erage = designed to designed t	(25 x N) to achieve Aug (43) 94.08 77m / 3600 113.11 boxes (46) 16.97 within sa (47)	+ 36 a water us Sep 98.09 0 kWh/mor 114.46 17.17 ame vess ers) ente	Oct 102.09 Total = Sun 133.39 Total = Sun 20.01	Nov 106.09 m(44) _{1 12} = sbles 1b, 1 145.61 m(45) _{1 12} = 21.84	Dec 110.1 c, 1d) 158.12 c 23.72		(43) (44) (45) (46) (47)

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51) 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) × (51) × (52) × (53) = 1.03 (54) Enter (50) or (54) in (55) 1.03 (55) Water storage loss calculated for each month ((56)m = (55) × (41)m (56)m = 32.01 28.92 32.01 30.98 32.01
Volume factor from Table 2a Temperature factor from Table 2b Energy lost from water storage, kWh/year Enter (50) or (54) in (55) Water storage loss calculated for each month ((56)m = (32.01 28.92 32.01 30.98 3
Temperature factor from Table 2b
Energy lost from water storage, kWh/year Enter (50) or (54) in (55) Water storage loss calculated for each month ((56)m = (55) × (41)m) (56)m = 32.01 28.92 32.01 30.98 32.01 30
Enter (50) or (54) in (55) Water storage loss calculated for each month ((56)m = (55) × (41)m) (56)m = 32.01 28.92 32.01 30.98 32.0
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 30.98 32.01 30.98 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 (57)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 30.98 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 thermostat) (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 month (61)m = (60) ÷ 365 × (41)m (61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where $(H11)$ is from Appendix H (57)m = 32.01 28.92 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 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 $(59)m = (58) \div 365 \times (41)m$ (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)m = 23.26 21.01 23.26 22.51 23.26 22.51 23.26 22.51 23.26 22.51 23.26 (59) Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$ (61)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(57)m= 32.01 28.92 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 30.98 32.01 (57) Primary circuit loss (annual) from Table 3 Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)m= 23.26 21.01 23.26 22.51 23.26 22.51 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 0 0 0 0 0 0
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)m= $\begin{bmatrix} 23.26 & 21.01 & 23.26 & 22.51 & 23.26 & $
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)m= $\begin{bmatrix} 23.26 & 21.01 & 23.26 & 22.51 & 23.26 $
(59)m= 23.26 21.01 23.26 22.51 23.26 22.51 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 0 0 (61)
Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$ $(61)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= 218.55 192.73 202.63 181.96 178.55 159.87 153.85 168.39 167.95 188.67 199.1 213.4 (62)
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)
(63)m =
Output from water heater
(64)m= 218.55 192.73 202.63 181.96 178.55 159.87 153.85 168.39 167.95 188.67 199.1 213.4
Output from water heater (annual) _{1 12} 2225.64 (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= 98.51 87.42 93.22 85.51 85.21 78.16 77 81.83 80.85 88.57 91.21 96.8 (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= 138.71 138.71 138.71 138.71 138.71 138.71 138.71 138.71 138.71 138.71 138.71 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
(67)m= 23.58 20.94 17.03 12.9 9.64 8.14 8.79 11.43 15.34 19.48 22.73 24.24 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m= 262.78 265.5 258.63 244 225.54 208.18 196.59 193.86 200.73 215.36 233.83 251.18 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 36.87 36.87 36.87 36.87 36.87 36.87 36.87 36.87 36.87 36.87 36.87 36.87 36.87 (69)
Pumps and fans gains (Table 5a)
(70)m =
Losses e.g. evaporation (negative values) (Table 5)
(71)m= -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 -110.97 (71)
(71)m= -110.97

Total inte	rnal	gains =					(66))m + (67)m	ı + (68	3)m +	· (69)m + (7	70)m +	(71)m + (72)	m		
(73)m= 483	3.38	481.15	465.57	440.28	414.32	2 3	89.49	373.48	379	.89	392.98	418.5	1 447.86	470.13		(73)
6. Solar g	gains	:								'	· ·					
Solar gains	are c	alculated i	using sola	ar flux fror	n Table 6	a and	d assoc	iated equa	tions	to co	nvert to the	applic	able orientat	ion.		
Orientation			actor	Are	_		Flu			_	g_ - l- l - Ol-		FF		Gains	
		able 6d		m²			ı aı	ble 6a			able 6b	_	Table 6c		(W)	_
Northeast 0).9x	0.77	x	4	.24	X	1	1.28	X		0.63	X	0.7	=	14.62	(75)
Northeast 0).9x	0.77	×	4	.24	X	2	22.97	X		0.63	X	0.7	=	29.76	(75)
Northeast 0).9x	0.77	×	4	.24	X	4	1.38	X		0.63	X	0.7	=	53.62	(75)
Northeast 0	느	0.77	×	4	.24	X	6	37.96	X		0.63	×	0.7		88.06	(75)
Northeast 0		0.77	x	4	.24	X	9	1.35	X		0.63	X	0.7	=	118.37	(75)
Northeast 0	느	0.77	×	4	.24	X	9	7.38	X		0.63	X	0.7	=	126.19	(75)
Northeast 0		0.77	x	4	.24	X		91.1	X		0.63	X	0.7	=	118.05	(75)
Northeast 0	느	0.77	×	4	.24	X	7	2.63	X		0.63	X	0.7	=	94.11	(75)
Northeast 0	느	0.77	×	4	.24	X	5	0.42	X		0.63	X	0.7	=	65.34	(75)
Northeast 0	느	0.77	x	4	.24	X	2	28.07	X		0.63	X	0.7	=	36.37	(75)
Northeast 0	ᆫ	0.77	X	4	.24	X		14.2	X		0.63	×	0.7	=	18.4	(75)
Northeast 0).9x	0.77	x	4	.24	X		9.21	X		0.63	X	0.7	=	11.94	(75)
East 0).9x	0.77	x	0	.69	X		9.64	X		0.63	X	0.7	=	4.14	(76)
East 0).9x	0.77	×		.8	X		9.64	X		0.5	X	0.7	=	8.57	(76)
East 0).9x	0.77	×	1	.44	X	1	9.64	X		0.5	X	0.7	=	6.86	(76)
East 0).9x	0.77	×	0	.69	X	3	88.42	X		0.63	X	0.7	=	8.1	(76)
East 0).9x	0.77	×		.8	X	3	88.42	X		0.5	X	0.7	=	16.77	(76)
East 0).9x	0.77	×	1	.44	X	3	88.42	X		0.5	X	0.7	=	13.42	(76)
East 0).9x	0.77	×	0	.69	X	6	3.27	X		0.63	X	0.7	=	13.34	(76)
).9x	0.77	×		.8	X	6	3.27	X		0.5	X	0.7	=	27.62	(76)
).9x	0.77	x	1	.44	X	6	3.27	X		0.5	X	0.7	=	22.1	(76)
East 0).9x	0.77	×	0	.69	X	9	2.28	X		0.63	X	0.7	=	19.46	(76)
).9x	0.77	×		.8	X	9	2.28	X		0.5	X	0.7	=	40.29	(76)
).9x	0.77	×	1	.44	X		2.28	X		0.5	×	0.7	=	32.23	(76)
).9x	0.77	×	0	.69	X	1	13.09	X		0.63	X	0.7	=	23.85	(76)
).9x	0.77	×		.8	X	1	13.09	X		0.5	X	0.7	=	49.38	(76)
East 0).9x	0.77	x	1	.44	X	1	13.09	X		0.5	X	0.7	=	39.5	(76)
East 0).9x	0.77	×	0	.69	X	1	15.77	X		0.63	X	0.7	=	24.41	(76)
East 0).9x	0.77	X		.8	X	1	15.77	X		0.5	×	0.7	=	50.54	(76)
).9x	0.77	×	1	.44	X	1	15.77	x		0.5	X	0.7	=	40.44	(76)
).9x	0.77	×	0	.69	X	1	10.22	x		0.63	X	0.7	=	23.24	(76)
).9x	0.77	X		.8	X	1	10.22	X		0.5	X	0.7	=	48.12	(76)
).9x	0.77	×	1	.44	X	1	10.22	X		0.5	X	0.7	=	38.5	(76)
East 0).9x	0.77	X	0	.69	X	9	94.68	X		0.63	X	0.7	=	19.96	(76)

_												_
East 0.9x	0.77	X	1.8	X	94.68	X	0.5	X	0.7	=	41.33	(76)
East 0.9x	0.77	X	1.44	x	94.68	X	0.5	X	0.7	=	33.07	(76)
East 0.9x	0.77	X	0.69	X	73.59	X	0.63	X	0.7	=	15.52	(76)
East 0.9x	0.77	X	1.8	X	73.59	X	0.5	x	0.7	=	32.13	(76)
East 0.9x	0.77	X	1.44	X	73.59	X	0.5	X	0.7	=	25.7	(76)
East 0.9x	0.77	X	0.69	x	45.59	X	0.63	X	0.7	=	9.61	(76)
East 0.9x	0.77	X	1.8	x	45.59	X	0.5	x	0.7	=	19.9	(76)
East 0.9x	0.77	x	1.44	x	45.59	x	0.5	x	0.7	=	15.92	(76)
East 0.9x	0.77	x	0.69	x	24.49	X	0.63	X	0.7	=	5.16	(76)
East 0.9x	0.77	x	1.8	x	24.49	X	0.5	x	0.7] =	10.69	(76)
East 0.9x	0.77	x	1.44	x	24.49	x	0.5	x	0.7	=	8.55	(76)
East 0.9x	0.77	x	0.69	x	16.15	x	0.63	x	0.7	=	3.41	(76)
East 0.9x	0.77	x	1.8	x	16.15	x	0.5	x	0.7	=	7.05	(76)
East 0.9x	0.77	x	1.44	x	16.15	x	0.5	x	0.7	=	5.64	(76)
Southeast _{0.9x}	0.77	X	1.44	x	36.79	X	0.63	X	0.7	=	16.19	(77)
Southeast _{0.9x}	0.77	x	2.64	x	36.79	x	0.63	x	0.7	=	29.69	(77)
Southeast _{0.9x}	0.77	x	1.44	x	62.67	x	0.63	x	0.7	=	27.58	(77)
Southeast _{0.9x}	0.77	x	2.64	x	62.67	x	0.63	x	0.7] =	50.57	(77)
Southeast _{0.9x}	0.77	x	1.44	x	85.75	x	0.63	x	0.7	=	37.74	(77)
Southeast _{0.9x}	0.77	x	2.64	x	85.75	x	0.63	x	0.7] =	69.19	(77)
Southeast _{0.9x}	0.77	x	1.44	x	106.25	x	0.63	x	0.7	=	46.76	(77)
Southeast _{0.9x}	0.77	x	2.64	x	106.25	x	0.63	x	0.7	j =	85.73	(77)
Southeast _{0.9x}	0.77	x	1.44	x	119.01	x	0.63	x	0.7	j =	52.37	(77)
Southeast _{0.9x}	0.77	x	2.64	×	119.01	x	0.63	x	0.7	j =	96.02	(77)
Southeast _{0.9x}	0.77	x	1.44	x	118.15	x	0.63	x	0.7	j =	52	(77)
Southeast _{0.9x}	0.77	x	2.64	x	118.15	x	0.63	x	0.7] =	95.33	(77)
Southeast _{0.9x}	0.77	x	1.44	x	113.91	x	0.63	x	0.7	=	50.13	(77)
Southeast 0.9x	0.77	x	2.64	x	113.91	x	0.63	x	0.7] =	91.9	(77)
Southeast _{0.9x}	0.77	x	1.44	×	104.39	x	0.63	x	0.7] =	45.94	(77)
Southeast 0.9x	0.77	x	2.64	x	104.39	x	0.63	x	0.7	j =	84.22	(77)
Southeast _{0.9x}	0.77	х	1.44	x	92.85	x	0.63	x	0.7] =	40.86	(77)
Southeast _{0.9x}	0.77	х	2.64	x	92.85	x	0.63	x	0.7	=	74.91	(77)
Southeast 0.9x	0.77	x	1.44	x	69.27	x	0.63	x	0.7	j =	30.48	(77)
Southeast _{0.9x}	0.77	х	2.64	x	69.27	x	0.63	x	0.7] =	55.89	(77)
Southeast _{0.9x}	0.77	х	1.44	x	44.07	x	0.63	x	0.7	=	19.39	(77)
Southeast 0.9x	0.77	x	2.64	x	44.07	x	0.63	x	0.7	j =	35.56	(77)
Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.63	x	0.7] =	13.86	(77)
Southeast 0.9x	0.77	x	2.64	x	31.49	x	0.63	x	0.7	j =	25.4	(77)
Northwest 0.9x	0.77	x	8.66	x	11.28	x	0.5	x	0.7	j =	23.7	(81)
Northwest 0.9x	0.77	x	8.66	x	22.97	x	0.5	x	0.7] =	48.24	(81)
Northwest _{0.9x}	0.77	X	8.66	x	41.38	X	0.5	x	0.7	=	86.92	(81)

Northwest 0.9	9x 0.77	X	8.6	66	X	67.96	X		0.5	X	0.7	=	142.74	(81)
Northwest 0.9	9x 0.77	X	8.6	66	x	91.35	x		0.5	x	0.7	=	191.87	(81)
Northwest 0.9	9x 0.77	X	8.6	66	x	97.38	x		0.5	x	0.7	=	204.55	(81)
Northwest 0.	9x 0.77	x	8.6	66	x	91.1	x		0.5	x	0.7	=	191.36	(81)
Northwest 0.9	9x 0.77	X	8.6	66	x	72.63	x		0.5	x	0.7		152.55	(81)
Northwest 0.	9x 0.77	X	8.6	66	x	50.42	×		0.5	x	0.7	_	105.91	(81)
Northwest 0.	9x 0.77	X	8.6	66	x	28.07	x		0.5	x	0.7	=	58.95	(81)
Northwest 0.9	9x 0.77	X	8.6	66	x	14.2	x		0.5	x	0.7	=	29.82	(81)
Northwest 0.9	9x 0.77	X	8.6	66	x	9.21	x		0.5	x	0.7	=	19.35	(81)
Solar gains	in watts, c	alculated	for eac	h month			(83)r	n = S	um(74)m	(82)m			_	
(83)m= 103.	77 194.44	310.53	455.26	571.35	593.	.46 561.3	47	1.19	360.37	227.13	127.58	86.65		(83)
Total gains	– internal a	and solar	(84)m =	= (73)m ·	+ (83)m , watts	•					•		
(84)m= 587.	15 675.6	776.1	895.54	985.67	982	.95 934.78	85°	1.08	753.35	645.64	575.43	556.79		(84)
7. Mean ir	ternal tem	perature	(heating	season)							-		
	ıre during l		`		,	ea from Ta	ahle 9) Th	1 (°C)				21	(85)
·	factor for g	•			•			,	. (0)					(55)
Ja	T	Mar	Apr	May	Ju	1	<u> </u>	Aug	Sep	Oct	Nov	Dec]	
(86)m= 1	-	0.99	0.97	0.91	0.7		+	.7	0.91	0.99	1	1		(86)
		I	<u> </u>		<u> </u>					0.00	<u> </u>	<u> </u>		()
	rnal temper	1		`		- i				00.04	10.75	1 40 00	1	(07)
(87)m= 19.3	19.53	19.82	20.23	20.61	20.8	87 20.96	20	.94	20.73	20.24	19.75	19.36		(87)
Temperati	ire during l	neating p	eriods ir	rest of	dwel	ling from	Гable	9, TI	12 (°C)				-	
(88)m= 19.7	75 19.75	19.75	19.76	19.77	19.	78 19.78	19	.78	19.77	19.77	19.76	19.76		(88)
Utilisation	factor for g	ains for	rest of d	wellina.	h2.m	(see Tab	le 9a)							
(89)m= 1	1	0.99	0.96	0.87	0.6	` 	$\overline{}$	55	0.84	0.98	1	1]	(89)
Moon into	nal tempe	ratura in	the rest	of dwalli	na T	2 (follow o	tona '	2 +0 -	7 in Tabl	0.00)			ı	
(90)m= 17.	 · _ · _	18.26	18.85	19.38	19.0	`	-i	.76	19.54	18.88	18.15	17.58	1	(90)
(00)111	0 17.00	10.20	10.00	10.00	10.	10.77	1 10				ng area ÷ (4		0.33	(91)
											.g a. oa (•,	0.33	(31)
	nal tempe	rature (fo	r the wh	ole dwe	lling)	= fLA × T	1 + (1	– fL	A) × T2				1	
(92)m= 18.1		18.78	19.31	19.79	20.0			.15	19.94	19.34	18.68	18.17		(92)
Apply adju	1	he mear	interna	temper	ature	from Tab	le 4e,	whe	re appro	priate			1	
(93)m= 18.1	19 18.4	18.78	19.31	19.79	20.0	09 20.17	20	.15	19.94	19.34	18.68	18.17		(93)
8. Space h	neating req	uirement												
	ne mean in				ned a	t step 11 d	of Tab	le 9b	o, so tha	t Ti,m=(76)m an	d re-cald	culate	
the utilisat				I			Τ.				1	Ι_	1	
Ja		Mar	Apr	May	Jι	ın Jul	<u> </u>	lug	Sep	Oct	Nov	Dec		
	factor for g	1 	r					_					1	(0.4)
(94)m= 1	0.99	0.98	0.95	0.88	0.7	1 0.53	0	.6	0.86	0.97	0.99	1		(94)
	ns, hmGm	· `	``				.				1	l	1	(05)
(95)m= 585.		764.03	855.15	863.11	701		1 508	8.75	644.23	628	571.74	555.27]	(95)
	/erage exte		 	1			1			40 -	T = /		1	(00)
(96)m= 4.3		6.5	8.9	11.7	14.			5.4	14.1	10.6	7.1	4.2]	(96)
Heat loss (97)m= 2058	rate for me	r		1174.72	Lm , 787		`				1,000 = 5	2048.88	1	(97)
				. 11// 77	. /97	.97 512.16	- F29	3.04	842.42	1268.78	1690.23	שם שורותי ו		14/1

Space heating requirement for each month, kWh/month = 0.024	x [(97)n	n – (95))m] x (41	1)m			
(98)m= 1096.33 889.51 778.03 475.7 231.84 0 0	0	0	476.74	805.31	1111.25		
	Total p	per year ((kWh/year) = Sum(98	8) _{15,912} =	5864.72	(98)
Space heating requirement in kWh/m²/year						56.34	(99)
9b. Energy requirements – Community heating scheme							
This part is used for space heating, space cooling or water heatin Fraction of space heat from secondary/supplementary heating (Ta	• .	-		unity sch	neme.	0	(301)
Fraction of space heat from community system 1 – (301) =					[1	(302)
The community scheme may obtain heat from several sources. The procedure allowincludes boilers, heat pumps, geothermal and waste heat from power stations. See Fraction of heat from Community heat pump			ıp to four d	other heat	sources; th	ne latter	(303a)
Fraction of heat from Community heat pump (Water)					Ī	0.8	(303a)
Fraction of community heat from heat source 2 (Water)					Ĭ	0.2	(303b)
Fraction of total space heat from Community heat pump			(30	02) x (303a	a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for communication	ity heati	ing syst	em		Ī	1	(305)
Distribution loss factor (Table 12c) for community heating system					Ī	1.05	(306)
Distribution loss factor (Table 12c) for community heating system	(Water))				1.05	(306)
Space heating					-	kWh/yea	<u>r</u>
Annual space heating requirement						5864.72	
					Ļ		
Space heat from Community heat pump	((98) x (30	14a) x (305	5) x (306) =	= [_	6157.95	(307a)
Space heat from Community heat pump Efficiency of secondary/supplementary heating system in % (from					- [(307a) (308
	Table 4	4a or A		E)	_ = [[6157.95	╡`
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system.) Water heating	Table 4	4a or A	ppendix	E)	- [[6157.95 0 0	(308
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system.) Water heating Annual water heating requirement	Table 4	4a or A	ppendix	E)	= [[[6157.95	(308
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system.) Water heating	n Table 4 m (4a or A	ppendix 11) x 100 ÷	E)]]]	6157.95 0 0	(308
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system.) Water heating Annual water heating requirement If DHW from community scheme:	n Table 4 m (4a or A (98) x (30 (64) x (30	ppendix 11) x 100 ÷	E) - (308) =	[[_ _	0 0 0 2225.64	(308
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system. Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water)	n Table 4 m (4a or A (98) x (30 (64) x (30 (64) x (30	ppendix 11) x 100 ÷ 13a) x (305 13a) x (305	E) - (308) = - (306) = - ([[= [0 0 2225.64 1869.54	(308 (309) (310a)
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system. Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water)	n Table 4 m ((((0.01 ×	4a or A (98) x (30 (64) x (30 (64) x (30 x [(307a)	ppendix 11) x 100 ± 13a) x (305 13a) x (305 (307e) +	E) - (308) = - (306) = - (5) x	= = = [310e)] =	0 0 0 2225.64 1869.54 467.38	(308 (309) (310a) (310b)
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system. Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution	n Table 4 m ((((0.01 ×	4a or A (98) x (30 (64) x (30 (64) x (30 x [(307a)	ppendix 11) x 100 ± 13a) x (305 13a) x (305 (307e) +	E) - (308) = - (308) = - (306) = - (310a) (= = = [310e)] =	0 0 2225.64 1869.54 467.38 61.58	(308 (309) (310a) (310b) (313)
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system. Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water)	n Table 4 m (0.01 × 0.01 ×	4a or A (98) x (30 (64) x (30 (64) x (30 x [(307a)	ppendix 11) x 100 ± 13a) x (305 13a) x (305 (307e) + (307e) +	E) - (308) = - (308) = - (306) = - (310a) (= = = [310e)] =	0 0 2225.64 1869.54 467.38 61.58 23.37	(308 (309) (310a) (310b) (313) (313)
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system. Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water) Cooling System Energy Efficiency Ratio	n Table 4 m (0.01 × 0.01 ×	4a or A (98) x (30 (64) x (30 (64) x (30 (64) x (30 (307a)	ppendix 11) x 100 ± 13a) x (305 13a) x (305 (307e) + (307e) +	E) - (308) = - (308) = - (306) = - (310a) (= = = [310e)] =	0 0 0 2225.64 1869.54 467.38 61.58 23.37	(308 (309) (310a) (310b) (313) (313) (314)
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water) Cooling System Energy Efficiency Ratio Space cooling (if there is a fixed cooling system, if not enter 0) Electricity for pumps and fans within dwelling (Table 4f):	n Table 4 m (0.01 × 0.01 ×	4a or A (98) x (30 (64) x (30 (64) x (30 (64) x (30 (307a)	ppendix 11) x 100 ± 13a) x (305 13a) x (305 (307e) + (307e) +	E) - (308) = - (308) = - (306) = - (310a) (= = = [310e)] =	6157.95 0 0 2225.64 1869.54 467.38 61.58 23.37 0	(308 (309) (310a) (310b) (313) (313) (314) (315)
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system.) Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water) Cooling System Energy Efficiency Ratio Space cooling (if there is a fixed cooling system, if not enter 0) Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from or	n Table 4 m (0.01 × 0.01 ×	4a or A (98) x (30 (64) x (30 (64) x (30 (64) x (30 (307a)	ppendix 11) x 100 ± 13a) x (305 13a) x (305 (307e) + (307e) +	E) - (308) = - (308) = - (306) = - (310a) (= = = [310e)] =	6157.95 0 0 2225.64 1869.54 467.38 61.58 23.37 0 0	(308 (309) (310a) (310b) (313) (313) (314) (315) (330a)
Efficiency of secondary/supplementary heating system in % (from Space heating requirement from secondary/supplementary system.) Water heating Annual water heating requirement If DHW from community scheme: Water heat from CHP (Water) Water heat from heat source 2 (Water) Electricity used for heat distribution Electricity used for heat distribution (Water) Cooling System Energy Efficiency Ratio Space cooling (if there is a fixed cooling system, if not enter 0) Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from or warm air heating system fans	m (0.01 × 0.01 × utside	4a or A (98) x (30 (64) x (30 (64) x (30 (64) x (30 (307a) = (107) ÷	ppendix 11) x 100 ± 13a) x (305 13a) x (305 (307e) + (307e) +	E) - (308) = - (308) = - (306) = - (310a) (- (310a) (= = = [310e)] =	6157.95 0 0 2225.64 1869.54 467.38 61.58 23.37 0 0	(308 (309) (310a) (310b) (313) (313) (314) (315) (330a) (330b)

12b. CO2 Emissions – Community heati	ng scheme				
		Energy kWh/year	Emission facto kg CO2/kWh	r Emissions kg CO2/year	
CO2 from other sources of space and w	ater heating (not CHE	_	kg 002kWii	kg CO2/year	
Efficiency of heat source 1 (%)		sing two fuels repeat (363) to	(366) for the second fu	uel 290	(367a)
CO2 associated with heat source 1	[(307b	o)+(310b)] x 100 ÷ (367b) x	0.52	1102.06	(367)
Electrical energy for heat distribution		[(313) x	0.52	31.96	(372)
Water heating from separate community	system				
CO2 from other sources of space and v			(266) for the coord for	uol.	¬
Efficiency of heat source 1 (%)		sing two fuels repeat (363) to		290	(367a)
Efficiency of heat source 2 (%)	If there is CHP us	sing two fuels repeat (363) to	(366) for the second fu	uel 100	(367b)
CO2 associated with heat source 1	[(307b	o)+(310b)] x 100 ÷ (367b) x	0	334.58	(367)
CO2 associated with heat source 2	[(307b	b)+(310b)] x 100 ÷ (367b) x	0.52	= 242.57	(368)
Electrical energy for heat distribution		[(313) x	0.52	12.13	(372)
Total CO2 associated with community sy	vstems	(363) (366) + (368)(372	2)	1723.3	(373)
CO2 associated with space heating (sec	ondary)	(309) x	0	= 0	(374)
CO2 associated with water from immers	on heater or instanta	neous heater (312) x	0.52	= 0	(375)
Total CO2 associated with space and wa	ater heating	(373) + (374) + (375) =		1723.3	(376)
CO2 associated with electricity for pump	s and fans within dwe	elling (331)) x	0.52	= 0	(378)
CO2 associated with electricity for lighting	g	(332))) x	0.52	216.14	(379)
Total CO2, kg/year	sum of (376) (382) =			1939.44	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			18.63	(384)
El rating (section 14)				82.57	(385)

			User E	Detaile:						
Assessor Name:	Chris Hock	nell	—	Strom	o Nive	bor:		STD0	016363	
Software Name:	Stroma FS/			Softwa					n: 1.0.4.26	
Software Name:	Stroma FS/		Duan anti-					versic)II. I.U. 4 .20	
A 1.1	FI-+ 05 54 C		Property			-Green				
Address:		Calthorpe Stree	et, LOND	ON, WC	1X 0HH					
1. Overall dwelling dime	ensions:		_	(0)						· ·
Craying floor				a(m²)	l., .		eight(m)	_	Volume(m ³	<u>-</u>
Ground floor				75.09	(1a) x		2.4	(2a) =	180.22	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1n)	75.09	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	180.22	(5)
2. Ventilation rate:										
	main heating	seconda heating		other		total			m³ per hou	ır
Number of chimneys	0	+ 0	+ [0] = [0	X	40 =	0	(6a)
Number of open flues	0	+ 0		0	j = [0	x	20 =	0	(6b)
Number of intermittent fa	ans	<u> </u>				3	x	10 =	30	(7a)
Number of passive vents	<u>.</u>				F	0	x	10 =	0	(7b)
·					Ļ			40 =		= '
Number of flueless gas f	ires					0		40 -	0	(7c)
								Air ch	anges per ho	our
Infiltration due to chimne	vs flues and fa	ns = (6a)+(6b)+	·(7a)+(7b)+((7c) =	Г	30		÷ (5) =	0.17	(8)
If a pressurisation test has b					_ continue fr			. (3) –	0.17	(0)
Number of storeys in t			, ca to (17),			c (c) to	(10)		0	(9)
Additional infiltration		,					[(9])-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or	timber frame	or 0.35 fo	r masoni	rv constr	ruction		, .j	0	(11)
if both types of wall are p					•				0	(
deducting areas of openi	• /									_
If suspended wooden		` ,	0.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	iter 0.05, else e	enter 0							0	(13)
Percentage of window	s and doors dra	aught stripped							0	(14)
Window infiltration				0.25 - [0.2	2 x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expresse	d in cubic met	res per ho	our per s	quare m	etre of e	envelope	area	5	(17)
If based on air permeabi	lity value, then	$(18) = [(17) \div 20]$	+(8), otherw	rise (18) = ((16)				0.42	(18)
Air permeability value applie	es if a pressurisatio	n test has been d	one or a de	gree air pe	rmeability	is being u	sed			_
Number of sides sheltered	ed								1	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	19)] =			0.92	(20)
Infiltration rate incorpora	ting shelter fact	tor		(21) = (18) x (20) =				0.39	(21)
Infiltration rate modified	for monthly win	d speed		_				_	•	
Jan Feb	Mar Apr	May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table	e 7								
(22)m= 5.1 5	4.9 4.4	4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (00-) (0	2)									
Wind Factor (22a)m = $(2^{22})^{m-1}$		100 005	0.05	1 000	1		1	1	1	

1.1

1.08

0.95

0.95

0.92

1.08

1.12

1.18

1.23

(22a)m=

1.27

1.25

24c)m= 0 d) If natura	th heat recovered mechan of the dispersion of th	tion: sing Appervery: effice unical very unical very oract very (23b), t	endix N, (2 entilation 0 entilation 0 entilation chilation (240	3b) = (23a allowing f with head of without of positive of the control of the cont	a) × Fmv (effor in-use for in-use	equation (Nactor (from Pry (MVI)) 0 covery (Nactor (n Table 4h HR) (24a 0 MV) (24b) = a)m = (22 0 b)m = (22	2b)m + (2	0	0.45 1 - (23c)	0 0 0 ÷ 100]	(23a (23d (23d (24a
If mechanic If exhaust air If balanced wi a) If balance 24a)m= 0 b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	th heat reconsed mechanical wentilate the mechanical me	tion: sing Appervery: effice unical very unical very oract very (23b), t	endix N, (2 entilation 0 entilation 0 entilation chilation (240	3b) = (23a allowing f with head of without 0 or positive) = (23b)	a) × Fmv (effor in-use for in-use	equation (Nactor (from Pry (MVI)) 0 covery (Nactor (n Table 4h HR) (24a 0 MV) (24b) = a)m = (22 0 b)m = (22	2b)m + (2	0	<u> </u>	0	(23)
If balanced wi a) If balance 24a)m= 0 b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	th heat recorded mechan of the desired mechan of the desired mechan of the desired mechan of the desired mechan of the desired mechan of the desired mechan of the desired mechanism of the desired	very: effice anical very of the control of the cont	entilation o entilation o entilation o entilation o then (240)	allowing f with her 0 without 0 or positive) = (23b	for in-use for at recover 0 heat recover 0 ve input v	actor (from ery (MVI 0 covery (N 0	n Table 4h HR) (24a 0 MV) (24b) = a)m = (22 0 b)m = (22	2b)m + (2	0	<u> </u>	0	(23)
a) If balance 24a)m= 0 b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	ed mecha ed mecha house ext m < 0.5 × 0 I ventilatio m = 1, the	nnical ve 0 nnical ve 0 ract ver (23b), t	entilation o entilation o ntilation o then (240	with head of without of positive of the control of	at recover the street of the s	ery (MVI 0 covery (N 0	HR) (24a 0 MV) (24b 0	a)m = (22) a)m = (22) a)m = (22)	0	0	<u> </u>		
24a)m= 0 b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	o ded mechalo o	o inical ve 0 ract ver (23b), t 0	0 entilation 0 ntilation chen (240	without o or positive c) = (23b)	neat rec	ocovery (No	0 ИV) (24b	0 0)m = (22	0	0	<u> </u>	÷ 100]	(24
b) If balance 24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	eed mecha o house ext m < 0.5 × o ventilatio m = 1, the	nnical ver 0 ract ver (23b), t 0 n or wh	entilation o ntilation o then (24o	without or positive) = (23b	heat rec	covery (N o ventilation	иV) (24b)m = (22			0		(24
24b)m= 0 c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	house ext m < 0.5 × 0 I ventilatio m = 1, the	oract ven (23b), t o	ontilation of then (24o	0 or positiv c) = (23b	0 ve input v	0 ventilatio	0	``	2b)m + (2	23b)			
c) If whole if (22b) 24c)m= 0 d) If natura if (22b)	house ext m < 0.5 × 0 I ventilatio m = 1, the	ract ven (23b), t 0 n or wh	ntilation of then (24o	or positiv	e input	ventilatio		_					
if (22b) 24c)m= 0 d) If natura if (22b)	m < 0.5 × 0 I ventilatio m = 1, the	(23b), t 0 n or wh	then (240	c) = (23b	•			0	0	0	0		(24
d) If natura if (22b)	I ventilatio m = 1, the	n or wh		Λ	,,	vise (24			5 × (23b)			
if (22b)	m = 1, the		ole hous	l	0	0	0	0	0	0	0		(24
24d)m= 0.62	0.62	··· (= ·u)							0.5]			•	
		0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6		(24
Effective ai	r change ı	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)					
25)m= 0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6		(25
3. Heat loss	es and he	at loss r	paramete	er:									
ELEMENT	Gros area (s	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/h	()	k-value kJ/m²·ł		A X k kJ/K
Doors					1.98	х	1.4	= [2.772				(26
Windows Typ	e 1				4.24	x1.	/[1/(1.6)+	0.04] =	6.38	=			(27
Vindows Typ	e 2				2.03	x1.	/[1/(1.6)+	0.04] =	3.05	=			(27
Floor					75.09) x	0.12		9.010799	<u>=</u>			(28
Walls Type1	52.54	4	8.3		44.24	x	0.23	<u> </u>	10.18				(29
Walls Type2	8.28		1.98		6.3	x	0.12	<u> </u>	0.73	T i		ī	(29
Roof	9.64		0		9.64	x	0.12	<u> </u>	1.16	T i		ī	(30
Total area of	elements,	m²			145.5	5							(31
Party wall					40.53	3 x	0	=	0				(32
Party ceiling					65.45	5						7 F	(32
for windows an						ated using	ı formula 1	/[(1/U-valu	ie)+0.04] a	s given in	paragraph	3.2	
abric heat lo	ss, W/K =	S (A x	U)				(26) (30)) + (32) =				36.32	(33
Heat capacity	/ Cm = S(/	Axk)						((28)	(30) + (32) + (32a)	(32e) =	16157.1	12 (34
Thermal mas	s paramet	er (TMF	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	(35
For design asses an be used inst				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridg	ges : S (L :	x Y) cal	culated ı	using Ap	pendix l	<						21.83	(36
f details of thern		are not kn	own (36) =	= 0.05 x (3	1)			(00) ÷	(26) -		ĺ		
Fotal fabric h		- عداريما	l manth					` '	(36) =)E\m +: /E\		58.16	(37
/entilation he	eat loss ca	Iculated Mar	Apr	y May	Jun	Jul	Aug	(38)m Sep	= 0.33 × (2	25)m x (5) Nov	Dec	1	

													(00)
(38)m= 36.91	36.63	36.36	35.08	34.84	33.72	33.72	33.51	34.15	34.84	35.32	35.83		(38)
Heat transfer of							04.07	· · · ·	= (37) + (3	·			
(39)m= 95.07	94.79	94.52	93.23	92.99	91.88	91.88	91.67	92.31	92.99	93.48	93.99	93.23	(39)
Heat loss para	meter (I	HLP), W	/m²K						Average = = (39)m ÷		12 / 12=	93.23	(39)
(40)m= 1.27	1.26	1.26	1.24	1.24	1.22	1.22	1.22	1.23	1.24	1.24	1.25		_
Number of day	/s in mo	nth (Tab	le 1a)					/	Average =	Sum(40) ₁	12 /12=	1.24	(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/ye	ar:	
Assumed occu	inancv	N									36		(42)
if TFA > 13.9	9, N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.		36		(42)
Annual averag	•	ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		90	.32		(43)
Reduce the annuant not more that 125	_				_	_	to achieve	a water us	se target o	f			
		<u> </u>		ı	ı		١ ,						
Jan Hot water usage i	Feb	Mar r day for ea	Apr	May Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m= 99.36	95.74	92.13	88.52	84.9	81.29	81.29	84.9	88.52	92.13	95.74	99.36		
(44)111- 99.30	95.74	92.13	00.32	04.9	01.29	01.29	04.9		Fotal = Su			1083.89	(44)
Energy content of	hot water	used - cal	culated me	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			` '	<u> </u>	1000.00	(/
(45)m= 147.34	128.87	132.98	115.93	111.24	95.99	88.95	102.07	103.29	120.38	131.4	142.69		
									Γotal = Su	m(45) _{1 12} =		1421.15	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46,) to (61)					
(46)m= 22.1 Water storage	19.33	19.95	17.39	16.69	14.4	13.34	15.31	15.49	18.06	19.71	21.4		(46)
Storage volum) includir	ng any so	olar or W	/WHRS	storage	within sa	ame vess	sel		0		(47)
If community h	•		•			•							` '
Otherwise if no	stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage					(1.18/1	<i>(</i>							
a) If manufact				or is kno	wn (kvvr	1/day):					0		(48)
Temperature f							(40) (40)				0		(49)
Energy lost fro b) If manufact		_	-		or is not		(48) x (49)) =		1	10		(50)
Hot water stor			-							0.	02		(51)
If community h	_		on 4.3										
Volume factor			O.I.							-	.03		(52)
Temperature f										0	.6		(53)
Energy lost fro Enter (50) or (•	e, kWh/ye	ear			(47) x (51)) x (52) x (53) =		.03		(54)
Water storage	. , .	,	for each	month			((56)m = (55) × (41)r	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)	32.01 m = (56)m	30.98 x [(50) – (32.01 H11)l ÷ (5	32.01 0). else (5	30.98 7)m = (56)	32.01 m where (30.98 H11) is fro	32.01 m Appendix	ĸН	(56)
				· · ·									(57)
(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		(37)

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 × (45)m +	+ (46)m + (57)m + (59)m + (61)m
(62)m= 202.62 178.79 188.26 169.43 166.52 149.49 144.23 157.35 156.79 175.65	```` ``
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)	and the mater meaning)
(63)m= 0 0 0 0 0 0 0 0 0 0	0 0 (63)
Output from water heater	
(64)m= 202.62 178.79 188.26 169.43 166.52 149.49 144.23 157.35 156.79 175.65	5 184.89 197.97
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= 93.21 82.79 88.44 81.34 81.21 74.71 73.8 78.16 77.14 84.25	
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is	nom community neating
5. Internal gains (see Table 5 and 5a):	
Metabolic gains (Table 5), Watts	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct	
(66)m= 118.16 118.16 118.16 118.16 118.16 118.16 118.16 118.16 118.16 118.16	6 118.16 118.16 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
(67)m= 21.05 18.69 15.2 11.51 8.6 7.26 7.85 10.2 13.69 17.38	20.29 21.63 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
(68)m= 208.87 211.04 205.58 193.95 179.27 165.48 156.26 154.1 159.56 171.18	3 185.86 199.66 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
(69)m= 34.82 34.82 34.82 34.82 34.82 34.82 34.82 34.82 34.82 34.82 34.82	34.82 34.82 (69)
Pumps and fans gains (Table 5a)	· · · · · · · · · · · · · · · · · · ·
(70)m= 0 0 0 0 0 0 0 0 0	0 0 (70)
Losses e.g. evaporation (negative values) (Table 5)	<u> </u>
(71)m= -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52 -94.52	-94.52 -94.52 (71)
Water heating gains (Table 5)	
(72)m= 125.29 123.2 118.87 112.98 109.15 103.77 99.19 105.05 107.14 113.24	1 120.12 123.21 (72)
Total internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (68)m$	(71)m + (72)m
(73)m= 413.65 411.38 398.1 376.88 355.48 334.96 321.75 327.8 338.83 360.25	5 384.72 402.94 (73)
6. Solar gains:	
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applications	able orientation.
Orientation: Access Factor Area Flux g_	FF Gains
0 _	Table 6c (W)
Northeast 0.9x 0.77 x 4.24 x 11.28 x 0.63 x	0.7 = 14.62 (75)
Northeast 0.9x	0.7 = 29.76 (75)
7.27 22.01 0.00	25.70

Northogat a a T							1		\neg				7(75)
Northeast _{0.9x}	0.77	X	4.2	4	* <u> </u>	41.38	X	0.63	×	0.7	=	53.62	(75)
Northeast 0.9x	0.77	X	4.2	.4	x	67.96	X	0.63	X	0.7	=	88.06	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	91.35	X	0.63	X	0.7	=	118.37	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	97.38	X	0.63	X	0.7	=	126.19	(75)
Northeast _{0.9x}	0.77	X	4.2	.4	x	91.1	X	0.63	X	0.7	=	118.05	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	72.63	X	0.63	X	0.7	=	94.11	(75)
Northeast 0.9x	0.77	X	4.2	.4	x	50.42	X	0.63	X	0.7	=	65.34	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	28.07	X	0.63	X	0.7	=	36.37	(75)
Northeast _{0.9x}	0.77	X	4.2	24	x	14.2	X	0.63	X	0.7	=	18.4	(75)
Northeast 0.9x	0.77	X	4.2	24	x	9.21	X	0.63	X	0.7	=	11.94	(75)
Southwest _{0.9x}	0.77	X	2.0	13	x	36.79		0.63	X	0.7	=	45.65	(79)
Southwest _{0.9x}	0.77	X	2.0	13	x	62.67]	0.63	X	0.7	=	77.76	(79)
Southwest _{0.9x}	0.77	X	2.0	13	x	85.75]	0.63	X	0.7	=	106.4	(79)
Southwest _{0.9x}	0.77	X	2.0	13	x	106.25]	0.63	X	0.7	=	131.84	(79)
Southwest _{0.9x}	0.77	X	2.0	13	x	119.01]	0.63	X	0.7	=	147.67	(79)
Southwest _{0.9x}	0.77	x	2.0	3	x	118.15	Ī	0.63	x	0.7	=	146.6	(79)
Southwest _{0.9x}	0.77	X	2.0	3	x =	113.91	Ī	0.63	x	0.7	<u> </u>	141.34	(79)
Southwest _{0.9x}	0.77	X	2.0	13	x	104.39	Ī	0.63	x	0.7	=	129.53	(79)
Southwest _{0.9x}	0.77	x	2.0	3	x	92.85	Ī	0.63	x	0.7	=	115.21	(79)
Southwest _{0.9x}	0.77	X	2.0	3	x	69.27	Ī	0.63	x	0.7	=	85.95	(79)
Southwest _{0.9x}	0.77	x	2.0	3	x	44.07	ĺ	0.63	x	0.7	=	54.68	(79)
Southwest _{0.9x}	0.77	x	2.0	3	x 🗀	31.49	ĺ	0.63	×	0.7	=	39.07	(79)
-							_						_
Solar gains in	watts, ca	lculated	for eacl	n month			(83)m	n = Sum(74)m	(82)m				
(83)m= 60.27	107.52	160.02	219.89	266.03	272.7	9 259.39	223	.64 180.54	122.3	2 73.08	51.01		(83)
Total gains – i	nternal a	nd solar	(84)m =	(73)m ·	+ (83)ı	n , watts		-			-		
(84)m= 473.93	518.91	558.11	596.78	621.51	607.7	5 581.13	551	.43 519.38	482.5	7 457.8	453.95		(84)
7. Mean inter	nal temp	erature	(heating	season)								
Temperature	during h	eating p	eriods ir	the livii	ng are	a from Ta	ble 9	, Th1 (°C)				21	(85)
Utilisation fac	ctor for ga	ains for I	iving are	ea, h1,m	(see	Table 9a)							
Jan	Feb	Mar	Apr	May	Jur	Jul	Α	ug Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.98	0.93	0.81	0.65	0.	7 0.9	0.98	1	1		(86)
Mean interna	l temper	ature in	living are	ea T1 (fo	ollow s	tens 3 to	7 in T	able 9c)		•		•	
(87)m= 19.63	19.76	20	20.33	20.65	20.88	i i	20.		20.39	19.96	19.62		(87)
	ما بمنامه ام		oriodo ir		السلم							l	
Temperature (88)m= 19.87	19.87	19.87	19.89	19.89	19.9	<u> </u>	19		19.89	19.88	19.88		(88)
	<u> </u>				<u> </u>		<u> </u>	19.9	19.08	13.00	19.00		(30)
Utilisation fac	r i				·	1	T _	.		T	1 .	Ī	(00)
(89)m= 1	0.99	0.99	0.97	0.9	0.72	0.51	0.5	0.84	0.97	0.99	1		(89)
Mean interna	l tempera	ature in	the rest	of dwelli	ng T2	(follow ste	eps 3	to 7 in Tab	le 9c)	_		•	
(90)m= 18.06	18.25	18.59	19.08	19.52	19.82	19.89	19.		19.18		18.04		(90)
									fLA = Liv	ving area ÷ (4) =	0.36	(91)

Mean	internal te	mnerature	(for the wl	nole dwe	lling) = f	ΙΔ × T1	+ (1 _ fl	Δ) x T2					
(92)m=		8.79 19.	`	19.93	20.2	20.28	20.27	20.1	19.61	19.06	18.61		(92)
L			ean interna			Į							
(93)m=		8.79 19.		19.93	20.2	20.28	20.27	20.1	19.61	19.06	18.61		(93)
8. Spa	ace heating	g requirem	ent										
			temperatuns using T		ned at st	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	culate	
		Feb M		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
۱ Utilisa	tion factor		_ <u></u>	1			1	1 224					
(94)m=	1 0	.99 0.9	8 0.96	0.9	0.75	0.56	0.61	0.85	0.97	0.99	1		(94)
Useful	l gains, hm	ıGm , W =	(94)m x (8	34)m							•		
(95)m=	471.66 51	4.81 549	43 573.95	558.96	456.99	326.82	338.18	442.6	466.95	453.77	452.17		(95)
Month	ıly average	external	temperatur	e from Ta	able 8							•	
(96)m=	4.3	4.9 6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
			ternal temp	1	1	- ` 	 	<u> </u>			i	ı	
L	1361.89 13			765.03	514.56	337.86	354.74	554.08	838.19	1117.84	1354.2		(97)
			t for each i	1		1		<u> </u>		r -		İ	
(98)m=	662.34	539 477.	08 300.23	153.32	0	0	0	0	276.21	478.13	671.1	0 //	7,000
							Tota	ıl per year	(kWh/year	r) = Sum(9	8) _{15,912} =	3557.41	(98)
Space	e heating re	equiremen	it in kWh/m	²/year								47.38	(99)
9b. Ene	ergy requir	ements –	Community	/ heating	scheme)							
			heating, sp secondary							unity sch	neme.	0	(301)
Fraction	n of space	heat from	communit	y system	1 – (30	1) =						1	(302)
	-	-	in heat from s thermal and w						up to four	other heat	sources; t	he latter	
			nunity heat									1	(303a)
Fraction	n of heat fr	om Comn	nunity heat	pump (V	Vater)							0.8	(303a)
Fraction	n of comm	unity heat	from heat	source 2	(Water)							0.2	(303b)
Fraction	n of total s	pace heat	from Com	munity he	eat pum	р			(3	02) x (303	a) =	1	(304a)
Factor	for control	and charg	ing method	d (Table	4c(3)) fo	r comm	unity hea	ating sys	tem			1	(305)
Distribu	ution loss fa	actor (Tab	le 12c) for	commun	ity heati	ng syste	m					1.05	(306)
Distribu	ution loss fa	actor (Tab	le 12c) for	commun	ity heati	ng syste	m (Wate	er)				1.05	(306)
Space	heating										,	kWh/yea	<u></u>
Annual	space hea	ating requi	rement									3557.41	
Space	heat from (Communit	y heat pun	np				(98) x (30	04a) x (30	5) x (306)	=	3735.28	(307a)
Efficien	ncy of seco	ndary/sup	plementary	/ heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space l	heating red	quirement	from seco	ndary/su _l	oplemen	tary sys	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
	heating water hea	ting requi	rement									2071.99	7
	from com	• .											
	heat from ((64) x (30	03a) x (30	5) x (306)	=	1740.47	(310a)

Water heat from heat source 2 (Water)	(64) x (303a) x (305) x (306) =	435.12 (310b)
Electricity used for heat distribution	0.01 × [(307a) (307e) + (310a) (3	10e)] = 37.35 (313)
Electricity used for heat distribution (Water)	0.01 × [(307a) (307e) + (310a) (3	10e)] = 21.76 (313)
Cooling System Energy Efficiency Ratio		0 (314)
Space cooling (if there is a fixed cooling system, if I	not enter 0) = (107) ÷ (314) =	0 (315)
Electricity for pumps and fans within dwelling (Table		
mechanical ventilation - balanced, extract or positive	e input from outside	0 (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) =	0 (331)
Energy for lighting (calculated in Appendix L)		371.68 (332)
12b. CO2 Emissions – Community heating scheme		
	Energy Emission f kWh/year kg CO2/kW	factor Emissions /h kg CO2/year
CO2 from other sources of space and water heating		
(,	ere is CHP using two fuels repeat (363) to (366) for the sec	290 (367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x 0.52	= 668.49 (367)
Electrical energy for heat distribution	[(313) x 0.52	= 19.39 (372)
Water heating from separate community system		
CO2 from other sources of space and water heatin Efficiency of heat source 1 (%)	ng (not CHP) ere is CHP using two fuels repeat (363) to (366) for the sec	cond fuel 290 (367a)
Efficiency of heat source 2 (%)	ere is CHP using two fuels repeat (363) to (366) for the sec	cond fuel 100 (367b)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	= 311.48 (367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x 0.52	= 225.83 (368)
Electrical energy for heat distribution	[(313) x 0.52	= 11.29 (372)
Total CO2 associated with community systems	(363) (366) + (368)(372)	= 1236.47 (373)
CO2 associated with space heating (secondary)	(309) x	= 0 (374)
CO2 associated with water from immersion heater	or instantaneous heater (312) x 0.52	= 0 (375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =	1236.47 (376)
CO2 associated with electricity for pumps and fans	within dwelling (331)) x 0.52	= 0 (378)
CO2 associated with electricity for lighting	(332))) x 0.52	= 192.9 (379)
Total CO2, kg/year sum of (376)	(382) =	1429.37 (383)
Dwelling CO2 Emission Rate (383) ÷ (4) =		19.04 (384)
El rating (section 14)		84.05 (385)

			User D	otaile:						
Access Names	Chris Hockn		– USE I L		a Ni	ho=-		OTD O	016363	
Assessor Name:	Stroma FSA			Strom					n: 1.0.4.26	
Software Name:	Stioilia FSA		una in a inferior	Softwa				versic)II. I.U. 4 .20	
A 1.1	FI-+ 00 F4 O		•	Address		-Green				
Address:		althorpe Street	, LONDO	JN, WC	IX UHH					
1. Overall dwelling dime	ensions:									· ·
Ground floor				a(m²)	(4=)		eight(m)	_	Volume(m ³	<u>-</u>
					(1a) x		2.2	(2a) =	117.06	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1	d)+(1e)+(1r	1) 5	3.21	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	117.06	(5)
2. Ventilation rate:										
	main heating	secondar heating	' y	other		total			m³ per hou	ır
Number of chimneys	0	+ 0] + [0] = [0	X	40 =	0	(6a)
Number of open flues	0	+ 0	T + [0	Ī = [0	X	20 =	0	(6b)
Number of intermittent fa	ans	· ·			, <u> </u>	0	x	10 =	0	(7a)
Number of passive vents	S				F	0	×	10 =	0	(7b)
Number of flueless gas f	ires				F	0	x	40 =	0	(7c)
ŭ					L					`
								Air ch	anges per ho	our
Infiltration due to chimne	ys, flues and far	ns = (6a) + (6b) + (7a)	a)+(7b)+(7c) =	Γ	0		÷ (5) =	0	(8)
If a pressurisation test has b	peen carried out or is	s intended, procee	d to (17), d	otherwise o	continue fr	om (9) to	(16)			
Number of storeys in t	he dwelling (ns)								0	(9)
Additional infiltration							[(9))-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or t	timber frame or	0.35 fo	r masonr	y constr	ruction			0	(11)
if both types of wall are p deducting areas of openi			the great	er wall are	a (after					_
If suspended wooden	floor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	iter 0.05, else er	nter 0							0	(13)
Percentage of window	s and doors dra	ught stripped							0	(14)
Window infiltration				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	I in cubic metre	s 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), otherwi	ise (18) = (16)				0.15	(18)
Air permeability value applie	-					is being u	sed			
Number of sides sheltered	ed								2	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter facto	or		(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified t	for monthly wind	l 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 Easter (22a)m = (2	2)m ÷ 4									
Wind Factor (22a)m = $(2^{2})^{2}$		1.00 0.05	0.05	1 000		1 4 00	1 46	1 440	1	

1.1

1.08

0.95

0.95

0.92

1.08

1.12

1.18

1.23

(22a)m=

1.27

1.25

(24c)m= 0 d) If natura	rective air ical ventila i heat pump vith heat reco ced mecha 0.28 ced mecha 0 house ex 0)m < 0.5 > 0 al ventilatio 0)m = 1, th 0 air change 0.28	ation: using Apper overy: efficient anical ver anical ver anical ver c (23b), t 0 on or when (24d)	endix N, (2 entilation 0.26 entilation 0 ntilation (246 0 encle hous m = (221 0	allowing f with hea 0.25 without 0 or positive c) = (23b	a) × Fmv (effor in-use for in-use	equation (National Property (MV) 0.24 covery (National Property (Nat	n Table 4h HR) (24a 0.24 MV) (24b 0 on from c c) = (22b 0) = a)m = (22 0.24))m = (22 0)m = (22 0)utside b) m + 0. 0	2b)m + (2 0.25 2b)m + (2 0	0.26 23b)	0.15 1 - (23c) 0.27	0.5 0.5 76.5 ÷ 100]	(23a) (23a) (23a) (24a) (24a)
If mechanic lf exhaust air lf balanced wa) If balanced wa) If balanced wa) If balanced wa) If balanced wa) If balanced wa) If balanced was bounded if (24b)m= 0 c) If whole if (22b) was considered was a consider	ical ventilation heat pump with heat recorded mechanisms of the control of the co	ation: using Apper overy: effice anical vectorical vectorical 0 tract ver (23b), to 0 on or when (24d) 0 rate - er	endix N, (2 entilation 0.26 entilation 0 ntilation (246 0 encle hous m = (221 0	allowing f with hea 0.25 without 0 or positive c) = (23b 0 se positive c)m other	a) × Fmv (effor in-use for in-use	equation (National Property (MV) 0.24 covery (National Property (Nat	n Table 4h HR) (24a 0.24 MV) (24b 0 on from c c) = (22b 0) = a)m = (22 0.24))m = (22 0)m = (22 0)utside b) m + 0. 0	2b)m + (2 0.25 2b)m + (2 0 5 × (23b	0.26 23b) 0	0.27	0.5 76.5	(23) (23) (24) (24)
a) If balanced w a) If balanced w a) If balanced w 244a)m= 0.28 b) If balanced w 244b)m= 0 c) If whole if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a (25)m= 0.28	ced mechanic of the control of the c	overy: efficient anical version of tract version of when (24d) or rate - er	entilation 0.26 entilation 0 then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of then (246 0 entilation of the of	allowing f with hea 0.25 without 0 or positiv c) = (23t 0 se positiv c)m other	for in-use for in-use for at recover the control of	ery (MVI) 0.24 covery (N 0 ventilation ventilation ventilation ventilation ventilation	n Table 4h HR) (24a 0.24 MV) (24b 0 on from c c) = (22b 0) = a)m = (22 0.24))m = (22 0)m = (22 0)utside b) m + 0. 0	2b)m + (2 0.25 2b)m + (2 0 5 × (23b	0.26 23b) 0	0.27	0.5 76.5	(23) (23) (24) (24)
a) If balance (24a)m= 0.28 b) If balance (24b)m= 0 c) If whole if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a	ced mechanics of the control of the	anical version of tract version of the contract versio	entilation 0.26 entilation ontilation of then (24c) ontile house om = (22c) o	with head 0.25 without 0 or positive 0 c) = (23t) se positive 0)m other	at recover 10.24 heat recover 10	covery (MVI) 0.24 covery (N) ventilation vise (24) ventilation ventilation	HR) (24a 0.24 MV) (24b 0 on from 0 c) = (22b 0	a)m = (22 0.24 b)m = (22 0 outside b) m + 0.	0.25 2b)m + (2 0	0.26 23b) 0	0.27	76.5	(24)
(24a)m= 0.28 b) If baland (24b)m= 0 c) If whole if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a	0.28 ced mechange of the control of	0.27 anical veres (23b), to 0 on or when (24d) rate - er	0.26 entilation 0 ntilation (24c) 0 nole house m = (22l) 0	0.25 without 0 or positive c) = (23b 0 se positive c)m other	0.24 heat recovering only only otherwise input version of the covering of the	0.24 covery (N 0 ventilation wise (24 0 ventilation	0.24 MV) (24th 0 on from (c) = (22th 0	0.24 0)m = (22 0 0 0 0 0 m + 0.	0.25 2b)m + (2 0	0.26 23b) 0	0.27	÷ 100]	(24)
b) If baland (24b)m= 0 c) If whole if (22b) (24c)m= 0 d) If natural if (22b) (24d)m= 0 Effective at (25)m= 0.28	house ex)m < 0.5 > 0 al ventilation)m = 1, th 0 air change	anical ver tract ver (23b), t 0 on or wh en (24d) rate - er	entilation ontilation of then (24o) oliole house om = (22o) o	without 0 or positiv c) = (23t 0 se positiv c)m other	heat red ove input vo); other ove input	covery (N 0 ventilatio wise (24 0 ventilatio	MV) (24b 0 on from (c) = (22b	b)m = (22 0 cutside b) m + 0.	2b)m + (2 0 5 × (23b	23b) 0	0		(24)
c) If whole if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a	0 house ex)m < 0.5 > 0 al ventilation)m = 1, th 0 air change 0.28	tract ver (23b), t 0 on or wh en (24d) 0 rate - er	0 ntilation of then (24) 0 nole house om = (22) 0	or positive) = (23b) 0 se positive) m other	ove input o); other	ventilation vise (24 0 ventilation	0 on from (c) = (22t	0 outside o) m + 0.	0 5 × (23b	0			
c) If whole if (22b (24c)m= 0 d) If natura if (22b (24d)m= 0 Effective a (25)m= 0.28	house ex)m < 0.5 > 0 al ventilation)m = 1, th 0 air change	tract ver (23b), t 0 on or wh en (24d) 0	ole house of the control of the cont	or positive c) = (23b) 0 se positive c)m other	ve input vo); otherwood	ventilation vise (24) 0 ventilation	on from (c) = (22b	outside b) m + 0.	5 × (23b)			
if (22b) (24c)m= 0 d) If natura if (22b) (24d)m= 0 Effective a (25)m= 0.28	0)m < 0.5 > 0 al ventilatio)m = 1, th 0 air change 0.28	(23b), t 0 on or wh en (24d) 0 rate - er	0 ole house m = (221	c) = (23b 0 se positivo)m othe	o); other 0 ve input	wise (24 0 ventilation	c) = (22h	o) m + 0.	<u> </u>		0		(24
d) If natura if (22b) (24d)m= 0 Effective a (25)m= 0.28	al ventilation) m = 1, th 0 air change 0.28	on or wh en (24d) 0 rate - er	ole hous m = (221	se positive)m othe	ve input	ventilatio			0	0	0		(24)
if (22b) (24d)m= 0 Effective a (25)m= 0.28)m = 1, th 0 hir change 0.28	en (24d) 0 rate - er	m = (22l	o)m othe			on from I	- £1		U		•	
Effective a (25)m= 0.28	uir change 0.28	rate - er		0		:4a)m =			0.5]				
(25)m= 0.28	0.28		nter (24a	<u> </u>	0	0	0	0	0	0	0		(24
` '		0.27	1101 (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)	-		-		
3. Heat loss	ses and be	1	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27		(25
· · · · · · · · · · · · · · · · · · ·		eat loss i	paramet	er:									
ELEMENT		SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/ł	()	k-value kJ/m²·ł		A X k kJ/K
Doors					1.98	х	1.4	= [2.772				(26
Windows Ty	pe 1				4.95	x1.	/[1/(1.2)+	0.04] =	5.67	=			(27
Windows Ty	pe 2				1.67	x1.	/[1/(1.2)+	0.04] =	1.91	\exists			(27
Nalls Type1	29.7	77	8.29)	21.48	3 x	0.12		2.58	$\overline{\neg}$ [(29
Walls Type2	11.9	99	1.98	3	10.01	1 x	0.12	_ = [1.16	$\overline{}$ $\overline{}$		$\neg $	(29
Roof	38.7	74	0		38.74	1 x	0.12	_ = [4.65	$\overline{}$ $\overline{}$		$\neg $	(30
Total area of	elements	s, m²			80.5							_	(31
Party wall					39.44	1 x	0	= [0	\neg			(32
Party floor					53.21	1							(32
Party ceiling					14.48	3				Ī			(32
* for windows a ** include the a						lated using	formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragraph	3.2	
abric heat I	oss, W/K	= S (A x	U)				(26) (30)) + (32) =				20.65	(33
Heat capacit	y Cm = S	(Axk)						((28)	(30) + (32	!) + (32a)	(32e) =	7125.67	7 (34
hermal mas	ss parame	eter (TMF	⊃ = Cm ÷	+ TFA) ir	n kJ/m²K			Indica	tive Value:	Low		100	(35
For design asse an be used ins				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal brid	ges : S (L	x Y) cal	culated (using Ap	pendix I	K						12.08	(36
f details of then		are not kn	nown (36) =	= 0.05 x (3	11)			(20) ÷	(26) -		ĺ		
Fotal fabric h		oloulete -	1 manthi					, ,	(36) =	0E\m v (F\		32.72	(37
entilation h/ Jan	T	Mar	Apr	y May	Jun	Jul	Aug	(38)m Sep	= 0.33 × (2	25)m x (5) Nov	Dec		

	ı					.	ı			l			(22)
(38)m= 10.82	10.7	10.57	9.96	9.83	9.22	9.22	9.1	9.46	9.83	10.08	10.33		(38)
Heat transfer of		· ·							= (37) + (1			
(39)m= 43.54	43.42	43.3	42.68	42.56	41.94	41.94	41.82	42.19	42.56	42.8	43.05	40.05	(39)
Heat loss para	meter (I	HLP), W	m²K						average = = (39)m ÷	Sum(39) ₁ (4)	12 /12=	42.65	(39)
(40)m= 0.82	0.82	0.81	0.8	8.0	0.79	0.79	0.79	0.79	8.0	0.8	0.81		_
Number of day	e in mo	nth (Tah	le 1a)					,	Average =	Sum(40) ₁	12 /12=	0.8	(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>						<u> </u>			<u> </u>			
4. Water heat	tina ene	rav reaui	rement								kWh/ye	ar:	
4. Water fied	ung ene	igy roqui	rement.								KVVIII y	our.	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.(0013 x (ΓFA -13.		.78		(42)
Annual average	•	ater usag	ge in litre	s per da	y Vd,av	erage =	(25 x N)	+ 36		76	5.59		(43)
Reduce the annua							to achieve	a water us	se target o	ł			
not more that 125													
Jan Hot water usage i	Feb	Mar day for ea	Apr	May	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
								75.06	70.10	81.18	84.25		
(44)m= 84.25	81.18	78.12	75.06	71.99	68.93	68.93	71.99		78.12	m(44) _{1 12} =	<u> </u>	919.05	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x E	OTm / 3600			· /		313.00	(\.,'
(45)m= 124.94	109.27	112.76	98.3	94.32	81.39	75.42	86.55	87.58	102.07	111.42	120.99		
									Γotal = Su	m(45) _{1 12} =		1205.02	(45)
If instantaneous w		ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46 ₎) to (61)					
(46)m= 18.74 Water storage	16.39	16.91	14.75	14.15	12.21	11.31	12.98	13.14	15.31	16.71	18.15		(46)
Storage volum) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	` '					_							,
Otherwise if no	_			-			. ,	ers) ente	er '0' in (47)			
Water storage													
a) If manufact				or is kno	wn (kWf	n/day):					0		(48)
Temperature f							(10)				0		(49)
Energy lost fro b) If manufact		_	-		or is not		(48) x (49)) =		1	10		(50)
Hot water stor			-							0.	.02		(51)
If community h	_		on 4.3										
Volume factor			01							—	.03		(52)
Temperature f										0	0.6		(53)
Energy lost fro Enter (50) or (_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		.03		(54)
Water storage	. , .	,	or oach	month			((56)m = (55) v (41):	m	1.	.03		(55)
					00.00		· · · ·			00.00	00.04		(EG)
(56)m= 32.01 If cylinder contains	28.92 s dedicate	32.01 d solar sto	30.98 rage. (57)	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 m Append	ix H	(56)
-						· · · ·							(57)
(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) fr	om Table 3			0	(58)
Primary circuit loss calculated	for each month (59)m =	(58) ÷ 365 × (41))m		
(modified by factor from Tab	ole H5 if there is solar w	ater heating and a	cylinder 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 calculated for each	h month (61)m = (60) ÷ 3	365 × (41)m			
(61)m= 0 0 0	0 0 0	0 0	0 0	0 0	(61)
Total heat required for water h	neating calculated for ea	ch month (62)m =	: 0.85 × (45)m +	(46)m + (57)m +	(59)m + (61)m
(62)m= 180.21 159.2 168.03	151.8 149.6 134.89	130.7 141.83	141.08 157.35	164.91 176.27	(62)
Solar DHW input calculated using App	pendix G or Appendix H (nega	itive quantity) (enter '0	' if no solar contributi	on to water heating)	ı
(add additional lines if FGHRS	and/or WWHRS applie	s, see Appendix (3)		
(63)m= 0 0 0	0 0 0	0 0	0 0	0 0	(63)
Output from water heater	•		•		'
(64)m= 180.21 159.2 168.03	151.8 149.6 134.89	130.7 141.83	141.08 157.35	164.91 176.27	
		Out	out from water heater	(annual) _{1 12}	1855.86 (64)
Heat gains from water heating	, kWh/month 0.25 ´ [0.8	5 × (45)m + (61)n	n] + 0.8 x [(46)m	+ (57)m + (59)m]
(65)m= 85.76 76.27 81.71	75.48 75.58 69.86	69.3 73	71.92 78.16	79.84 84.45	(65)
include (57)m in calculation	of (65)m only if cylinder	is in the dwelling	or hot water is fr	om community h	neating
5. Internal gains (see Table	5 and 5a):				
Metabolic gains (Table 5), Wa	·				
Jan Feb Mar	Apr May Jun	Jul Aug	Sep Oct	Nov Dec	
(66)m= 89.24 89.24 89.24	89.24 89.24 89.24	89.24 89.24	89.24 89.24	89.24 89.24	(66)
Lighting gains (calculated in A	ppendix L, equation L9	or L9a), also see	Table 5	l l	I
(67)m= 14.55 12.92 10.51	7.95 5.95 5.02	5.42 7.05	9.46 12.02	14.02 14.95	(67)
Appliances gains (calculated in	n Appendix L. equation	 L13 or L13a). also	see Table 5	l l	I
(68)m= 155.56 157.18 153.11	144.45 133.52 123.24		118.83 127.49	138.42 148.7	(68)
Cooking gains (calculated in A	Appendix L. equation L1	5 or L15a), also s	ee Table 5	<u> </u>	I
(69)m= 31.92 31.92 31.92	31.92 31.92 31.92	31.92 31.92	31.92 31.92	31.92 31.92	(69)
Pumps and fans gains (Table	5a)	<u> </u>	l l	<u> </u>	l
(70)m= 0 0 0		0 0	0 0	0 0	(70)
Losses e.g. evaporation (nega	 				1
(71)m= -71.39 -71.39 -71.39	-71.39 -71.39 -71.39	-71.39 -71.39	-71.39 -71.39	-71.39 -71.39	(71)
Water heating gains (Table 5)	1 1	1		1 1100	` ′
(72)m= 115.27 113.5 109.83	1 1 1	93.15 98.12	99.88 105.05	110.89 113.51	(72)
Total internal gains =	<u> </u>	6)m + (67)m + (68)m	<u> </u>		` '
(73)m= 335.15 333.37 323.22	 	, , , , , , , , , , , , , , , , , , , 	277.95 294.33	313.11 326.93	(73)
6. Solar gains:	307.01 230.03 273.00	204.72 203.7	277.55 254.55	313.11 320.33	(1.5)
Solar gains are calculated using solar	ar flux from Table 6a and asso	ociated equations to co	onvert to the applicab	le orientation.	
Orientation: Access Factor		lux	g_	FF	Gains
Table 6d				able 6c	(W)
Northeast _{0.9x} 0.77 x	4.95 X	11.28 ×	0.5 x	0.7	13.55 (75)
Northeast _{0.9x} 0.77 x		22.97 ×	0.5 ×	0.7 =	27.57 (75)
-					

Northogat a a F					_		٦ .		_				— ,,
Northeast _{0.9x}	0.77	X	4.9	5	×	41.38	X	0.5	X	0.7	=	49.68	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x	67.96	X	0.5	X	0.7	=	81.59	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x	91.35	X	0.5	X	0.7	=	109.67	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x	97.38	X	0.5	X	0.7	=	116.92	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x	91.1	X	0.5	X	0.7	=	109.38	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x	72.63	X	0.5	X	0.7	=	87.2	(75)
Northeast 0.9x	0.77	X	4.9	5	x	50.42	X	0.5	X	0.7	=	60.54	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x	28.07	X	0.5	X	0.7	=	33.7	(75)
Northeast _{0.9x}	0.77	X	4.9	5	x	14.2	X	0.5	X	0.7	=	17.05	(75)
Northeast 0.9x	0.77	X	4.9	5	x	9.21	X	0.5	X	0.7	=	11.06	(75)
Northwest 0.9x	0.77	X	1.6	7	x	11.28	X	0.5	X	0.7	=	9.14	(81)
Northwest 0.9x	0.77	X	1.6	7	x	22.97	X	0.5	X	0.7	=	18.61	(81)
Northwest 0.9x	0.77	X	1.6	7	x =	41.38	X	0.5	x	0.7		33.52	(81)
Northwest _{0.9x}	0.77	x	1.6	7	x =	67.96	X	0.5	X	0.7		55.05	(81)
Northwest 0.9x	0.77	x	1.6	7	x	91.35	X	0.5	X	0.7		74	(81)
Northwest 0.9x	0.77	x	1.6	7	x	97.38	X	0.5	X	0.7		78.89	(81)
Northwest 0.9x	0.77	x	1.6	7	x	91.1	X	0.5	x	0.7		73.8	(81)
Northwest _{0.9x}	0.77	x	1.6	7	x	72.63	X	0.5	x	0.7		58.84	(81)
Northwest _{0.9x}	0.77	x	1.6	7	x 🗀	50.42	X	0.5	×	0.7	-	40.85	(81)
Northwest 0.9x	0.77	X	1.6	7	x	28.07] x	0.5	x	0.7		22.74	(81)
Northwest 0.9x	0.77	X	1.6	7	x	14.2] x	0.5	X	0.7		11.5	(81)
Northwest 0.9x	0.77	x	1.6		x 🗀	9.21	X	0.5	×	0.7		7.46	(81)
L					<u> </u>		J						 ` `
Solar gains in	watts, ca	lculated	for eacl	n month			(83)m	n = Sum(74)n	n (82)m				
(83)m= 22.69	46.18	83.2	136.64	183.67	195.8	1 183.18	146	.03 101.38	56.4	28.55	18.53		(83)
Total gains – i	nternal a	nd solar	(84)m =	(73)m ·	+ (83)	m , watts						_	
(84)m= 357.84	379.55	406.42	443.65	474.5	470.8	7 447.9	415	.74 379.33	350.7	7 341.66	345.46		(84)
7. Mean inter	nal temp	erature	(heating	season)								
Temperature						a from Tal	ble 9	, Th1 (°C)				21	(85)
Utilisation fac	ctor for ga	ains for I	iving are	a, h1,m	(see	Table 9a)							
Jan	Feb	Mar	Apr	May	Jur		A	ug Sep	Oc	t Nov	Dec]	
(86)m= 0.95	0.93	0.9	0.82	0.69	0.53	0.4	0.4	14 0.66	0.85	0.92	0.95	1	(86)
Mean interna	l temnera	ature in l	living are	a T1 (fc	llow s	tens 3 to	7 in T	ahle 9c)	<u> </u>	<u>.</u>		4	
(87)m= 19.53	19.69	20	20.42	20.75	20.93	_i	20.		20.4	19.94	19.5]	(87)
						<u> </u>	<u> </u>	<u> </u>	_!				
Temperature					1	<u> </u>	1		1	5 20.25	20.25	1	(88)
(88)m= 20.24	20.24	20.24	20.25	20.25	20.26	!	20.	27 20.26	20.2	20.25	20.25	J	(00)
Utilisation fac	, <u> </u>					·	T -		_		1	1	,:
(89)m= 0.94	0.92	0.89	8.0	0.66	0.48	0.34	0.3	38 0.61	0.82	0.91	0.95	J	(89)
Mean interna	I tempera	ature in t	the rest	of dwelli	ng T2	(follow ste	eps 3	to 7 in Ta	ble 9c)				
(90)m= 18.25	18.49	18.94	19.53	19.96	20.19	20.25	20.	24 20.1	19.5		18.22		(90)
									fLA = Li	ving area ÷ (4) =	0.43	(91)

Mean in	ternal temper	atura (fo	or the wh	ole dwe	lling) = fl	Δ × T1	+ (1 _ fl	Δ) × T2					
	8.81 19.01	19.4	19.92	20.3	20.51	20.57	20.56	20.42	19.95	19.32	18.77		(92)
` ′	ljustment to t	he mear				m Table							, ,
· · · · · —	8.81 19.01	19.4	19.92	20.3	20.51	20.57	20.56	20.42	19.95	19.32	18.77		(93)
8. Space	e heating req	uirement											
	the mean in		•		ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
	Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	n factor for g		<u> </u>				7.09	СОР					
	0.93 0.91	0.87	0.79	0.66	0.5	0.36	0.4	0.62	0.81	0.9	0.93		(94)
Useful g	ains, hmGm	, W = (94	4)m x (8	4)m						ı		ı	
(95)m= 33	31.18 344.88	353.85	350.35	313.59	233.35	162.46	168.33	235.47	285.62	307.1	321.81		(95)
Monthly	average exte	rnal tem	perature	from Ta	able 8							•	
(96)m=	4.3 4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat los	s rate for me		al tempe		Lm , W =	=[(39)m	x [(93)m	– (96)m]			•	
` ′	81.64 612.66	558.52	470.19	366.18	247.94	166.3	173.87	266.7	398.03	523.15	627.38		(97)
_	eating requir		r	ı —	I					r	l	1	
(98)m= 22	23.54 179.95	152.27	86.28	39.13	0	0	0	0	83.63	155.56	227.34		٦,,,,,
							Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1147.7	(98)
Space h	eating require	ement in	kWh/m²	²/year								21.57	(99)
9b. Energ	y requiremer	nts – Coi	mmunity	heating	scheme								
	is used for sp of space heat									unity sch	neme.	0	(301)
Fraction of	of space heat	from co	mmunity	system	1 – (30	1) =						1	(302)
	nity scheme ma								up to four	other heat	sources; ti	he latter	
	ilers, heat pump of heat from (rom powei	stations.	<i>See Арре</i> і	naix C.				1	(303a)
Fraction of	of heat from (Commun	ity heat	pump (V	Vater)							0.8	(303a)
Fraction of	of community	heat fro	m heat s	source 2	(Water)							0.2	(303b)
Fraction of	of total space	heat fro	m Comr	nunity he	eat pump)			(3	02) x (303	a) =	1	(304a)
Factor for	control and	charging	method	(Table	4c(3)) fo	r commı	unity hea	ting sys	tem			1	(305)
Distribution	on loss factor	(Table 1	12c) for (commun	ity heatii	ng syste	m					1.05	(306)
Distribution	on loss factor	(Table 1	12c) for o	commun	ity heatii	ng syste	m (Wate	er)				1.05	(306)
Space he	•										,	kWh/yea	<u>-</u>
Annual sp	pace heating	requiren	nent									1147.7	
Space he	at from Com	munity h	eat pum	р				(98) x (30	04a) x (30	5) x (306) :	=	1205.09	(307a)
Efficiency	of secondar	y/supple	mentary	heating	system	in % (fro	m Table	4a or A	ppendix	E)		0	(308
Space he	ating require	ment fro	m secon	ıdary/sur	oplemen	tary syst	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water he Annual w	ating ater heating i	reguirem	ent									1855.86	7
If DHW fr	om communi	ty schen									,		」 −
Water he	at from CHP	(Water)						(64) x (30	03a) x (30	5) x (306) :	=	1558.93	(310a)

Water heat from heat source 2 (Water)	(64) x (303a) x	(305) x (306) =	389.73	(310b)
Electricity used for heat distribution		'e) + (310a) (310e)] =	12.05	(313)
Electricity used for heat distribution (Water)	-	(e) + (310a) (310e)] =	19.49	(313)
Cooling System Energy Efficiency Ratio		Γ	0	(314)
Space cooling (if there is a fixed cooling system)	em, 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 outside		103.54	(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) =	103.54	(331)
Energy for lighting (calculated in Appendix L)			256.89	(332)
12b. CO2 Emissions – Community heating so				
	Energy kWh/year	Emission factor E	Emissions kg CO2/year	
CO2 from other sources of space and water Efficiency of heat source 1 (%)	•	_	290	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	215.67	(367)
Electrical energy for heat distribution	[(313) x	0.52	6.25	(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 repeat (363) to	(366) for the second fuel	290	(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 100 ÷ (367b) x	0 =	278.99] (367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.52	202.27	(368)
Electrical energy for heat distribution	[(313) x	0.52	10.11	(372)
Total CO2 associated with community system	1S (363) (366) + (368)(372	2) =	713.3	(373)
CO2 associated with space heating (seconda	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 I	neating (373) + (374) + (375) =		713.3	」 [376]
CO2 associated with electricity for pumps an	d fans within dwelling (331)) x	0.52	53.74	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	133.32	」 [379]
	of (376) (382) =		900.36	(383)
, , ,	÷ (4) =	Ţ	16.92	(384)
El rating (section 14)		Ĭ	87.72	(385)
		_		

			lloor F) otoilo:						
Assessor Name: Software Name:	Chris Hocknell Stroma FSAP 20		User D	Strom Softwa	are Ve	rsion:			0016363 on: 1.0.4.26	
Address	Flat 07, 51 Caltho		•	Address		-Green				
Address: 1. Overall dwelling dim		rpe Street	, LOND	JIN, VVC						
1. Overall awelling all	ichsions.		Δre	a(m²)		Δν Ηρ	eight(m)		Volume(m ²	3)
Ground floor					(1a) x		2.2	(2a) =	140.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1r	n) 6	33.73	(4)			-		
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	140.21	(5)
2. Ventilation rate:										
	main heating	secondar heating	Y	other		total			m³ per hou	ır
Number of chimneys	0 +	0] + [0	=	0	X	40 =	0	(6a)
Number of open flues	0 +	0] + [0] = [0	X :	20 =	0	(6b)
Number of intermittent	fans					0	X	10 =	0	(7a)
Number of passive ven	ts					0	×	10 =	0	(7b)
Number of flueless gas	fires					0	x -	40 =	0	(7c)
					_			A i u a b		<u> </u>
La Cita attana along taga belanga	and force	(C-) - (Ch) - (7-\./7 - \./	7-) -	_				nanges per ho	_
Infiltration due to chimn	eys, flues and fans = been carried out or is inter				continue fr	0 (9) to		÷ (5) =	0	(8)
Number of storeys in		иси, ргоссс	<i>a to (17),</i> (ourier wise (continue n	om (5) to	(10)		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration:	0.25 for steel or timbe	r frame or	0.35 fo	r masoni	ry constr	uction			0	(11)
	present, use the value corr	esponding to	the great	ter wall are	ea (after					
• .	nings); if equal user 0.35 n floor, enter 0.2 (unse	aled) or 0	1 (seale	ad) else	enter 0				0	(12)
•	enter 0.05, else enter 0	•	. i (ocaic	<i>Ju)</i> , 0.00	Cittor 0				0	(13)
•	ws and doors draught								0	(14)
Window infiltration	J	• •		0.25 - [0.2	2 x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value	e, q50, expressed in c	ubic metre	es per ho	our per s	quare m	etre of e	envelope	area	3	(17)
If based on air permeat	oility value, then (18) =	[(17) ÷ 20]+(8), otherw	ise (18) = ((16)				0.15	(18)
	lies if a pressurisation test f	nas been dor	ne or a de	gree air pe	rmeability	is being u	sed		<u> </u>	–
Number of sides shelte Shelter factor	red			(20) = 1 -	[0.075 x (1	19)1 =			1 0.00	(19)
Infiltration rate incorpor	ating shelter factor			(21) = (18	•	/1			0.92	(20)
Infiltration rate modified	-	ed			, , ,				0.14	(
Jan Feb	Mar Apr Mar	1	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind s		<u> </u>					1		J	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7]	
	20)			•			•	•	J	
Wind Factor (22a)m = (·	0.05	0.05	I 0.00		100	1 40	1 10	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	J	

Adjusted infiltra	ation rate (allov	ving for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.18	0.17 0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16]	
Calculate effec	_	rate for t	he appli	cable ca	se			!				
If mechanica	il ventilation: eat pump using Ap	nendiy N (2	3h) = (23a	a) × Emy (4	equation (N5N othe	nwise (23h	n) = (23a)			0.5	(23a)
	heat recovery: eff							,, (20a)			0.5	(23b)
	d mechanical v	-	_					2h\m + /	23h) v [:	1 (226)	76.5 ÷ 1001	(23c)
(24a)m= 0.29	0.29 0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28]	(24a)
` ′	d mechanical v	Į l		<u> </u>	ļ	<u>l</u>	<u>. </u>	ļ	ļ	0.20	J	(- 7
(24b)m= 0		0	0	0	0	0	0	0	0	0	1	(24b)
	ouse extract ve		_	<u> </u>							J	,
,	ouse extract ve o < 0.5 × (23b),		•	•				.5 × (23b))			
(24c)m= 0	0 0	0	0	0	0	0	0	0	0	0]	(24c)
d) If natural v	entilation or w	hole hous	e positiv	/e input	ventilati	on from	loft				•	
if (22b)m	n = 1, then (24c	l)m = (22b)m othe	rwise (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		(24d)
Effective air	change rate - e	enter (24a) or (24b	o) or (24	c) or (24	d) in bo	x (25)				_	
(25)m= 0.29	0.29 0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28		(25)
3. Heat losses	s and heat loss	paramete	er:									
ELEMENT	Gross area (m²)	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/l		k-value kJ/m²·		A X k kJ/K
Doors				1.98		1.4		2.772				(26)
Windows Type	1			3.4	_	/[1/(1.2)+	0.04] =	3.89	一			(27)
Windows Type				1.8	<u> </u>	/[1/(1.2)+	· 0.04] =	2.06	\exists			(27)
Windows Type				2.07	_	/[1/(1.2)+		2.37	=			(27)
Walls Type1	51.69	10.87	7	40.82	=	0.12		4.9	=			(29)
Walls Type2	9.19	1.98	=	7.21	=	0.12	-	0.83	륵 ;		i iii	(29)
Roof	63.73	0	=	63.73	=	0.12	=	7.65	믁 ¦			(30)
Total area of e				124.6	=	0.12		7.03				(31)
Party wall	icinicinto, in				=							(32)
Party floor				28.69	=	0		0			-	
Party ceiling				63.73	=				Ĺ		╡ ⊨	(32a)
* for windows and	roof windows use	offootivo wi	ndow II vo	14.48		a formula :	1/[/1/ valu	10) 10 041 6	e aiven in	naragrani		(32b)
** include the area					aleu usirig	j iorriula i	17[(170-vail	1 0)+0.04] a	is giveri iii	paragrapi	1 3.2	
Fabric heat los	s, W/K = S (A	x U)				(26) (30) + (32) =				28.6	(33)
Heat capacity	Cm = S(A x k)						((28)	(30) + (32	2) + (32a)	(32e) =	8126.04	4 (34)
Thermal mass	parameter (TM	1P = Cm ÷	· TFA) in	ı kJ/m²K			Indica	ative Value	: Low		100	(35)
For design assess can be used instea			constructi	ion are no	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
Thermal bridge	es : S (L x Y) ca	alculated ι	using Ap	pendix l	K						18.69	(36)
if details of therma	l bridging are not l	(nown (36) =	0.05 x (3	1)								
Total fabric hea	at loss						(33) +	(36) =			47.29	(37)

Ventila	ition hea	it loss ca	alculated	l monthly	y				(38)m	= 0.33 × (25)m x (5)	ı		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	13.62	13.46	13.3	12.5	12.34	11.54	11.54	11.37	11.86	12.34	12.66	12.98		(38)
Heat tr	ansfer c	oefficier	nt, W/K					•	(39)m	= (37) + (37)	38)m		•	
(39)m=	60.91	60.75	60.59	59.79	59.63	58.83	58.83	58.66	59.15	59.63	59.95	60.27		
			= \		•	•		•		•	Sum(39) ₁	12 /12=	59.75	(39)
			HLP), W/	i						= (39)m ÷	·		1	
(40)m=	0.96	0.95	0.95	0.94	0.94	0.92	0.92	0.92	0.93	0.94	0.94	0.95	0.04	
Numbe	er of day	s in moi	nth (Tabl	le 1a)						Average =	Sum(40) ₁	12 /12=	0.94	(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>	<u>. </u>	!	!	!	<u>. </u>	!			
4. Wa	iter heat	ing enei	rgy requi	irement:								kWh/ye	ear:	
													1	
	ed occu A > 13 9		N + 1.76 x	[1 - exn	(-0 0003	849 x (TF	-A -13 9	1211 + 0 (0013 x (ΓFA -13		80		(42)
	A £ 13.9		11.70 X	i oxp	(0.0000	/10 X (11	71 10.0	<i>)</i> _/] · O	3010 X ()			
			ater usag									.72		(43)
		_	hot water person per			_	_	to achieve	a water us	se target o	f			
not more								1 .		<u> </u>	l		1	
l lot wate	Jan	Feb	Mar	Apr	May	Jun	Jul Table 10 v	Aug	Sep	Oct	Nov	Dec		
Hot wate		-	day for ea					· ·		ı		·	I	
(44)m=	92.09	88.74	85.39	82.04	78.69	75.34	75.34	78.69	82.04	85.39	88.74	92.09		-
Energy o	content of	hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x [OTm / 3600			m(44) _{1 12} = ables 1b, 1		1004.6	(44)
(45)m=	136.56	119.44	123.25	107.45	103.1	88.97	82.44	94.61	95.74	111.57	121.79	132.25		
If inctant	tanaque w	ator hoati	ng at point	of use (no	hot water	r ctorago)	ontor O in	hoves (46		Total = Su	m(45) _{1 12} =	=	1317.18	(45)
1			· ·	·		· · · ·		· `	· · ·	40.74	40.07	40.04	1	(46)
(46)m= Water	20.48 storage	17.92 loss:	18.49	16.12	15.47	13.35	12.37	14.19	14.36	16.74	18.27	19.84		(46)
	•		includin	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)						
Otherw	vise if no	stored	hot wate	er (this in	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (47)			
Water	storage	loss:												
a) If m	nanufacti	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature fa	actor fro	m Table	2b								0		(49)
			storage	-				(48) x (49) =		1	10		(50)
,			eclared o	•									1	
		_	factor fr ee section		e z (KVV	n/litre/da	iy)				0.	02		(51)
	e factor	_		0114.3								00		(52)
			m Table	2b								.6		(52)
			storage		aar			(47) v (51) v (52) v (53) =				
	(50) or (_	, KVVII/yt	-ai			(47) x (51	, ^ (JZ)	55) -		03 03		(54) (55)
	. , .	, ,	culated f	for each	month			((56)m = (55) × (41)	m	<u>'</u>			(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)
(30)111=	JZ.U1	20.92	JZ.U1	30.90	JZ.U1	30.80	JZ.U1	J 32.01	30.80	JZ.U1	30.90	JZ.U1		(50)

	airis dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	u), eise (5	/)m = (56)	m where (H11) IS Tro	m Append	lix H	
(57)m= 32.0	1 28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circ	uit loss (ar	nnual) fro	m Table	3				•			0		(58)
Primary circ	`	,			59)m = ((58) ÷ 36	55 × (41)	m				•	
(modified	by factor f	rom Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.2	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	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 r	equired for	water he	eating ca	alculated	for eacl	n month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 191.	84 169.37	178.53	160.95	158.38	142.46	137.72	149.88	149.23	166.85	175.28	187.53		(62)
Solar DHW inp	out 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	iter										_	
(64)m= 191.	84 169.37	178.53	160.95	158.38	142.46	137.72	149.88	149.23	166.85	175.28	187.53		_
							Outp	out from wa	ater heate	r (annual) ₁	12	1968.02	(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= 89.6	79.66	85.2	78.52	78.5	72.38	71.63	75.68	74.63	81.32	83.29	88.2		(65)
include (57)m in cal	culation (of (65)m	only if c	ylinder is	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Interna	gains (see	e Table 5	and 5a):									
Metabolic g	ains (Table	e 5), Wat	ts										
Ja		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 104.	24 104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24	104.24		(66)
Lighting gai	ns (calcula	ted in Ar											
(67)m= 16.7		ica iii / i	ppendix	L, equati	ion L9 oi	r L9a), a	lso see	Table 5					
	75 14.87	12.1	9.16	L, equat 6.85	5.78	6.24 £	8.12	Table 5	13.83	16.15	17.21		(67)
Appliances		12.1	9.16	6.85	5.78	6.24	8.12	10.9		16.15	17.21		(67)
Appliances (68)m= 182.	gains (calc	12.1	9.16	6.85	5.78	6.24	8.12	10.9		16.15	17.21]	(67) (68)
· · · —	gains (calc 25 184.14	12.1 culated ir 179.37	9.16 Append 169.23	6.85 dix L, equ	5.78 uation L 144.38	6.24 13 or L1 136.34	8.12 3a), also 134.45	10.9 see Tal 139.22	ble 5 149.36	<u> </u>	I		` ,
(68)m= 182.	gains (calc 25 184.14 ins (calcula	12.1 culated ir 179.37	9.16 Append 169.23	6.85 dix L, equ	5.78 uation L 144.38	6.24 13 or L1 136.34	8.12 3a), also 134.45	10.9 see Tal 139.22	ble 5 149.36	<u> </u>	I]]	` ,
(68)m= 182. Cooking ga	gains (calculations (calculate) 33.42	12.1 culated in 179.37 ated in A 33.42	9.16 Append 169.23 ppendix 33.42	6.85 dix L, equated to 156.42 L, equated to 156.42	5.78 uation L 144.38 ion L15	6.24 13 or L1 136.34 or L15a)	8.12 3a), also 134.45), also se	10.9 see Tal 139.22 ee Table	ble 5 149.36 5	162.17	174.21		(68)
(68)m= 182. Cooking ga (69)m= 33.4	gains (calculations (calculate) 33.42	12.1 culated in 179.37 ated in A 33.42	9.16 Append 169.23 ppendix 33.42	6.85 dix L, equated to 156.42 L, equated to 156.42	5.78 uation L 144.38 ion L15	6.24 13 or L1 136.34 or L15a)	8.12 3a), also 134.45), also se	10.9 see Tal 139.22 ee Table	ble 5 149.36 5	162.17	174.21] 	(68)
(68)m= 182. Cooking ga (69)m= 33.4 Pumps and	gains (calculations)	12.1 culated in 179.37 ated in A 33.42 c (Table 5	9.16 9.16 169.23 ppendix 33.42 5a) 0	6.85 dix L, eq 156.42 L, equat 33.42	5.78 uation L 144.38 ion L15 33.42	6.24 13 or L1 136.34 or L15a) 33.42	8.12 3a), also 134.45), also se 33.42	10.9 see Tal 139.22 ee Table 33.42	ble 5 149.36 5 33.42	162.17	174.21 33.42		(68) (69)
(68)m= 182. Cooking ga (69)m= 33.4 Pumps and (70)m= 0	gains (calculations (calculations (calculations) 33.42 fans gains 0 evaporations	12.1 culated in 179.37 ated in A 33.42 c (Table 5	9.16 9.16 169.23 ppendix 33.42 5a) 0	6.85 dix L, eq 156.42 L, equat 33.42	5.78 uation L 144.38 ion L15 33.42	6.24 13 or L1 136.34 or L15a) 33.42	8.12 3a), also 134.45), also se 33.42	10.9 see Tal 139.22 ee Table 33.42	ble 5 149.36 5 33.42	162.17	174.21 33.42] 	(68) (69)
(68)m= 182. Cooking ga (69)m= 33.4 Pumps and (70)m= 0 Losses e.g. (71)m= -83	gains (calculations)	12.1 culated in 179.37 ated in A 33.42 c (Table 5 0 on (negative)	9.16 9.16 169.23 ppendix 33.42 5a) 0 tive valu	6.85 dix L, equal 156.42 L, equal 33.42	5.78 uation L 144.38 ion L15 33.42 0 le 5)	6.24 13 or L1 136.34 or L15a) 33.42	8.12 3a), also 134.45), also se 33.42	10.9 see Tal 139.22 ee Table 33.42	ble 5 149.36 5 33.42	162.17 33.42	33.42 0		(68) (69) (70)
(68)m= 182. Cooking ga (69)m= 33.4 Pumps and (70)m= 0 Losses e.g.	gains (calculations)	12.1 culated in 179.37 ated in A 33.42 c (Table 5 0 on (negative)	9.16 9.16 169.23 ppendix 33.42 5a) 0 tive valu	6.85 dix L, equal 156.42 L, equal 33.42	5.78 uation L 144.38 ion L15 33.42 0 le 5)	6.24 13 or L1 136.34 or L15a) 33.42	8.12 3a), also 134.45), also se 33.42	10.9 see Tal 139.22 ee Table 33.42	ble 5 149.36 5 33.42	162.17 33.42	33.42 0		(68) (69) (70)
(68)m= 182. Cooking ga (69)m= 33.4 Pumps and (70)m= 0 Losses e.g. (71)m= -83 Water heati (72)m= 120.	gains (calculations)	12.1 culated in 179.37 ated in A 33.42 c (Table 5 0 on (negative states 5) 114.52	9.16 9.16 Appendix 169.23 ppendix 33.42 5a) 0 tive valu -83.4	6.85 dix L, equator 156.42 L, equator 33.42 0 es) (Taber -83.4	5.78 uation L 144.38 ion L15 33.42 0 le 5) -83.4	6.24 13 or L1 136.34 or L15a) 33.42 0 -83.4	8.12 3a), also 134.45), also se 33.42 0 -83.4	10.9 see Tal 139.22 ee Table 33.42 0	ole 5 149.36 5 33.42 0 -83.4	162.17 33.42 0 -83.4 115.68	174.21 33.42 0 -83.4		(68) (69) (70)
(68)m= 182. Cooking ga (69)m= 33.4 Pumps and (70)m= 0 Losses e.g. (71)m= -83 Water heati	gains (calculations)	12.1 culated in 179.37 ated in A 33.42 c (Table 5 0 on (negative states 5) 114.52	9.16 9.16 Appendix 169.23 ppendix 33.42 5a) 0 tive valu -83.4	6.85 dix L, equator 156.42 L, equator 33.42 0 es) (Taber -83.4	5.78 uation L 144.38 ion L15 33.42 0 le 5) -83.4	6.24 13 or L1 136.34 or L15a) 33.42 0 -83.4	8.12 3a), also 134.45), also se 33.42 0 -83.4	10.9 see Tal 139.22 ee Table 33.42 0 -83.4	ole 5 149.36 5 33.42 0 -83.4	162.17 33.42 0 -83.4 115.68	174.21 33.42 0 -83.4		(68) (69) (70)
(68)m= 182. Cooking ga (69)m= 33.4 Pumps and (70)m= 0 Losses e.g. (71)m= -83 Water heati (72)m= 120. Total intern	gains (calculations)	12.1 culated in 179.37 ated in A 33.42 c (Table 5 o on (negated 114.52)	9.16 9.16 Appendix 33.42 5a) 0 tive valu -83.4	6.85 dix L, equator 156.42 L, equator 33.42 0 es) (Taber -83.4	5.78 uation L 144.38 ion L15 33.42 0 le 5) -83.4 100.52 (66)	6.24 13 or L1 136.34 or L15a) 33.42 0 -83.4 96.28 m + (67)m	8.12 3a), also 134.45), also se 33.42 0 -83.4 101.72 1+ (68)m+	10.9 see Tal 139.22 ee Table 33.42 0 -83.4 103.65 + (69)m + (ole 5 149.36 5 33.42 0 -83.4 109.3 (70)m + (7	162.17 33.42 0 -83.4 115.68 1)m + (72	174.21 33.42 0 -83.4 118.54		(68) (69) (70) (71) (72)
(68)m= 182. Cooking ga (69)m= 33.4 Pumps and (70)m= 0 Losses e.g. (71)m= -83 Water heati (72)m= 120. Total interi (73)m= 373. 6. Solar ga	gains (calculations)	12.1 culated in 179.37 ated in A 33.42 c (Table 5 0 on (negar -83.4	9.16 9.16 n Append 169.23 ppendix 33.42 5a) 0 tive valu -83.4 109.06	6.85 dix L, equator 156.42 L, equator 33.42 0 es) (Taber -83.4 105.52	5.78 uation L 144.38 ion L15 33.42 0 le 5) -83.4 100.52 (66) 304.96	6.24 13 or L1 136.34 or L15a) 33.42 0 -83.4 96.28 m + (67)m 293.14	8.12 3a), also 134.45), also se 33.42 0 -83.4 101.72 1+(68)m+ 298.56	10.9 2 see Tal 139.22 2 ee Table 33.42 0 -83.4 103.65 + (69)m + (308.03	ole 5 149.36 5 33.42 0 -83.4 109.3 70)m + (7 326.77	162.17 33.42 0 -83.4 115.68 1)m + (72 348.27	174.21 33.42 0 -83.4 118.54		(68) (69) (70) (71) (72)
(68)m= 182. Cooking ga (69)m= 33.4 Pumps and (70)m= 0 Losses e.g. (71)m= -83 Water heati (72)m= 120. Total interi (73)m= 373. 6. Solar ga	gains (calculated gains) (calcul	12.1 culated in 179.37 ated in A 33.42 c (Table 5 0 on (negar -83.4 Table 5) 114.52 c 360.26 c using solar actor	9.16 9.16 n Append 169.23 ppendix 33.42 5a) 0 tive valu -83.4 109.06	6.85 dix L, equator 156.42 L, equator 33.42 0 es) (Taber -83.4 105.52	5.78 uation L 144.38 ion L15 33.42 0 le 5) -83.4 100.52 (66) 304.96 and associ	6.24 13 or L1 136.34 or L15a) 33.42 0 -83.4 96.28 m + (67)m 293.14	8.12 3a), also 134.45), also se 33.42 0 -83.4 101.72 1+(68)m+ 298.56 tions to co	10.9 2 see Tal 139.22 2 ee Table 33.42 0 -83.4 103.65 + (69)m + (308.03	ole 5 149.36 5 33.42 0 -83.4 109.3 70)m + (7 326.77 e applicate	162.17 33.42 0 -83.4 115.68 1)m + (72 348.27	174.21 33.42 0 -83.4 118.54	Gains (W)	(68) (69) (70) (71) (72)

Northeast _{0.9x}	0.77	×	3.4	x	11.28	X	0.5	x	0.7	=	9.3	(75)
Northeast _{0.9x}	0.77	x	3.4	x	22.97	X	0.5	x	0.7	=	18.94	(75)
Northeast _{0.9x}	0.77	x	3.4	x	41.38	X	0.5	x	0.7	=	34.12	(75)
Northeast _{0.9x}	0.77	x	3.4	x	67.96	x	0.5	x	0.7	=	56.04	(75)
Northeast _{0.9x}	0.77	×	3.4	x	91.35	x	0.5	x	0.7	=	75.33	(75)
Northeast _{0.9x}	0.77	X	3.4	x	97.38	x	0.5	x	0.7	=	80.31	(75)
Northeast _{0.9x}	0.77	x	3.4	x	91.1	x	0.5	x	0.7	=	75.13	(75)
Northeast _{0.9x}	0.77	x	3.4	x	72.63	x	0.5	x	0.7	=	59.89	(75)
Northeast _{0.9x}	0.77	x	3.4	x	50.42	X	0.5	x	0.7	_	41.58	(75)
Northeast _{0.9x}	0.77	x	3.4	x	28.07	x	0.5	х	0.7	-	23.15	(75)
Northeast _{0.9x}	0.77	x	3.4	x	14.2	x	0.5	х	0.7	=	11.71	(75)
Northeast _{0.9x}	0.77	x	3.4	x	9.21	x	0.5	х	0.7	=	7.6	(75)
Northwest 0.9x	0.77	x	1.8	x	11.28	x	0.5	х	0.7	=	14.78	(81)
Northwest 0.9x	0.77	×	2.07	x	11.28	x	0.5	x	0.7	=	5.66	(81)
Northwest 0.9x	0.77	×	1.8	x	22.97	x	0.5	x	0.7	=	30.08	(81)
Northwest 0.9x	0.77	x	2.07	x	22.97	x	0.5	x	0.7		11.53	(81)
Northwest 0.9x	0.77	x	1.8	x	41.38	x	0.5	x	0.7	=	54.2	(81)
Northwest 0.9x	0.77	X	2.07	x	41.38	x	0.5	x	0.7	=	20.78	(81)
Northwest _{0.9x}	0.77	x	1.8	x	67.96	x	0.5	x	0.7	=	89.01	(81)
Northwest 0.9x	0.77	X	2.07	x	67.96	x	0.5	x	0.7	=	34.12	(81)
Northwest 0.9x	0.77	×	1.8	x	91.35	x	0.5	x	0.7	=	119.64	(81)
Northwest 0.9x	0.77	×	2.07	x	91.35	x	0.5	x	0.7	=	45.86	(81)
Northwest 0.9x	0.77	×	1.8	x	97.38	x	0.5	х	0.7	=	127.55	(81)
Northwest _{0.9x}	0.77	X	2.07	x	97.38	x	0.5	x	0.7	=	48.89	(81)
Northwest _{0.9x}	0.77	X	1.8	x	91.1	x	0.5	x	0.7		119.32	(81)
Northwest _{0.9x}	0.77	X	2.07	x	91.1	x	0.5	x	0.7	=	45.74	(81)
Northwest _{0.9x}	0.77	x	1.8	x	72.63	X	0.5	X	0.7	=	95.12	(81)
Northwest _{0.9x}	0.77	×	2.07	X	72.63	X	0.5	x	0.7	=	36.46	(81)
Northwest _{0.9x}	0.77	X	1.8	X	50.42	X	0.5	Х	0.7	=	66.04	(81)
Northwest 0.9x	0.77	X	2.07	X	50.42	X	0.5	x	0.7	=	25.32	(81)
Northwest _{0.9x}	0.77	X	1.8	X	28.07	X	0.5	x	0.7	=	36.76	(81)
Northwest _{0.9x}	0.77	X	2.07	X	28.07	X	0.5	x	0.7	=	14.09	(81)
Northwest 0.9x	0.77	X	1.8	X	14.2	X	0.5	x	0.7	=	18.59	(81)
Northwest _{0.9x}	0.77	X	2.07	X	14.2	X	0.5	×	0.7	=	7.13	(81)
Northwest _{0.9x}	0.77	X	1.8	X	9.21	X	0.5	X	0.7	=	12.07	(81)
Northwest _{0.9x}	0.77	X	2.07	X	9.21	X	0.5	Х	0.7	=	4.63	(81)
Solar gains in v					-	` 	1 = Sum(74)m .48 132.94	(82)m	1 27 42	04.00	1	(83)
(83)m= 29.75 Total gains – in		9.1 solar	$179.17 \mid 240.8$		56.76 240.19	191	.48 132.94	74	37.43	24.29		(65)
(84)m= 403.48		9.36	520.88 563.8	`	61.72 533.33	490	.04 440.97	400.77	385.7	388.53	1	(84)
					71.72	100	110.07	100.77	1 333.7	000.00	İ	(= .)
7. Mean interr	·				aroa from Tab		Th1 (°C)				24	(OE)
Temperature	•	•		_		ле 9,	, IIII (C)				21	(85)
Utilisation fact		. 1		Ť		٨٠	ug Sep	Oct	Nov	Dec		
Stroma ESAP 2012	Version 1.0	4.26 (5	SAP 9.92] - http://	Www.	stromal.com ^{ui}		uy Sep	1 000	I INOV	l Dec	Page	5 of 8

(86)m=	0.96	0.95	0.92	0.86	0.74	0.59	0.46	0.51	0.72	0.88	0.94	0.96		(86)
Mear	interna	I temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.11	19.29	19.65	20.16	20.59	20.86	20.95	20.93	20.72	20.19	19.58	19.07		(87)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)					
(88)m=	20.12	20.12	20.12	20.14	20.14	20.15	20.15	20.15	20.14	20.14	20.13	20.13		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	ee Table	9a)						
(89)m=	0.95	0.94	0.91	0.83	0.7	0.53	0.38	0.43	0.67	0.86	0.93	0.96		(89)
Mear	interna	I temper	ature in	the rest	of dwell	ing T2 (f	ollow ste	ps 3 to	7 in Tabl	e 9c)				
(90)m=	17.57	17.84	18.36	19.08	19.67	20.01	20.11	20.1	19.86	19.15	18.27	17.53		(90)
									1	fLA = Livin	g area ÷ (4) =	0.47	(91)
Mear	interna	I temper	ature (fo	r the wh	ole dwe	lling) = f	LA × T1	+ (1 – fL	A) × T2				i	
(92)m=		18.52	18.97	19.59	20.1	20.41	20.51	20.49	20.27	19.64	18.88	18.26		(92)
			1	interna		1				·	40.00	40.00		(02)
(93)m=	18.29	18.52	18.97 uirement	19.59	20.1	20.41	20.51	20.49	20.27	19.64	18.88	18.26		(93)
					e obtair	ned at st	en 11 of	Table 9	n so tha	t Ti m=(76)m an	d re-calc	ulate	
				using Ta			ор 11 от 							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			ains, hm	1		ı	ı	1	1	1	1	ı -	1	(0.4)
(94)m=		0.92	0.89	0.82	0.7	0.55	0.41	0.46	0.67	0.85	0.92	0.94		(94)
(95)m=		399.24	, VV = (94 417.79	4)m x (84 426.62	396.28	306.97	219.04	224.85	297.55	339.36	353.76	366.56		(95)
		l	l	perature		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	loss rate	e for me	an interr	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]				
(97)m=	852.27	827.43	755.57	639.08	500.88	341.78	229.82	239.98	364.73	538.92	706.46	847.12		(97)
•		ř 	i e	r each n				 	``	í -	<u> </u>	057.54		
(98)m=	352.45	287.75	251.3	152.97	77.82	0	0	0 	0	148.47	253.94	357.54	4000.04	(98)
0				138/1/	.,			Tota	l per year	(kwn/year) = Sum(9	8)15,912 =	1882.24	=
•		•		kWh/m²								ļ	29.53	(99)
				mmunity	Ĭ						., .			
				ating, spa condary							unity sci	neme.	0	(301)
	-			mmunity		•	_		, -				1	(302)
	•			-	•	,	,	allows for	CUD and	un to four	othar boot	aguraga: t		(002)
	-		-	eat trom se mal and wa						up ιο rour (ouiei neat	sources; to	ie iallei	
Fraction	on of hea	at from (Commun	ity heat	pump								1	(303a)
Fractio	on of hea	at from C	Commun	ity heat	pump (V	Vater)							0.8	(303a)
Fractio	on of cor	mmunity	heat fro	m heat s	ource 2	(Water)							0.2	(303b)
Fraction	on of tota	al space	heat fro	m Comn	nunity he	eat pum	o			(3	02) x (303	a) =	1	(304a)
		•		method	•			unitv hea	itina svs	tem			1	(305)
. 50.01		5. 3.10		,	,	. 5(5), 10		, 1100					'	(3.5.5)

Distribution loss factor (Table 12s) for commu	nity hooting graters	4.05	7(206)
Distribution loss factor (Table 12c) for commun		1.05	(306)
Distribution loss factor (Table 12c) for commun	nity heating system (vvater)	1.05	(306)
Space heating Annual space heating requirement		kWh/year 1882.24	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1976.35	_ ☐(307a)
Efficiency of secondary/supplementary heating		0	`
Space heating requirement from secondary/su	, , , ,	0	(309)
Water heating			
Annual water heating requirement		1968.02	
If DHW from community scheme: Water heat from CHP (Water)	(64) x (303a) x (305) x (306) =	1653.14	(310a)
Water heat from heat source 2 (Water)	(64) x (303a) x (305) x (306) =	413.28	(310b)
Electricity used for heat distribution	0.01 × [(307a) (307e) + (310a) (310e)] =	19.76	(313)
Electricity used for heat distribution (Water)	0.01 × [(307a) (307e) + (310a) (310e)] =	20.66	(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 (mechanical ventilation - balanced, extract or p	` '	124.01	(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) =	124.01	(331)
Energy for lighting (calculated in Appendix L)		295.76	(332)
12b. CO2 Emissions – Community heating sch			
	Energy Emission factor kWh/year kg CO2/kWh	Emissions kg 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 repeat (363) to (366) for the second fuel	290	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x 0.52 =	353.7	(367)
Electrical energy for heat distribution	[(313) x 0.52 =	10.26	(372)
Water heating from separate community syste	m		
CO2 from other sources of space and water Efficiency of heat source 1 (%)	neating (not CHP) If there is CHP using two fuels repeat (363) to (366) for the second fuel	290	(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 100 ÷ (367b) x 0 =	295.85	(367)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x 0.52 =	214.49	(368)
Electrical energy for heat distribution	[(313) x 0.52 =	10.72	(372)
Total CO2 associated with community system	s (363) (366) + (368)(372) =	885.03	(373)
CO2 associated with space heating (secondar	y) (309) x 0 =	0	(374)

CO2 associated with water from immer	rsion heater or instant	taneous heater (312) x	0.52	=	0	(375)
Total CO2 associated with space and v	water heating	(373) + (374) + (375) =			885.03	(376)
CO2 associated with electricity for pur	nps and fans within dv	velling (331)) x	0.52	=	64.36	(378)
CO2 associated with electricity for light	ting	(332))) x	0.52	=	153.5	(379)
Total CO2, kg/year	sum of (376) (382) =				1102.89	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.31	(384)
El rating (section 14)					86.41	(385)

		User Details:				
Assessor Name:	Chris Hocknell	Stroma Nu	mber:	STRO	016363	
Software Name:	Stroma FSAP 2012	Software V	ersion:	Versio	n: 1.0.4.26	
		roperty Address: Flat				
Address :	Flat 08, 51 Calthorpe Street	, LONDON, WC1X 0H	IH .			
1. Overall dwelling dime	nsions:					
Ground floor		Area(m²) 7.67 (1a)	Av. Height(n	n) (2a) = [Volume(m³)	(3a)
				-	19.18	_
First floor		138.42 (1b)	2.5	(2b) =	346.05	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1r	1) 146.09 (4)		_		_
Dwelling volume		(3a)+	(3b)+(3c)+(3d)+(3e)+	+(3n) =	365.22	(5)
2. Ventilation rate:	main accorde	n. albau	total		ma ³ may bayy	
	main secondar heating heating	y other	total	_	m³ per hour	_
Number of chimneys	0 + 0	+ 0 =	0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent fa	ns		0	x 10 =	0	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fi	res		0	x 40 =	0	(7c)
						_
				-	anges per ho	_
•	ys, flues and fans = (6a)+(6b)+(7 een carried out or is intended, proceed		0 from (0) to (16)	÷ (5) =	0	(8)
Number of storeys in the		a to (17), otnerwise continu	e IIOIII (9) 10 (10)	Г	0	(9)
Additional infiltration	3 (1)		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame or	0.35 for masonry con	struction	Ī	0	(11)
	resent, use the value corresponding to	the greater wall area (after		•		
deducting areas of opening	igs), ii equal user 0.35 iloor, enter 0.2 (unsealed) or 0.	.1 (sealed), else enter	0	Γ	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) + (11)	+ (12) + (13) + (15) =	. [0	(16)
Air permeability value,	q50, expressed in cubic metre	s per hour per square	metre of envelo	pe area	3	(17)
•	ity value, then (18) = [(17) ÷ 20]+(8			· [0.15	(18)
Air permeability value applie	s if a pressurisation test has been dor	ne or a degree air permeabi	lity is being used	-		
Number of sides sheltere	d				0	(19)
Shelter factor		(20) = 1 - [0.075]	x (19)] =		1	(20)
Infiltration rate incorporat		$(21) = (18) \times (20)$	=	[0.15	(21)
Infiltration rate modified f	<u> </u>		<u> </u>			
Jan Feb	Mar Apr May Jun	Jul Aug Se	p Oct No	v Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

Wind Factor (22a)m = (22)m ÷ 4								
	1.1 1.08	0.95	0.95 0.92	1	1.08	1.12	1.18	
Adiante dis Citantina ante dell'acciona	f l l	de de de ace	1) (04 -) -	(00 -)				
Adjusted infiltration rate (allowing to 0.19 0.19 0.18 0	or sneiter and	<u>i</u> _	$\frac{(21a) \times (21a) \times (21a)}{0.14}$	0.15	0.16	0.17	0.18	
Calculate effective air change rate	I I			0.13	0.10	0.17	0.10	
If mechanical ventilation:								0.5 (23a)
If exhaust air heat pump using Appendix	, , ,	, , ,	, ,,	,) = (23a)			0.5 (23b)
If balanced with heat recovery: efficiency	-							73.1 (23c)
a) If balanced mechanical ventile		<u>_</u>	` 	- 	 		— `	-
` '	0.3	I	0.28 0.27	0.28	0.3	0.3	0.31	(24a)
b) If balanced mechanical ventile (24b)m= 0 0 0	ation without	neat recove	$\frac{\text{dery}(MV)(24)}{0}$	$\frac{b)m = (22)}{l}$	2b)m + (2 0	23D) 0	0	(24b)
c) If whole house extract ventilate					0	U	U	(240)
if (22b)m < 0.5 × (23b), then	•	•			.5 × (23b)		
	0 0	0	0 0	0	0	0	0	(24c)
d) If natural ventilation or whole	house positiv	e input ver	ntilation from	loft				
if (22b)m = 1, then (24d)m =	(22b)m othe	rwise (24d))m = 0.5 + [(2	22b)m² x	0.5]			
(24d)m = 0 0 0	0 0	0	0 0	0	0	0	0	(24d)
Effective air change rate - enter	` 			- ` 				
(25)m= 0.33 0.32 0.32 0	0.3	0.28	0.28 0.27	0.28	0.3	0.3	0.31	(25)
0. 1111								
3. Heat losses and heat loss para	ameter:							
· · · · · · · · · · · · · · · · · · ·	oenings m²	Net Area A ,m²	U-va W/m		A X U (W/ł	ζ)	k-value kJ/m²·ł	
ELEMENT Gross Op	enings					<) 		
ELEMENT Gross Operation of the Gross area (m²)	enings	A ,m²	W/m	2K	(W/ł	<) 		K kJ/K
ELEMENT Gross Operation of the Gross area (m²) Doors	enings	A ,m²	W/m × 1.4	2K = + 0.04] =	(W/ł 2.772	() 		(kJ/K (26)
ELEMENT Gross operation of the second of the	enings	A ,m ² 1.98 1.45	W/m x 1.4 x1/[1/(1.2)	2K = + 0.04] = + 0.04] =	2.772 1.66	() 		(kJ/K (26) (27)
ELEMENT Gross operation of the street of the	enings	A ,m ² 1.98 1.45 3.21	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2)	2K = + 0.04] = + 0.04] = + 0.04] =	2.772 1.66 3.68	() 		(26) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3	enings	A ,m ² 1.98 1.45 3.21 1.56	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2)	2K = + 0.04] = + 0.04] = + 0.04] = - 0.04] =	(W/F 2.772 1.66 3.68 1.79	() 		(26) (27) (27) (27)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1	enings	A ,m ² 1.98 1.45 3.21 1.56 1.38	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) +	2K = + 0.04] = + 0.04] = + 0.04] = - 0.04] =	2.772 1.66 3.68 1.79	() 		(26) (27) (27) (27) (27) (27b)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2	enings	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) +	2K = + 0.04] = + 0.04] = + 0.04] = - 0.04] = - 0.04] =	2.772 1.66 3.68 1.79 1.656	() 		(26) (27) (27) (27) (27) (27b) (27b)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor	penings m²	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) + x1/[1/(1.2) + x1/[1/(1.2) + x1/[1/(1.2) +	2K = + 0.04 =	2.772 1.66 3.68 1.79 1.656 1.584 2.0208	()		(26) (27) (27) (27) (27b) (27b) (28)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24	oenings m²	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2)	2K = + 0.04] =	2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61	() 		(26) (27) (27) (27) (27b) (27b) (28) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56	3.12 1.98	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58	W/m x 1.4 x1/[1/(1.2) x1/[1/	2K = + 0.04] =	2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31	() 		(26) (27) (27) (27) (27b) (27b) (28) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68	3.12 1.98	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68	W/m x 1.4 x1/[1/(1.2) x1/[1/	2K = + 0.04 =	2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64	() 		(26) (27) (27) (27) (27b) (27b) (28) (29) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95	3.12 1.98 0 16.57	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.2	2K = + 0.04 =	(W/F 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25	3.12 1.98 0 16.57 2.7	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.55	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12	2K = + 0.04 =	(W/h 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08	()		(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25 Roof Type2 6.05	3.12 1.98 0 16.57 2.7	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.55 6.05	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12	2K = + 0.04 =	(W/h 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08	()		(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30) (30)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25 Roof Type2 6.05 Total area of elements, m²	3.12 1.98 0 16.57 2.7	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.55 6.05 307.57	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12	2K = + 0.04 =	(W/h 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08 12.91			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30) (30) (31)
ELEMENT Gross area (m²) Doors Windows Type 1 Windows Type 2 Windows Type 3 Rooflights Type 1 Rooflights Type 2 Floor Walls Type1 58.24 Walls Type2 30.56 Walls Type3 63.68 Walls Type4 21.95 Roof Type1 110.25 Roof Type2 6.05 Total area of elements, m² Party wall	3.12 1.98 0 16.57 2.7	A ,m ² 1.98 1.45 3.21 1.56 1.38 1.32 16.84 55.12 28.58 63.68 5.38 107.55 6.05 307.57 19.63	W/m x 1.4 x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x1/[1/(1.2) x 0.12 x 0.12 x 0.12 x 0.12 x 0.12 x 0.12	2K = + 0.04] = + 0.04] = + 0.04] = -	(W/h 2.772 1.66 3.68 1.79 1.656 1.584 2.0208 6.61 3.31 7.64 1.08 12.91			(26) (27) (27) (27) (27b) (27b) (28) (29) (29) (29) (29) (30) (30) (31) (32)

* 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 Fabric heat loss, W/K = S (A x U) (26) (30) + (32) =(33)62.88 Heat capacity $Cm = S(A \times k)$ ((28) (30) + (32) + (32a) (32e) =(34)15227.24 Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low (35)100 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 46.14 (36)if details of thermal bridging are not known (36) = $0.05 \times (31)$ Total fabric heat loss (33) + (36) =(37)109.02 Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)$ m x (5)Jan Feb Mar Apr Mav Jun Jul Oct Nov Dec Aug Sen (38)38.36 36.1 33.39 33.39 32.93 34.29 36.55 (38)m=39.26 38.81 35.65 35.65 37.45 Heat transfer coefficient, W/K (39)m = (37) + (38)m 148.28 147.83 147.37 145.11 144.66 142.4 142.4 141.95 143.31 144.66 145.57 146 47 (39)m =(39)Average = $Sum(39)_{1}$ /12= 145 Heat loss parameter (HLP), W/m2K (40)m = (39)m ÷ (4)(40)m =1.01 1.01 1.01 0.99 0.97 0.97 0.97 0.98 0.99 1 (40)Average = $Sum(40)_{1/12}/12=$ 0.99 Number of days in month (Table 1a) Feb Mar May Aug Jan Jun .lul Sep Oct Nov Dec Apr 31 30 31 (41)(41)m=4. Water heating energy requirement: kWh/vear: Assumed occupancy, N 2.93 (42)if TFA > 13.9, N = 1 + 1.76 x [1 - $\exp(-0.000349 \times (TFA - 13.9)2)] + 0.0013 \times (TFA - 13.9)$ if TFA £ 13.9, N = 1Annual average hot water usage in litres per day Vd, average = (25 x N) + 36 103.74 (43)Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold) Oct Jan Feb Mar Apr May Jun Jul Aug Sep Nov Dec Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) 114.11 109.96 105.81 101.66 97.51 93.36 93.36 97.51 101.66 105.81 109.96 114.11 (44)Total = $Sum(44)_{1}$ 12 = 1244.85 Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (45)m=169.22 148 152.73 133.15 127.76 110.25 102.16 117.23 118.63 138.25 150.92 163.88 1632.19 (45)Total = $Sum(45)_{1}$ 12 = If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) 22.2 22.91 20.74 24.58 (46)(46)m=25.38 19 97 19 16 16 54 15.32 17 58 17 79 22 64 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)n Temperature factor from Table 2b 0 (49)

								•	
Energy lost from water storage, kW b) If manufacturer's declared cyline	•	ıt known:	(48) x (49) =		1	10		(50)
Hot water storage loss factor from						0.	.02		(51)
If community heating see section 4	3								
Volume factor from Table 2a							.03		(52)
Temperature factor from Table 2b	·				(4-) (-4) (-5)				(53)
Energy lost from water storage, kW Enter (50) or (54) in (55)	Energy lost from water storage, kWh/year) x (52) x (53) =	-	.03		(54) (55)
Water storage loss calculated for e	ach month		((56)m = ((55) × (41)ı	m	1.	.03		(55)
(56)m= 32.01 28.92 32.01 30.		32.01	32.01	30.98	32.01	30.98	32.01]	(56)
If cylinder contains dedicated solar storage,] lix H	(00)
(57)m= 32.01 28.92 32.01 30.		32.01	32.01	30.98	32.01	30.98	32.01]	(57)
· /		32.01	32.01	30.90	32.01	ļ			
Primary circuit loss (annual) from T Primary circuit loss calculated for e		(E0) ± 2	SE ~ (41)	\m			0		(58)
(modified by factor from Table H					r thermo	stat)			
(59)m= 23.26 21.01 23.26 22.		23.26	23.26	22.51	23.26	22.51	23.26		(59)
Combi loss calculated for each more	oth (61)m = (60) ÷ 3	 265 × (41	\m	!	<u> </u>	<u>I</u>	!		
(61)m= 0 0 0 0	- ì ´ - ì ´ -	0 700	0	0	0	0	0		(61)
Total heat required for water heating	n calculated for ea	ch month	1 (62)m =	: 0 85 × ((45)m +	(46)m +	(57)m +	l (59)m + (61)m	
(62)m= 224.5 197.93 208 186	- 	_	172.51	172.13	193.53	204.41	219.16		(62)
Solar DHW input calculated using Appendix			tv) (enter '0		r contributi	lion to wate	Ler 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		(63)
Output from water heater	•	•	•			•		•	
(64)m= 224.5 197.93 208 186	64 183.04 163.74	157.44	172.51	172.13	193.53	204.41	219.16		_
			Out	out from wa	ater heater	r (annual)	1 12	2283.03	(64)
Heat gains from water heating, kW	n/month 0.25 ´ [0.8	5 × (45)n	n + (61)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m]	
(65)m= 100.49 89.15 95 87.	07 86.7 79.45	78.19	83.2	82.24	90.19	92.97	98.71		(65)
include (57)m in calculation of (6	5)m only if cylinder	is in the	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal gains (see Table 5 and	5a):								
Metabolic gains (Table 5), Watts			1		·	T	1	1	
	or May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 146.39 146.39 146.39 146			146.39	146.39	146.39	146.39	146.39		(66)
Lighting gains (calculated in Appen					ī	ī	•	1	
(67)m= 29.4 26.12 21.24 16.		10.96	14.25	19.13	24.29	28.35	30.22		(67)
Appliances gains (calculated in App		-	· · ·			1		1	
(68)m= 316.24 319.52 311.25 293			233.3	241.57	259.17	281.4	302.28		(68)
Cooking gains (calculated in Apper			<u> </u>			1		1	
(69)m= 37.64 37.64 37.64 37.	37.64 37.64	37.64	37.64	37.64	37.64	37.64	37.64		(69)
Pumps and fans gains (Table 5a)			1		1	1		1	 -
(70)m= 0 0 0 0		0	0	0	0	0	0		(70)
Losses e.g. evaporation (negative			1 ,	= :-			=	1	(74)
(71)m= -117.12 -117.12 -117.12 -117	.12 -117.12 -117.12	-117.12	-117.12	-117.12	-117.12	-117.12	-117.12		(71)

Water heating	gains (T	able 5)										_	
(72)m= 135.06	132.67	127.69	120.93	116.54	1	10.35 105.09	111	.83 114.22	121.2	2 129.13	132.68		(72)
Total internal	gains =	!		(66)m + (67)m			า + (68	3)m + (69)m + (70)m +	(71)m + (72)	m	_	
(73)m= 547.62	545.22	527.1	497.57	466.89	4	37.95 419.56	426	6.3 441.84	471.6	1 505.8	532.1		(73)
6. Solar gains													
_		_			and	associated equa	itions		e applic		ion.		
Orientation: A	Access F Fable 6d		Area m²			Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast _{0.9x}	0.77	X	1.5	56	X	11.28	x	0.5	x	0.7	=	8.54	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	22.97	X	0.5	X	0.7	=	17.38	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	41.38	x	0.5	X	0.7	=	31.31	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	67.96	x	0.5	X	0.7	=	51.43	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	91.35	X	0.5	X	0.7	=	69.13	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	97.38	x	0.5	×	0.7	=	73.7	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	91.1	X	0.5	×	0.7	=	68.94	(75)
Northeast _{0.9x}	0.77	X	1.5	6	X	72.63	X	0.5	X	0.7	=	54.96	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	50.42	X	0.5	X	0.7	=	38.16	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	28.07	X	0.5	×	0.7	=	21.24	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	14.2	X	0.5	X	0.7	=	10.74	(75)
Northeast _{0.9x}	0.77	X	1.5	56	X	9.21	X	0.5	X	0.7	=	6.97	(75)
Southeast _{0.9x}	0.77	X	1.4	15	X	36.79	X	0.5	×	0.7	=	90.58	(77)
Southeast _{0.9x}	0.77	X	1.4	15	X	62.67	X	0.5	×	0.7	=	154.29	(77)
Southeast _{0.9x}	0.77	X	1.4	15	X	85.75	X	0.5	X	0.7	=	211.11	(77)
Southeast _{0.9x}	0.77	X	1.4	15	X	106.25	X	0.5	X	0.7	=	261.58	(77)
Southeast _{0.9x}	0.77	X	1.4	15	X	119.01	X	0.5	X	0.7	=	292.99	(77)
Southeast _{0.9x}	0.77	X	1.4	15	X	118.15	X	0.5	X	0.7	=	290.87	(77)
Southeast _{0.9x}	0.77	X	1.4	15	X	113.91	X	0.5	X	0.7	=	280.43	(77)
Southeast _{0.9x}	0.77	X	1.4	15	X	104.39	X	0.5	X	0.7	=	257	(77)
Southeast 0.9x	0.77	X	1.4	15	X	92.85	X	0.5	X	0.7	=	228.59	(77)
Southeast _{0.9x}	0.77	X	1.4	15	X	69.27	X	0.5	X	0.7	=	170.53	(77)
Southeast 0.9x	0.77	X	1.4	15	X	44.07	X	0.5	X	0.7	=	108.5	(77)
Southeast 0.9x	0.77	X	1.4	15	X	31.49	X	0.5	X	0.7	=	77.52	(77)
Northwest _{0.9x}	0.77	X	3.2	21	X	11.28	X	0.5	X	0.7	=	17.57	(81)
Northwest 0.9x	0.77	X	3.2	21	X	22.97	X	0.5	X	0.7	=	35.76	(81)
Northwest 0.9x	0.77	X	3.2	21	X	41.38	x	0.5	X	0.7	=	64.43	(81)
Northwest 0.9x	0.77	X	3.2	21	X	67.96	x	0.5	×	0.7	=	105.82	(81)
Northwest 0.9x	0.77	X	3.2	21	X	91.35	x	0.5	X	0.7	=	142.24	(81)
Northwest 0.9x	0.77	x	3.2	21	X	97.38	x	0.5	×	0.7	=	151.64	(81)

3.21

3.21

91.1

72.63

0.5

0.5

0.7

0.7

0.77

0.77

Northwest 0.9x

Northwest 0.9x

141.86

113.09

(81)

(81)

Northwest 0.9x	0.77	x	3.21	x	5	0.42] x	0.5	×	0.7	=	78.51	(81)
Northwest _{0.9x}	0.77	x	3.21	x	2	28.07	X	0.5	x	0.7		43.71	(81)
Northwest 0.9x	0.77	X	3.21	×		14.2	X	0.5	x	0.7	= =	22.11	(81)
Northwest _{0.9x}	0.77	X	3.21	×		9.21	X	0.5	x	0.7		14.35	(81)
Rooflights 0.9x	1	X	1.38	X		26	X	0.5	×	0.8	=	12.92	(82)
Rooflights 0.9x	1	Х	1.32	×		26	j×	0.5	×	0.8	_ =	12.36	(82)
Rooflights 0.9x	1	х	1.38	x		54	X	0.5	x	0.8		26.83	(82)
Rooflights _{0.9x}	1	х	1.32	x		54	x	0.5	x	0.8		25.66	(82)
Rooflights 0.9x	1	X	1.38	x		96	x	0.5	x	0.8	=	47.69	(82)
Rooflights 0.9x	1	X	1.32	×		96	x	0.5	x	0.8	=	45.62	(82)
Rooflights 0.9x	1	X	1.38	x		150	Īx	0.5	x	0.8	=	74.52	(82)
Rooflights 0.9x	1	X	1.32	×		150	x	0.5	x	0.8	=	71.28	(82)
Rooflights _{0.9x}	1	X	1.38	x		192	x	0.5	x	0.8		95.39	(82)
Rooflights 0.9x	1	Х	1.32	x		192	x	0.5	x	0.8		91.24	(82)
Rooflights 0.9x	1	Х	1.38	x		200	X	0.5	x	0.8		99.36	(82)
Rooflights 0.9x	1	х	1.32	x		200	x	0.5	x	0.8		95.04	(82)
Rooflights 0.9x	1	Х	1.38	x		189	x	0.5	x	0.8		93.9	(82)
Rooflights 0.9x	1	Х	1.32	x		189	X	0.5	x	0.8		89.81	(82)
Rooflights 0.9x	1	х	1.38	x		157	x	0.5	x	0.8		78	(82)
Rooflights 0.9x	1	Х	1.32	x		157	j x	0.5	x	0.8		74.61	(82)
Rooflights 0.9x	1	Х	1.38	x		115	X	0.5	x	0.8		57.13	(82)
Rooflights 0.9x	1	х	1.32	×		115	j×	0.5	×	0.8	_ =	54.65	(82)
Rooflights 0.9x	1	Х	1.38	×		66	j×	0.5	×	0.8	_ =	32.79	(82)
Rooflights 0.9x	1	Х	1.32	×		66	j×	0.5	×	0.8	_ =	31.36	(82)
Rooflights 0.9x	1	Х	1.38	×		33	j×	0.5	×	0.8		16.39	(82)
Rooflights _{0.9x}	1	х	1.32	x		33	x	0.5	x	0.8		15.68	(82)
Rooflights _{0.9x}	1	х	1.38	x		21	x	0.5	x	0.8		10.43	(82)
Rooflights 0.9x	1	х	1.32	x		21	x	0.5	x	0.8		9.98	(82)
							-						<u>'</u>
Solar gains in y						•	<u> </u>	n = Sum(74)m	(82)m		•	_	
(83)m= 141.96	259.93	400.17			710.61	674.94	577	.65 457.04	299.6	3 173.42	119.25		(83)
Total gains – in			<u>` </u>		<u> </u>					_		7	
(84)m= 689.59	805.15	927.27	1062.19 11	57.88 1	148.56	1094.5	1003	898.88	771.2	679.22	651.35	_	(84)
7. Mean internal temperature (heating season)													
Temperature of	during h	eating pe	eriods in th	e living	area t	from Tal	ble 9	, Th1 (°C)				21	(85)
Utilisation fact			ving area,	h1,m (see Ta	ble 9a)						7	
Jan	Feb	Mar	Apr	May	Jun	Jul	Α	ug Sep	Oct	Nov	Dec		
(86)m= 0.98	0.97	0.94	0.89).79	0.65	0.52	0.5	0.78	0.92	0.97	0.98		(86)
Mean internal	tempera	ature in l	iving area	T1 (foll	ow ste	ps 3 to 7	7 in T	able 9c)		_		_	
(87)m= 18.69	18.94	19.38	19.95 2	0.45	20.79	20.92	20	.9 20.62	19.97	19.24	18.65		(87)
Temperature of	Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)												
(88)m= 20.07	20.07	20.08	20.09 2	0.09	20.1	20.1	20.	11 20.1	20.09	20.09	20.08		(88)
	•	•										_	

Utilisa	ation fac	tor for a	ains for	rest of d	wellina. I	n2.m (se	ee Table	9a)						
(89)m=	0.98	0.96	0.94	0.87	0.76	0.59	0.43	0.48	0.73	0.91	0.96	0.98		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	ps 3 to	7 in Tabl	le 9c)			l	
(90)m=	16.94	17.31	17.94	18.77	19.46	19.9	20.05	20.03	19.71	18.81	17.75	16.9		(90)
		ļ						Į.		fLA = Livin	g area ÷ (4	1) =	0.38	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwel	ling) = f	LA × T1	+ (1 – fL	.A) × T2			'		_
(92)m=	17.6	17.93	18.48	19.21	19.83	20.24	20.38	20.35	20.05	19.25	18.31	17.56		(92)
Apply	adjustn	nent to t	he mear	interna	temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	17.6	17.93	18.48	19.21	19.83	20.24	20.38	20.35	20.05	19.25	18.31	17.56		(93)
		·	uirement											
			ternal ter or gains			ed at st	ep 11 of	Table 9	b, so tha	it Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:										
(94)m=	0.97	0.95	0.92	0.85	0.75	0.6	0.46	0.51	0.72	0.89	0.95	0.97		(94)
	_ 	i — —	, W = (94	<u> </u>			ı	i	ı	ı			1	
(95)m=		763.98	849.86	904.95	865.35	689	500.71	510.35	649.81	684.07	645.71	632.1		(95)
(96)m=	avera	age exte	rnal tem	perature 8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
							[(39)m:	<u> </u>			7.1	4.2		(30)
	1972.22		1766	1496.84			537.91	561.28	852.75	1251.31	1631.79	1956.52		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Vh/mon	th = 0.02	24 x [(97)m – (95	i)m] x (4	1)m			
(98)m=	971.74	780.78	681.61	426.16	231.16	0	0	0	0	422.03	709.98	985.36		
	,		•					Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	5208.81	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								35.65	(99)
9b. En	ergy rec	quiremer	nts – Cor	mmunity	heating	scheme	:							
•						-	ater heat	• .	-		unity sch	neme.		_
Fractio	on of spa	ace heat	from se	condary	/supplem	nentary	heating (Table 1	1) '0' if n	one			0	(301)
Fractio	on of spa	ace heat	from co	mmunity	system	1 – (30	1) =						1	(302)
	-						procedure			up to four (other heat	sources; ti	he latter	
			s, <i>geomen</i> Commun			rom powe	r stations.	See Appe	naix C.				1	(303a)
			Commun			/ater)							0.8	(303a)
						,							0.2	」` ☐(303b)
Fraction of community heat from heat source 2 (Water) Fraction of total space heat from Community heat pump (302) x (303a) =						a) =	1	` ☐(304a)						
Factor for control and charging method (Table 4c(3)) for community heating system						, i	1	」` ´ □(305)						
					,			•	0 ,				1.05	(306)
	Distribution loss factor (Table 12c) for community heating system Distribution loss factor (Table 12c) for community heating system (Water)							1.05	(306)					
Space heating						kWh/year	」							
•		_	requiren	nent									5208.81	7
	•	•	-											_

0	(00) (00.4-)	··· (005) ··· (000)		— (007-)			
Space heat from Community heat pump		x (305) x (306) =	5469.25	(307a)			
Efficiency of secondary/supplementary heating		ndix E)	0	(308			
Space heating requirement from secondary/su	ipplementary system (98) x (301) x	100 ÷ (308) =	0	(309)			
Water heating				_			
Annual water heating requirement			2283.03				
If DHW from community scheme: Water heat from CHP (Water)	(64) x (303a)	x (305) x (306) =	1917.75	(310a)			
Water heat from heat source 2 (Water)	(64) x (303a)	x (305) x (306) =	479.44	(310b)			
Electricity used for heat distribution	0.01 × [(307a) (30	07e) + (310a) (310e)] =	54.69	(313)			
Electricity used for heat distribution (Water)	0.01 × [(307a) (30	07e) + (310a) (310e)] =	23.97	(313)			
Cooling System Energy Efficiency Ratio			0	(314)			
Space cooling (if there is a fixed cooling syster	m, if not enter 0) = (107) ÷ (314	1) =	0	(315)			
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside 395.45 (330)							
warm air heating system fans	·		0	(330b)			
pump for solar water heating	0	(330g)					
Total electricity for the above, kWh/year	395.45	(331)					
Energy for lighting (calculated in Appendix L)	519.29	(332)					
12b. CO2 Emissions – Community heating scheme							
12b. CO2 Emissions - Community heating sch	neme						
12b. CO2 Emissions – Community heating sch	Energy	Emission factor					
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year				
12b. CO2 Emissions – Community heating sch CO2 from other sources of space and water he Efficiency of heat source 1 (%)	Energy kWh/year	kg CO2/kWh	kg CO2/year	(367a)			
CO2 from other sources of space and water he	Energy kWh/year eating (not CHP)	kg CO2/kWh	kg CO2/year	(367a) (367)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%)	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to	kg CO2/kWh o (366) for the second fue	kg CO2/year 290 978.81	<u> </u>			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) t [(307b)+(310b)] x 100 ÷ (367b) x [(313) x	kg CO2/kWh o (366) for the second fue 0.52	kg CO2/year 290 978.81	(367)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) t [(307b)+(310b)] x 100 ÷ (367b) x [(313) x	kg CO2/kWh 0 (366) for the second fue 0.52 = 0.52 =	kg CO2/year 290 978.81 28.39	(367)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Water heating from separate community system CO2 from other sources of space and water heating from separate community system.	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(313) x m neating (not CHP)	kg CO2/kWh 0 (366) for the second fue 0.52 0.52 c) (366) for the second fue	kg CO2/year 290 978.81 28.39	(367)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Water heating from separate community system CO2 from other sources of space and water he Efficiency of heat source 1 (%)	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(313) x m neating (not CHP) If there is CHP using two fuels repeat (363) to	kg CO2/kWh 0 (366) for the second fue 0.52 0.52 c) (366) for the second fue	kg CO2/year 290 978.81 28.39 290 100	(367) (372) (367a)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Water heating from separate community system CO2 from other sources of space and water he Efficiency of heat source 1 (%) Efficiency of heat source 2 (%)	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(313) x m neating (not CHP) If there is CHP using two fuels repeat (363) to 15 there is CHP using two	kg CO2/kWh o (366) for the second fue 0.52 0.52 c (366) for the second fue o (366) for the second fue	kg CO2/year 290 978.81 28.39 290 100 343.21	(367) (372) (367a) (367b)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Water heating from separate community system CO2 from other sources of space and water he Efficiency of heat source 1 (%) Efficiency of heat source 2 (%) CO2 associated with heat source 1	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(313) x m neating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x	kg CO2/kWh 0 (366) for the second fue 0.52 0.52 0 (366) for the second fue 0 (366) for the second fue 0 (366) for the second fue	290 978.81 28.39 290 100 343.21 248.83	(367) (372) (367a) (367b) (367)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Water heating from separate community system CO2 from other sources of space and water he Efficiency of heat source 1 (%) Efficiency of heat source 2 (%) CO2 associated with heat source 1 CO2 associated with heat source 2	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(313) x m neating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(307b)+(310b)] x 100 ÷ (367b) x [(313) x	kg CO2/kWh 0 (366) for the second fue 0.52 0.52 0 (366) for the second fue 0 (366) for the second fue 0 0.52 0.52 = 0.52	290 978.81 28.39 290 100 343.21 248.83	(367) (372) (367a) (367b) (367) (368)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Water heating from separate community system CO2 from other sources of space and water he Efficiency of heat source 1 (%) Efficiency of heat source 2 (%) CO2 associated with heat source 1 CO2 associated with heat source 2 Electrical energy for heat distribution	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(313) x m neating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(307b)+(310b)] x 100 ÷ (367b) x [(307b)+(310b)] x 100 ÷ (367b) x [(313) x [(313) x	kg CO2/kWh 0 (366) for the second fue 0.52 0.52 0 (366) for the second fue 0 (366) for the second fue 0 0.52 0.52 = 0.52	290 978.81 28.39 290 100 343.21 248.83 12.44 1611.67	(367) (372) (367a) (367b) (367) (368) (372)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Water heating from separate community system CO2 from other sources of space and water he Efficiency of heat source 1 (%) Efficiency of heat source 2 (%) CO2 associated with heat source 1 CO2 associated with heat source 2 Electrical energy for heat distribution Total CO2 associated with community systems	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 + (367b) x [(313) x m neating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 + (367b) x [(307b)+(310b)] x 100 + (367b) x [(307b)+(310b)] x 100 + (367b) x [(313) x (363) (366) + (368)(37b) x (309) x	kg CO2/kWh 0 (366) for the second fue 0.52 0.52 0 (366) for the second fue 0 (366) for the second fue 0 0.52 0.52 = 0.52 = 0.52	290 978.81 28.39 290 100 343.21 248.83 12.44 1611.67	(367) (372) (367a) (367b) (367) (368) (372) (373)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Water heating from separate community system CO2 from other sources of space and water he Efficiency of heat source 1 (%) Efficiency of heat source 2 (%) CO2 associated with heat source 1 CO2 associated with heat source 2 Electrical energy for heat distribution Total CO2 associated with community systems CO2 associated with space heating (secondary	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 + (367b) x [(313) x m neating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 + (367b) x [(307b)+(310b)] x 100 + (367b) x [(307b)+(310b)] x 100 + (367b) x [(313) x [(313) x (363) (366) + (368)(37b) x (309) x eater or instantaneous heater (312) x	kg CO2/kWh 0 (366) for the second fue 0.52 0.52 0 (366) for the second fue 0 (366) for the second fue 0 0.52 0.52 1 0.52 1 0.52	290 978.81 28.39 290 100 343.21 248.83 12.44 1611.67	(367) (372) (367a) (367b) (367) (368) (372) (373) (374)			
CO2 from other sources of space and water he Efficiency of heat source 1 (%) CO2 associated with heat source 1 Electrical energy for heat distribution Water heating from separate community system CO2 from other sources of space and water he Efficiency of heat source 1 (%) Efficiency of heat source 2 (%) CO2 associated with heat source 1 CO2 associated with heat source 2 Electrical energy for heat distribution Total CO2 associated with community systems CO2 associated with space heating (secondary CO2 associated with water from immersion he	Energy kWh/year eating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(313) x m neating (not CHP) If there is CHP using two fuels repeat (363) to [(307b)+(310b)] x 100 ÷ (367b) x [(307b)+(310b)] x 100 ÷ (367b) x [(307b)+(310b)] x 100 ÷ (367b) x [(313) x [(313) x [(313) x [(303) (366) + (368)(383) (366) + (368)(383) (366) + (368)(383) (369) x [(307b) + (310b)] x 100 + (310b) x [(307b) + (310b)] x 100 + (310b) x [(313) x [(3	kg CO2/kWh 0 (366) for the second fue 0.52 0.52 0 (366) for the second fue 0 (366) for the second fue 0 0.52 0.52 1 0.52 1 0.52	290 978.81 28.39 290 100 343.21 248.83 12.44 1611.67 0 1611.67	(367) (372) (367a) (367b) (367) (368) (372) (373) (374) (375)			

CO2 associated with electricity for lighting	ng	(332))) x	0.52	=	269.51	(379)
Total CO2, kg/year	sum of (376) (382) =				2086.42	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.28	(384)
El rating (section 14)					85.37	(385)

Appendix B

Energy Assessment 51 Calthorpe Street

eight associates

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Baseline Non-domestic - TER from the Be Lean scenario BRUKL Be Lean Non-domestic - BER from the Be Lean scenario BRUKL

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name

51 Calthorpe Street

As designed

Date: Fri Aug 21 11:36:24 2020

Administrative information

Building Details

Address: 51 Calthorpe Street, , WC1X 0HH

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.2

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	28
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	28
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	25.2
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U a-Limit	Ua-Calc	U i-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.19	0.23	1-Lower Ground Floor - Meeting Room 1_W_7
Floor	0.25	0.08	0.12	1-Lower Ground Floor - Meeting Room 1_F_3
Roof	0.25	0.12	0.12	1-Lower Ground Floor - Circulation_R_5
Windows***, roof windows, and rooflights	2.2	1.45	1.6	1-Lower Ground Floor - Meeting Room 1_G_8
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
LL Limiting area waighted average LL values [M	11/21/\1			

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]

 $U_{a\text{-Calc}}$ = Calculated area-weighted average U-values [W/(m²K)]

U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m3/(h.m2) at 50 Pa	10	5

^{*} There might be more than one surface where the maximum U-value occurs.

^{**} Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

^{***} Display windows and similar glazing are excluded from the U-value check.

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency			
This system	0.91	3.8	-	-	-			
Standard value	0.91*	N/A	N/A	N/A	N/A			
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NO								
* Ctandard about is t	for any single boiler avetem	a c 0 MM output For sing	la bailar avatama > 0 MM/ a	r multi bailar avatan	o (overall) limiting			

^{*} Standard shown is for gas single boiler systems <= 2 MW output. For single boiler systems > 2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	-
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

	•
ID	System type in Non-domestic Building Services Compliance Guide
Α	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
Е	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
Н	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name ID of system type		SFP [W/(I/s)]							UD officionav		
		В	С	D	E	F	G	Н	I	HR efficiency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
0-Basement - Office	-	-	-	1.4	-	-	-	-	-	0.85	0.5
0-Basement - Meeting Room 3	-	-	-	1.4	-	-	-	-	-	0.85	0.5
0-Basement - WC	0.3	-	-	-	-	-	-	-	-	-	N/A
0-Basement - Meeting Room 1	-	-	-	1.4	-	-	-	-	-	0.85	0.5
0-Basement - Meeting Room 2	-	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - Meeting Roor	n-1	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - Office	-	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - Meeting Roor	n-3	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - Meeting Roor	n-2	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - WC	0.3	-	-	-	-	-	-	-	-	-	N/A
2-Ground Floor - Office	-	-	-	1.4	-	-	-	-	-	0.85	0.5
2-Ground Floor - WC	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Lumino	us effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
0-Basement - Office	120	-	-	1545

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
0-Basement - Staircase	-	120	-	24
0-Basement - Meeting Room 3	120	-	-	302
0-Basement - WC	-	120	-	44
0-Basement - Meeting Room 1	120	-	-	140
0-Basement - Meeting Room 2	120	-	-	216
1-Lower Ground Floor - Meeting Room 1	120	-	-	213
1-Lower Ground Floor - Office	120	-	-	1385
1-Lower Ground Floor - Staircase	-	120	-	39
1-Lower Ground Floor - Circulation	-	120	-	62
1-Lower Ground Floor - Meeting Room 3	120	-	-	117
1-Lower Ground Floor - Meeting Room 2	120	-	-	166
1-Lower Ground Floor - WC	-	120	-	26
1-Lower Ground Floor - Storage	120	-	-	16
2-Ground Floor - Storage	120	-	-	15
2-Ground Floor - Office	120	-	-	1154
2-Ground Floor - Staircase 2	-	120	-	17
2-Ground Floor - Staircase 1	-	120	-	21
2-Ground Floor - WC	-	120	-	27
2-Ground Floor - Lift	-	120	-	11
2-Ground Floor - Circulation	-	120	-	37

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0-Basement - Office	NO (-68.8%)	NO
0-Basement - Staircase	N/A	N/A
0-Basement - Meeting Room 3	N/A	N/A
0-Basement - WC	N/A	N/A
0-Basement - Meeting Room 1	N/A	N/A
0-Basement - Meeting Room 2	NO (-62.1%)	NO
1-Lower Ground Floor - Meeting Room 1	NO (-62%)	NO
1-Lower Ground Floor - Office	NO (-58.9%)	NO
1-Lower Ground Floor - Staircase	N/A	N/A
1-Lower Ground Floor - Circulation	N/A	N/A
1-Lower Ground Floor - Meeting Room 3	N/A	N/A
1-Lower Ground Floor - Meeting Room 2	N/A	N/A
1-Lower Ground Floor - WC	N/A	N/A
1-Lower Ground Floor - Storage	N/A	N/A
2-Ground Floor - Storage	N/A	N/A
2-Ground Floor - Office	NO (-59.3%)	NO
2-Ground Floor - Staircase 2	N/A	N/A
2-Ground Floor - Staircase 1	N/A	N/A
2-Ground Floor - WC	N/A	N/A
2-Ground Floor - Lift	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
2-Ground Floor - Circulation	YES (+61.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1233.7	1233.7
External area [m²]	1305.6	1305.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	329.74	541.31
Average U-value [W/m²K]	0.25	0.41
Alpha value* [%]	21.43	14.51

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

A1/A2 Retail/Financial and Professional services

A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways

100 **B1 Offices and Workshop businesses**

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Institutions: Hospitals and Care Homes

C2 Residential Institutions: Residential schools

C2 Residential Institutions: Universities and colleges

C2A Secure Residential Institutions

Residential spaces

D1 Non-residential Institutions: Community/Day Centre

D1 Non-residential Institutions: Libraries, Museums, and Galleries

D1 Non-residential Institutions: Education

D1 Non-residential Institutions: Primary Health Care Building D1 Non-residential Institutions: Crown and County Courts D2 General Assembly and Leisure, Night Clubs, and Theatres

Others: Passenger terminals Others: Emergency services

Others: Miscellaneous 24hr activities

Others: Car Parks 24 hrs Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.9	6.75
Cooling	10.4	7.57
Auxiliary	3.86	2.58
Lighting	12.12	21.08
Hot water	49.55	49.55
Equipment*	36.38	36.38
TOTAL**	79.82	87.53

^{*} Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO, Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	123.52	117.96
Primary energy* [kWh/m²]	146.16	162.16
Total emissions [kg/m²]	25.2	28

^{*} Primary energy is net of any electrical energy displaced by CHP generators, if applicable

F	HVAC Systems Performance									
System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST	[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
	Actual	11.9	111.6	3.9	10.4	3.9	0.85	2.98	0.91	4.2
	Notional	19.9	98.1	6.8	7.6	2.6	0.82	3.6		

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption

Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)

Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U i-Тур	U _{i-Min}	Surface where the minimum value occurs*			
Wall	0.23	0.12	0-Basement - Office_W_7			
Floor	0.2	0.08	0-Basement - Office_S_3			
Roof	0.15	0.12	1-Lower Ground Floor - Circulation_R_5			
Windows, roof windows, and rooflights	1.5	1.2	0-Basement - Office_G_9			
Personnel doors	1.5	-	"No external personnel doors"			
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"			
High usage entrance doors	1.5	-	"No external high usage entrance doors"			
U _{i-Typ} = Typical individual element U-values [W/(m²K))]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]			
* There might be more than one surface where the minimum U-value occurs.						

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

Appendix B Energy Assessment 51 Calthorpe Street

eight associates

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Be Green Non-domestic - BER from the Be Green scenario BRUKL

BRUKL Output Document



Compliance with England Building Regulations Part L 2013

Project name

51 Calthorpe Street

As designed

Date: Fri Aug 21 12:05:04 2020

Administrative information

Building Details

Address: 51 Calthorpe Street, , WC1X 0HH

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.2

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	26.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	26.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	24.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U a-Limit	Ua-Calc	U i-Calc	Surface where the maximum value occurs*
Wall**	0.35	0.19	0.23	1-Lower Ground Floor - Meeting Room 1_W_7
Floor	0.25	0.08	0.12	1-Lower Ground Floor - Meeting Room 1_F_3
Roof	0.25	0.12	0.12	1-Lower Ground Floor - Circulation_R_5
Windows***, roof windows, and rooflights	2.2	1.45	1.6	1-Lower Ground Floor - Meeting Room 1_G_8
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
LL Limiting area waighted average LL values [M	1//22/21			

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]

 $U_{a\text{-Calc}}$ = Calculated area-weighted average U-values [W/(m²K)]

U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

^{*} There might be more than one surface where the maximum U-value occurs.

^{**} Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

^{***} Display windows and similar glazing are excluded from the U-value check.

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

	Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
ſ	Whole building electric power factor achieved by power factor correction	<0.9

1- Project HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency	
This system	2.9	3.8	-	-	-	
Standard value	2.5*	N/A	N/A	N/A	N/A	
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system NO						
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825						

^{*} Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- Project DHW

Water heating efficiency		Storage loss factor [kWh/litre per day]				
This building	2.1	-				
Standard value	2*	N/A				
* Standard shown is for all types except absorption and gas engine heat pumps.						

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
Α	Local supply or extract ventilation units serving a single area
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
Н	Fan coil units
1	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(I/s)]			LID 4	UD officionav						
ID of system type	Α	В	С	D	Е	F	G	Н	I	HR efficiency	
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
0-Basement - Office	-	-	-	1.4	-	-	-	-	-	0.85	0.5
0-Basement - Meeting Room 3	-	-	-	1.4	-	-	-	-	-	0.85	0.5
0-Basement - WC	0.3	-	-	-	-	-	-	-	-	-	N/A
0-Basement - Meeting Room 1	-	-	-	1.4	-	-	-	-	-	0.85	0.5
0-Basement - Meeting Room 2	-	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - Meeting Roor	n-1	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - Office	-	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - Meeting Roor	n-3	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - Meeting Roor	n-2	-	-	1.4	-	-	-	-	-	0.85	0.5
1-Lower Ground Floor - WC	0.3	-	-	-	-	-	-	-	-	-	N/A
2-Ground Floor - Office	-	-	-	1.4	-	-	-	-	-	0.85	0.5
2-Ground Floor - WC	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Lumino	ous effic		
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
0-Basement - Office	120	-	-	1545
0-Basement - Staircase	-	120	-	24
0-Basement - Meeting Room 3	120	-	-	302
0-Basement - WC	-	120	-	44
0-Basement - Meeting Room 1	120	-	-	140
0-Basement - Meeting Room 2	120	-	-	216
1-Lower Ground Floor - Meeting Room 1	120	-	-	213
1-Lower Ground Floor - Office	120	-	-	1385
1-Lower Ground Floor - Staircase	-	120	-	39
1-Lower Ground Floor - Circulation	-	120	-	62
1-Lower Ground Floor - Meeting Room 3	120	-	-	117
1-Lower Ground Floor - Meeting Room 2	120	-	-	166
1-Lower Ground Floor - WC	-	120	-	26
1-Lower Ground Floor - Storage	120	-	-	16
2-Ground Floor - Storage	120	-	-	15
2-Ground Floor - Office	120	-	-	1154
2-Ground Floor - Staircase 2	-	120	-	17
2-Ground Floor - Staircase 1	-	120	-	21
2-Ground Floor - WC	-	120	-	27
2-Ground Floor - Lift	-	120	-	11
2-Ground Floor - Circulation	-	120	-	37

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0-Basement - Office	NO (-68.8%)	NO
0-Basement - Staircase	N/A	N/A
0-Basement - Meeting Room 3	N/A	N/A
0-Basement - WC	N/A	N/A
0-Basement - Meeting Room 1	N/A	N/A
0-Basement - Meeting Room 2	NO (-62.1%)	NO
1-Lower Ground Floor - Meeting Room 1	NO (-62%)	NO
1-Lower Ground Floor - Office	NO (-58.9%)	NO
1-Lower Ground Floor - Staircase	N/A	N/A
1-Lower Ground Floor - Circulation	N/A	N/A
1-Lower Ground Floor - Meeting Room 3	N/A	N/A
1-Lower Ground Floor - Meeting Room 2	N/A	N/A
1-Lower Ground Floor - WC	N/A	N/A
1-Lower Ground Floor - Storage	N/A	N/A
2-Ground Floor - Storage	N/A	N/A
2-Ground Floor - Office	NO (-59.3%)	NO
2-Ground Floor - Staircase 2	N/A	N/A

Zone	Solar gain limit exceeded	d? (%) Internal blinds used?
2-Ground Floor - Staircase 1	N/A	N/A
2-Ground Floor - WC	N/A	N/A
2-Ground Floor - Lift	N/A	N/A
2-Ground Floor - Circulation	YES (+61.5%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?		
Is evidence of such assessment available as a separate submission?	NO	
Are any such measures included in the proposed design?	NO	

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1233.7	1233.7
External area [m²]	1305.6	1305.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	329.74	541.31
Average U-value [W/m²K]	0.25	0.41
Alpha value* [%]	21.43	14.51

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

A1/A2 Retail/Financial and Professional services

A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways

100 **B1 Offices and Workshop businesses**

B2 to B7 General Industrial and Special Industrial Groups

B8 Storage or Distribution

C1 Hotels

C2 Residential Institutions: Hospitals and Care Homes

C2 Residential Institutions: Residential schools

C2 Residential Institutions: Universities and colleges

C2A Secure Residential Institutions

Residential spaces

D1 Non-residential Institutions: Community/Day Centre

D1 Non-residential Institutions: Libraries, Museums, and Galleries

D1 Non-residential Institutions: Education

D1 Non-residential Institutions: Primary Health Care Building D1 Non-residential Institutions: Crown and County Courts D2 General Assembly and Leisure, Night Clubs, and Theatres

Others: Passenger terminals Others: Emergency services

Others: Miscellaneous 24hr activities

Others: Car Parks 24 hrs Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.22	2.28
Cooling	10.4	7.57
Auxiliary	3.86	2.58
Lighting	12.12	21.08
Hot water	20.38	23.27
Equipment*	36.38	36.38
TOTAL**	47.98	56.77

^{*} Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO, Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	123.52	117.96
Primary energy* [kWh/m²]	147.29	151.17
Total emissions [kg/m²]	24.9	26.9

^{*} Primary energy is net of any electrical energy displaced by CHP generators, if applicable

F	HVAC Systems Performance									
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST	[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
	Actual	11.9	111.6	1.2	10.4	3.9	2.7	2.98	2.9	4.2
	Notional	19.9	98.1	2.3	7.6	2.6	2.43	3.6		

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption

Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)

Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U i-Тур	U _{i-Min}	Surface where the minimum value occurs*	
Wall	0.23	0.12	0-Basement - Office_W_7	
Floor	0.2	0.08	0-Basement - Office_S_3	
Roof	0.15	0.12	1-Lower Ground Floor - Circulation_R_5	
Windows, roof windows, and rooflights	1.5	1.2	0-Basement - Office_G_9	
Personnel doors	1.5	-	"No external personnel doors"	
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"	
High usage entrance doors	1.5	-	"No external high usage entrance doors"	
U _{i-Typ} = Typical individual element U-values [W/(m²K))]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.				

Air Permeability	Typical value	This building
m ³ /(h.m ²) at 50 Pa	5	5